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Piroska Szalai[1]

Is There a Central European Fertility Paradox?

Fertility, Women's Labour Market Participation and Household Income and Living Conditions in the European Union

Even today, some people believe that fewer children are being born because women have gone out to work, and that fertility would improve if women were allowed to stay at home. The experience of the last 60–70 years in Hungary and Central Europe is quite the opposite. Starting from this paradox, in the present research I sought to find out how fertility in the European Union and in the Member States is related to women's participation in the labour market and to the financial situation of families.

The study shows that over the period 2009–2022, female employment rates are correlated with fertility in all Member States, with 19 countries showing a strong correlation, nine with a positive correlation and ten with a negative correlation. In the Eastern Bloc countries, Germany, Portugal, Greece and Austria, the fertility rate and female employment are positively correlated, while in the other countries the correlation is inverted.

Since the correlation only shows the strength and direction of the relationship, to find out which of the factors in the relationship cause the change in fertility, I performed a Granger causality analysis. The excess of the relative income poverty rate of those living in households with children over those without children was found to be causally related to fertility in most places, in 9 countries and in the European Union as a whole. In seven countries (Bulgaria, the Czech Republic, Hungary, Latvia, Portugal, Romania and Slovenia), low levels of excess child poverty are associated with higher fertility, and the opposite is true in Ireland and Italy. This was the only causal connection when looking at the 27 EU countries as a unit.

[1] Labour Market Expert, Researcher at the Economy and Competitiveness Research Institute, Faculty of Political Science and International Studies, Ludovika University of Public Service; Former Ministerial Commissioner for the Improvement of the Labour Market Situation of Women, initiator of the GYED extra programme, e-mail: szalai.piroska@uni-nke.hu

Finally, I conducted a hierarchical cluster analysis using the Ward method with the factors most causally related to fertility. The Member States were classified into 3 clusters and 7 sub-clusters. One cluster includes the Czech Republic, Romania, Hungary, Cyprus, Portugal, Bulgaria, Greece, Latvia, Poland, Germany, Croatia, Slovenia and Slovakia, where fertility is negatively correlated with female unemployment and the risk of income poverty, i.e. more children are born when female unemployment is low and childbearing is not associated with the risk of income poverty. These countries have experienced significant fertility growth over the last decade, and all other countries have the lowest fertility in the last decade and a half in 2022. The furthest away from them are Ireland, Malta, the Netherlands, Austria, Luxembourg, Italy, Estonia, Spain, Lithuania, where high female unemployment and high relative income surplus poverty lead to higher rates of childbearing.

The study has shown that the relationship between fertility and economic and social factors varies considerably across the European Union. The countries of the former communist bloc (except Estonia and Lithuania) and Germany (part of which is part of the former communist territories), Greece, Portugal, Cyprus, with female employment at its current peak and low unemployment, are not experiencing their worst fertility period and most have seen a marked improvement in childbearing in recent years. In the rest of the EU, fertility is at historic lows.

Keywords: women, employment, living conditions, poverty, fertility, AROPE, LFS

"No investment is more profitable to any society than to give milk to babies."
Sir Winston Churchill

"Having children is like investing in a risky project. Postponing a birth is like postponing an investment opportunity that will never come back."
De La Croix – Pommeret 2018

Introduction

How economic and social factors affect fertility has been studied in the past. However, less is said about how these factors interact and affect fertility in very different ways in different groups of countries. Even in the European Union, we see contrasting patterns between groups of countries.

Most researchers have found that fertility declines when female labour force participation is high, i.e. there is a negative correlation between the two factors. The findings in Hungary and neighbouring countries contradict this. In this region, since the change of regime in 1990, fertility growth has been associated with an increase in female employment and its decline with a decline in employment, i.e. there is a positive correlation between fertility and female labour market participation.[2] In my previous

[2] SZALAI 2014, 2015, 2023a, 2023b.

presentations, I called this experience the Central European Paradox. In this paper, I examine in detail whether only the former communist countries really differ from the other countries, and which country clusters can be identified.

Given the contradictions between my experience and the literature, I sought to answer the following questions:

1. Which of the indicators related to women's labour market participation and family living conditions, household income and financial situation in the European Union and the Member States are most strongly related to fertility?
2. For which we can also show a causal connection, i.e. which changes in factors cause changes in fertility?
3. How Member States can be grouped into clusters?

Using Eurostat's public datasets from 2009–2022, I carried out a multidimensional analysis for the 27 Member States and the European Union as a whole (the latter treated as a geographical unit, not averaged across Member States). In addition to fertility rates, I examined 10 indicators, which I will detail in the third chapter.

The study was carried out in the following three steps:

- correlation analysis
- Granger causality analysis
- hierarchical cluster analysis using Ward's method

The results of the study are detailed in the fifth chapter.

The present research can also contribute to explaining the medium-term trend in fertility, and can also serve as a basis for precisely targeted interventions and government measures to increase fertility, as economic development and improved living conditions are key to maintaining and initiating positive demographic trends in all EU Member States. Moreover, it is worthwhile for economists and policy makers to monitor fertility changes in the same way as other macroeconomic indicators, as fertility is considered a "leading economic indicator".[3] Even news events can trigger changes in birth rates, as fertility reacts before there is an actual change, deterioration or improvement in income and employment.

One of the seven priorities of the Hungarian Presidency of the Council of the European Union in the second half of 2024 is to address demographic challenges. In its programme, the Hungarian presidency stated that demographic issues need to be put at the centre of attention, as they are of growing importance for the Union's competitiveness, the sustainability of social care systems, the efficient management of labour shortages from internal resources and the sustainability of public finances. The Hungarian presidency aims to draw attention to the challenges involved, while fully respecting the competences of the member states.

The aim of this study was to help formulate effective programmes under this priority.

[3] Buckles et al. 2018.

Literature summary

A number of studies have examined the interrelationship between fertility and women's labour market participation.[4]

Many have focused primarily on unemployment when examining the labour market. Bettio and Villa (1998) found a negative relationship between fertility and unemployment in Italy, as women forego childbearing to remain in the labour market.[5] A similar finding was made by Adsera (2011) looking at data from 13 European countries (Eastern Bloc countries were not included) in the 1980s and 1990s.[6] He finds that high and persistent unemployment is associated with a delay in childbearing and hence lower fertility. Having a second child is more likely if part-time work opportunities are available, but women on temporary and fixed-term contracts are less likely to have a second child. Huttunen and Kellokumpu (2017), looking at couples where one of the partners lost a job, find that female job loss (especially for the highly educated) reduces fertility, while male job loss has no effect on fertility despite the fact that in their case family income has decreased more.[7] He says this indicates that it is not the loss of income that affects fertility. Khattak (2019) also found that fertility rates are negatively related to unemployment. According to him, a high unemployment rate increases employment insecurity, and hence, fertility rates decline.[8]

Ellis (1993) found that women with higher education have lower incomes because of childbearing, so that an increase in women's education and employment reduces fertility.[9]

Hondroyiannis (2010) studied 27 countries in the European Union over the period 1960–2005 and found that high female labour force participation and high real wages reduce fertility. He argues that responsible parents decide to have children if they can support them not only in the present but also in the future. Thus, he argues that fertility is influenced by the present income situation and expectations of future family income.[10]

The relationship between insecurity and fertility has been analysed in a number of papers, with Hanappi et al. (2017) and Wilde et al. (2020) also finding that higher insecurity is associated with lower fertility.[11] Chabe-Ferret and Gobbi (2018) by examining twentieth century data (the Great Depression and the post-World War II baby boom), show that economic uncertainty has a large and strong negative impact on total fertility.[12] Buh (2023) provides a broad overview of the different interpretations of employment insecurity and its relationship with fertility.[13]

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4 E.g. CAIN–DOOLEY 1976; FLEISHER–RHODES 1976; MOFFITT 1984; HOTZ–MILLER 1988; MAHDAVI 1990; CIGNO 1991; KALWIJ 2000; PAPAPETROU 2004; HERBST–BARNOW 2008.

5 BETTIO–VILLA 1998.

6 ADSERA 2011.

7 HUTTUNEN–KELLOKUMPU 2017.

8 KHATTAK 2019.

9 ELLIS 1993.

10 HONDROYIANNIS 2010.

11 HANAPPI et al. 2017; WILDE et al. 2020.

12 CHABE-FERRET – GOBBI 2018.

13 BUH 2023.

De La Croix and Pommeret (2018) found that it is difficult to establish a clear negative relationship between income insecurity and fertility.[14] On the one hand, the decision to have children can cause multiple types of labour market insecurity, and on the other hand, the causal relationship can be bidirectional, i.e. having children can cause labour market insecurity and exogenous changes in labour market insecurity can delay having children.

Economists from Becker (1960) onwards have tended to explain the long-run relationship in terms of the link between human capital and fertility.[15] Children spend longer in school, the cost of educating them rises as the level of education rises, they become involved in family income production later, and this helps to explain the long-run negative correlation between income and fertility.

Income uncertainty offers a possible explanation for the short-term cyclical pattern of fertility. The level and cyclical variation of incomes do not clearly affect fertility. However, income uncertainty clearly increases precautionary saving by reducing current consumption. Households that perceive an increase in uncertainty about the future of the economy experience a decline in their "consumer confidence" and postpone fertility until a recession or economic recovery. The theory related to precautionary motives is extended to the fertility choice by Ranjan (1999) and Sommer (2016).[16]

Buckles et al. (2018) find that fertility declines several quarters before the onset of a recession, suggesting that fertility may be a leading procyclical variable.[17] They also find that the decline is not driven by abortions or fetal deaths, which may be sensitive to the psychological and physical stress from uncertainty, but rather by a decline in conceptions. The fear of consumption losses associated with possible recurrences creates uncertainty and reduces the desire to have children. Similarly, optimism about economic growth can reduce uncertainty and increase fertility.

One explanation for this surprising relationship is that households perceive economic uncertainty from the news, the stock market and other sources. Worries about future wages cause them to lose "consumer confidence", reduce current consumption and engage in "precautionary savings". This logic also extends to fertility, as precautionary savings can be built up by reducing consumption and postponing childbearing.[18] The precautionary effect is potentially relevant in explaining fertility differences across countries and variation in fertility across countries over time.

Gozgor et al. (2021)[19] investigated economic uncertainty using a new measure, the World Uncertainty Index (WUI),[20] created by the IMF and linked to income and wage uncertainty, for 126 countries between 1996 and 2017. He also found that economic uncertainty reduces fertility rates.

In addition to the large sample, he also examined how uncertainty affects short-term changes in fertility in a smaller sample of OECD countries at similar levels of

14 De La Croix – Pommeret 2018.
15 Becker 1960.
16 Ranjan 1999; Sommer 2016.
17 Buckles et al. 2018.
18 Ranjan 1999; Sommer 2016.
19 Gozgor et al. 2021.
20 Ahir et al. 2018.

development. Here, the differences are less due to differences between countries and more a reflection of short-term changes in fertility in some countries over the business cycle. He suggests that changes in uncertainty may be a factor that explains why fertility is pro-cyclical.

He argues that the challenge for fertility theory is to explain simultaneously why income and fertility are negatively correlated in the long run (fertility eventually declines during economic development), while they are positively correlated in the medium or short run. Explanations for long- or short-term differences are more convincing if they are consistent with each other.

Test method and data

The data are collected for all 27 Member States and for the European Union as a whole (the latter treated as a single geographical unit, i.e. not averaged across Member States).

The data source is Eurostat's aggregated data tables for the next mandatory surveys:

- Labour Force Survey (LFS)
- EU Statistics on Income and Living Conditions (EU-SILC)
- Structure of Earnings Survey (SES)

After examining a number of indicators, and taking into account the equation of Hondroyiannis (2009), I included in the multidimensional analysis, in addition to fertility, ten public Eurostat data series. Two of these are labour markets (B and C), four are living conditions (D, E, F and G), real GDP growth per capita (H), the gender pay gap (I), the difference in relative income poverty rates between the sexes for those aged 18–64 and between those with and without children (J and K).

A. fertility
B. female employment rate in the 20–64 age group (number of persons employed / total population in the age group)
C. female unemployment rate in the age group 20–64 (number of unemployed / active population, i.e. number of unemployed and employed)
D. AROPE2020 for people living in households with children: (Persons at risk of poverty or social exclusion by income quantile and household composition – EU 2020 strategy)
E. AROPE2020 Difference between households with and without children
F. AROPE2030 for people living in households with children: (Persons at risk of poverty or social exclusion by income quantile and household composition – EU 2030 strategy)
G. AROPE2030 Difference between households with and without children
H. Real GDP growth rate per capita: (Real GDP growth rate – volume)
I. Gender pay gap in unadjusted form by NACE Rev. 2 activity – structure of earnings survey methodology
J. relative income poverty rate by gender for 18–64 year olds (At-risk-of-poverty rate by poverty threshold, age and sex – EU-SILC and ECHP surveys)

K. Relative income poverty rate difference between households with and without children (At-risk-of-poverty rate by poverty threshold and household type – EU-SILC and ECHP surveys)

Salaries and wages are paid to the employed, while the total population has an income. Income includes all income received by the household, from work as well as from fees, benefits and even capital income. Per capita income is calculated by dividing the total income of the whole household by the number of household members, including dependent children and the elderly.

AROPE indicator

As measured by the AROPE (At Risk of Poverty or Social Exclusion) indicator, those at risk of poverty or social exclusion are those who are affected by at least one of the following three dimensions:

- Relative income poverty, i.e. living in a household with a net income below 60% of the median income (i.e. the poverty line)
- Very low work intensity, i.e. living in a household where household members aged 18–64 (18–59 by 2020) spent less than 20% of their potential working time at work
- People living in severe material and social deprivation, i.e. people who are materially deprived in at least 7 of the following 13 items:
  1. Capacity to face unexpected expenses
  2. Capacity to afford paying for one week annual holiday away from home
  3. Capacity to being confronted with payment arrears (on mortgage or rental payments, utility bills, hire purchase instalments or other loan payments)
  4. Capacity to afford a meal with meat, chicken, fish or vegetarian equivalent every second day
  5. Ability to keep home adequately warm
  6. Have access to a car/van for personal use
  7. Replacing worn-out furniture
  8. Having internet connection
  9. Replacing worn-out clothes by some new ones
  10. Having two pairs of properly fitting shoes (including a pair of all-weather shoes)
  11. Spending a small amount of money each week on him/herself
  12. Having regular leisure activities
  13. Getting together with friends/family for a drink/meal at least once a month

(The measurement of deprivation changed in 2020, when items 7–13 were introduced, previously the lack of a telephone, washing machine and colour television was measured, then 4 out of 9 items were considered severely deprived.)

The time series of the pre-change indicator, AROPE2020, was available for 2009–2020, and the post-change indicator, AROPE2030, for 2015–2022.

The study was carried out in three stages:

1. First, I conducted a correlation analysis for each country, where I examined the relationship of the data of all 10 indicators with the fertility rate. When examining

the 1997–2022 interval, it was observed that if I narrowed the time interval to look at the period 2009–2022, i.e. the period following the financial crisis that erupted in mid-October 2008, the correlation strengthened in several places. This also shows that there has been a major societal change, with many countries experiencing an "inflection point"[21] in terms of childbearing. The results of this study are more useful for the present period if we conduct it in detail for the shorter interval. I have therefore narrowed the study to this 14-year period.

2. In a second step, I performed a Granger causality test, since correlation only shows the strength and direction of the connection, but does not reveal whether there is causality between the factors or only cointegration. In this step, I have also examined the causality between the fertility rate and the data of the other 10 indicators by country.
3. In a third step, I conducted a hierarchical cluster analysis using Ward's method to determine which countries show a similar pattern in terms of the factors affecting fertility. I included in the analysis the 3 indicators that showed the most causality for countries in the Granger test. For each factor, I conducted the analysis using correlation coefficients.

The European picture

For reasons of length, I can only give a brief historical summary in this paper, further details can be found in my articles published in *European Conservative*[22] and *Polgári Szemle*.[23]

Trends in total fertility and employment rates

After the Second World War, the economies of Western European countries reached their pre-war levels in a few years with the Marshall Plan, and by 1951 Western Europe was producing 135% of what it had produced in 1938, the countries were on the way to creating welfare states, which is why they had a baby boom that lasted until the early 1960s. In the communist countries of Eastern Europe in the 1950s and 1960s, families everywhere lived in the deepest poverty. Nationalisations took away the small shops of traders, the workshops of industrialists, the land and livestock of farmers. At this time, we can only detect an increase in fertility where various coercive measures were introduced. In these countries, women were also obliged to work full time as employees. In addition to the legal constraints, families also needed to have two earners in order to support themselves financially, which is why the two-earner family model has been the most widespread in the region for seventy years.

21 According to Andrew Grove (1998), a so-called strategic inflection point is an environmental change that causes a major, dramatic change in the whole process under consideration, thereby challenging certain basic axioms, or what are thought to be firm foundations.

22 SZALAI 2023a.

23 SZALAI 2023b.

In 1960, the total fertility rates of the current 27 Member States of the European Union varied widely, according to Eurostat data. They were lowest in the Eastern communist bloc (e.g. Estonia 1.98, Hungary 2.02, the Czech Republic 2.09) and highest in Western Europe (Ireland 3.78, Portugal 3.16, the Netherlands 3.12).

By the mid-1960s, the employment rate for women aged 15–64 was between 65% and 70% in the communist bloc countries, while in southern Europe it was less than 30%, with only a third of women working in the Benelux countries, almost half in Austria and only two northern countries, Finland and Denmark, exceeding 50%.

Since the second half of the 1960s, many of the Eastern Bloc countries have introduced family support measures to improve low fertility. In Hungary, for example, from 1967, mothers were given leave until the child was 3 years old, and the state provided benefits for this period. In the early 1970s, housing companies have built masses of prefabricated flats in housing estates, which families with children received huge subsidies to buy, leading to a significant increase in fertility.

By the 1980s, women's participation in the labour market, family support systems, living conditions of families and thus the factors and attitudes influencing decisions to have children had become completely different in the eastern and western countries of Europe. The regime changes around 1990 have come at a heavy price for the people of the Eastern Bloc countries, for example in Hungary nearly 30% of jobs, according to some estimates 1.5 million jobs, were lost and the number of unemployed rose to 520,000 by 1993. Even those who were able to stay in employment became poorer, as double-digit inflation over a decade from 1988 to 1998 reduced the real value of average earnings by a quarter by 1996, back to 1966 levels. Economic insecurity became almost unbearable for families. The trends were similar in the other transition countries in the region.

As a result, fertility rates in these countries have plummeted to below 1.3 within a decade. The lowest fertility rate in EU history until 2021 was 1.09 in Bulgaria in 1997. It was previously unimaginably low in other countries in the region, 1.13 in the Czech Republic in 1999, 1.19 in Slovakia in 2002, 1.2 in Slovenia in 2003, 1.22 in Latvia in 2001, Lithuania and Poland in 2003, 1.27 in Romania in 2002 and 1.28 in Hungary in 1999.

In countries outside the Eastern bloc, women entered the labour market steadily during this period, and employment rates in these countries increased. By the turn of the millennium, countries outside the South had overtaken most of the Eastern Bloc countries. In most Western European countries, women entered the labour market by taking up part-time jobs.

Living conditions and employment, including for women, improved in the countries that changed their regime after the millennium and further improved after joining the EU, while fertility increased. The boom lasted until the 2008 financial crisis. The only exception was Hungary, where the improvement that started in 1998 was very short-lived. After 2002, Hungary suffered government failures on a scale that prevented economic improvement, and women's employment failed to increase substantially. By 2010, only the three southern countries, Italy, Greece and Malta had lower female employment rates than Hungary, and the fertility rate reached a century low of 1.23 in 2011.

In Western Europe, with the exception of France and Ireland, fertility rates plummeted to around 1.5 by the mid-1970s and remain stagnant at around that level today. In France, child benefits are larger than in the rest of the region, contributing to a much

higher fertility rate. In the meanwhile, Ireland had a much higher fertility rate, which fell later to 1.54 in 2022. In the Benelux countries, there was a slight increase from the early 1990s, which lasted until the recession of 2010, before falling in the last decade.

In Southern Europe, the fall started later than in Western Europe, but by the early 1990s the continental countries in this region had all fallen below 1.5, followed by the two island countries of Cyprus and Malta after the turn of the millennium.

Among the Northern European countries, the pattern of the former Soviet states is very similar to that described for the Central European countries, while the other three countries are more similar to the Benelux countries.

The boom in the transitioning countries between 2010 and 2021 also led to a significant improvement in female employment rates. Most of them have reached the level of 30 years earlier, which has been accompanied by a significant increase in fertility rates. While 20 years ago the countries of Central Europe had the lowest fertility rates in the European Union, the region has seen the greatest improvement in recent years, with six countries reaching their highest post-change rates in 2021. The Czech Republic has the second highest fertility rate in Europe with 1.83, followed by Romania with 1.81, but with 1.64 in Slovenia, 1.63 in Slovakia and 1.61 in Hungary.

In this millennium, the rise in female employment rates has been accompanied by a fall in fertility rates in countries other than the Central European countries. Malta has seen the largest increase in female employment over the past decade, and in parallel, in 2020 and 2022, Malta had the lowest fertility rate in the European Union, the latter year being lower than the 1997 Bulgarian minimum of 1.08.

The risk of poverty and social exclusion

The European Union has already set a target in its 2020 strategy to reduce the AROPE indicator, the proportion of people at risk of poverty or social exclusion. The reduction was one of the most significant in Hungary.

Since 2018, the proportion of women living at risk of poverty or social exclusion in Hungary has also been much lower than the EU average. The latest figure is 20.6%, the 13th lowest rate.

Of the 3 sub-areas of the AROPE complex indicator, the proportion of women living in relative income poverty, i.e. women living in households where per capita income (i.e. earnings and other social and other income received by the household) is below the poverty line (60% of median income), is only 14.1% of the total female population, which puts us in 8th place among EU Member States.

It is also a fact that in 2010, the proportion of people at risk of poverty or social exclusion was 8 percentage points higher for those living in households with children than for those without. A decade ago, we had the biggest financial disadvantage in the EU for raising children.

Results of the study

Correlations

As generally accepted in social science correlation studies, the correlation is considered to be high for $|r| > 0.5$ (very high for $|r| > 0.7$), medium for $0.3 < |r| \leq 0.5$, low for $0.1 < |r| \leq 0.3$, and no relationship between the indicators under study for $0 \leq |r| \leq 0.1$. The results are shown in Table 1 below (the numbers indicate the number of Member States for which a given type of relationship was found for a given indicator).

Table 1: Correlation test results

	EU27	positive					negative			
	r	very strong	strong	medium	small	none	small	medium	strong	very strong
B – female employment rate 20–64	–0.54	6	3	3	2	0	1	2	0	10
C – female unemployment 20–64	0.39	4	2	2	3	3	1	2	2	8
D – AROPE2020 with children	0.16	2	0	2	4	5	0	3	4	7
E – AROPE2020 with children – childless	0.24	3	2	3	1	3	0	2	6	7
F – AROPE2030 with children	0.46	4	4	1	1	3	4	1	5	4
G – AROPE2030 with children – childless	0.29	3	3	3	2	5	1	5	2	3
H – real GDP per capita growth	0.12	0	1	4	4	12	6	0	0	0
I – gender pay gap	0.53	7	4	3	1	2	2	3	3	2
J – difference in relative income poverty rate between genders (18–64)	0.28	0	0	5	2	6	4	7	2	1
K – difference in relative income poverty rate between child-headed and childless households	0.49	3	1	4	1	4	2	4	3	5

Source: compiled by the author

The EU27 is not an average of the indicators of the Member States, but an indicator calculated for the whole Union as a geographical unit. It can be seen that, looking at the 14-year period 2009–2022, and considering the EU as a single entity, two indicators have a high connection with fertility and three others a medium connection, with negative connections for female employment rates and positive connections for the others.

When looking at Member States separately, the most significant link between fertility and female employment is clearly the highest in 19 countries. Among them, 16 have a very high association. In Hungary, Slovakia, the Czech Republic, Germany, Romania, Portugal and Bulgaria, Latvia and Greece there is a very high positive connection, i.e. it is clear that higher fertility is associated with high female employment, i.e. women need to feel secure in their jobs, as families can only survive if both parents work. By contrast, in France, Belgium, Malta, Italy, Luxembourg, the Netherlands, Ireland, Finland, Spain and Sweden we find a very large negative connection (no Member State with a large connection), i.e. in these countries, increasing female employment is associated with a significant decrease in fertility

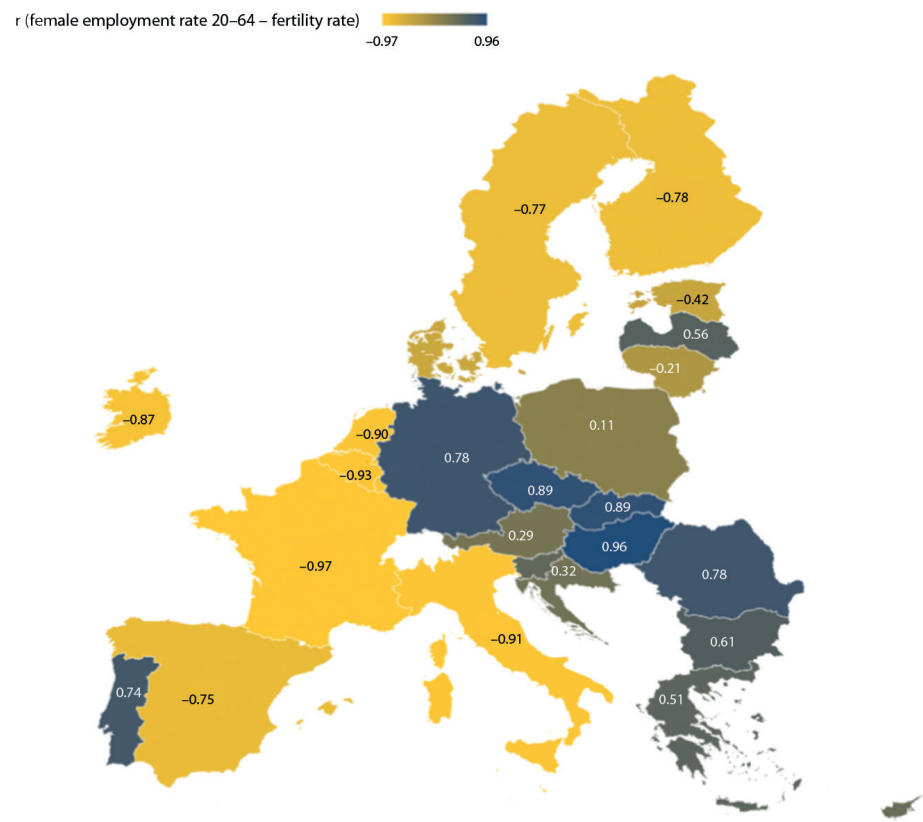

Figure 1: Correlation between the employment rate of women aged 20–64 and the fertility rate in the European Union Member States, 2009–2022

Source: compiled by the author based on Eurostat 2023

The female unemployment rate is also strongly correlated, but not fully inverse to the employment rate, in more than half of the countries, in 16 places. This is because if someone is not employed, they may not be unemployed, they may even be inactive, and this group is not included in the unemployment rate.

While the AROPE indicator for childlessness according to the methodology used in the EU2020 strategy gave only a high or very high relationship for 13 countries, the difference between with children and childless for the same indicator showed at least a high relationship for 18 countries and a medium relationship for 5 others. Portugal, Finland, France, Cyprus, Poland, Hungary and the Czech Republic have a very high negative connection, while Belgium, Romania, Sweden, Latvia, Greece and Bulgaria have a high negative connection. In these countries, higher fertility is correlated with lower surplus poverty among those with children relative to those without. However, the Netherlands, Ireland and Malta show a very large positive relationship, and Luxembourg and Austria a large positive connection, i.e. where and when the surplus poverty of those with children is larger.

The AROPE indicator for child poverty according to the methodology used in the EU2030 strategy shows a high or very high correlation with fertility in 17 Member States and a medium correlation in two others, while the indicator for child poverty calculated using this methodology is highly or very highly correlated in only 11 Member States. Although this is more than half of the countries, there are also indicators with a stronger connection in this area.

The connection between real GDP per capita growth and fertility is large for only one country (Estonia), so when examining fertility, the evolution of real GDP is not emphasised for Member States.

The difference in relative income poverty rates between the sexes and the connection with fertility also shows a strong connection in only a small group of countries, so it is not particularly relevant for our analysis.

However, the gender pay gap shows a high or very high connection with fertility in 16 of the Member States and a medium connection in six others. The Czech Republic and Romania show a very high negative connection and Slovakia, Portugal and Germany a high negative connection, i.e. higher fertility rates are associated with lower gender pay gaps. Luxembourg, Finland, Belgium, the Netherlands, Sweden, Spain and Greece show a very large positive connection, while Italy and Latvia, Ireland and Denmark show a large positive connection. In these countries, higher fertility rates are associated with higher gender pay gaps.

The difference between the relative income poverty rate for households with and without children, which is one of the components of AROPE, shows a very high or high connection in 12 Member States and a medium connection in eight others. Portugal, Hungary, Romania, the Czech Republic and Cyprus show a very high negative connection with fertility, while Bulgaria, Greece and Latvia show a high negative connection. Here, low-income disadvantage of having children is associated with high fertility. While Malta, Ireland and the Netherlands show a very high positive connection and Lithuania a high positive connection in this area. In these countries, high income disadvantage is associated with high fertility.

Granger causality analysis

Correlation can only show the direction and strength of the connection, it does not show causality. In order to draw conclusions about which indicator might be causing the increase in fertility, a Granger causality test was performed. The Granger causality test is used to determine whether the past evolution of one variable carries information about the future value of another variable, i.e. whether it helps to predict it.

As in the correlation analysis, I have also looked at the 27 Member States and the 27 countries of the European Union as a whole separately, i.e. I have looked to see whether there is a causal connection between fertility and any of the 10 indicators presented earlier, whether any of them can cause a change in fertility rates.

Table 2: Granger causality test and correlation test results

2009–2022		0–0.001	0.001–0.01	0.01–0.05							
Summa:	45	2	8	6	8	3	1	0	4	3	10
strong	4	0	0	1	1	0	0	0	0	1	1
medium	5	0	2	1	2	0	0	0	0	0	0
small	36	2	6	4	5	3	1	0	4	2	9
		B	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**
Austria	Corr	0.29	0.41	0.19	0.57	0.06	0.10	0.10	−0.27	−0.05	0.39
Austria	Gr				0.0183						
Belgium	Corr	−0.93	0.84	−0.06	−0.68	0.82	0.45	−0.01	0.94	−0.40	−0.06
Belgium	Gr					0.01177					
Bulgaria	Corr	0.61	−0.71	−0.34	−0.55	−0.61	−0.39	0.35	−0.48	−0.41	−0.61
Bulgaria	Gr	0.02368	0.02228								0.04364
Croatia	Corr	0.32	−0.43	0.31	0.30	−0.84	−0.80	0.38	−0.23	−0.25	−0.36
Croatia	Gr		0.02101								
Cyprus	Corr	0.39	−0.68	−0.63	−0.78	−0.45	0.40	0.06	0.46	−0.80	−0.72
Cyprus	Gr										
Czechia	Corr	0.89	−0.91	−0.91	−0.74	−0.79	−0.48	0.09	−0.81	−0.31	−0.76
Czechia	Gr			0.006987	0.02387						0.041
Denmark	Corr	−0.07	−0.19	0.07	−0.50	0.10	−0.45	0.46	0.49	−0.07	−0.18
Denmark	Gr		0.02549								
Estonia	Corr	−0.42	0.42	−0.09	0.08	0.11	0.43	0.55	0.01	−0.24	0.36
Estonia	Gr										
EU27	Corr	−0.54	0.39	0.16	0.24	0.46	0.29	0.12	0.53	0.28	0.49
EU27	Gr										0.03259
Finland	Corr	−0.78	0.27	0.20	−0.84	−0.13	−0.71	−0.28	0.95	0.24	−0.37
Finland	Gr										
France	Corr	−0.97	0.80	0.04	−0.79	−0.69	−0.08	0.02	0.20	0.36	−0.30
France	Gr		0.001089						0.0112		
Germany	Corr	0.78	−0.84	−0.40	−0.43	−0.29	−0.29	−0.09	−0.61	0.35	−0.20
Germany	Gr		0.004489	0.02986							
Greece	Corr	0.51	−0.74	−0.77	−0.56	0.01	0.29	−0.08	0.73	−0.07	−0.55
Greece	Gr										
Hungary	Corr	0.96	−0.97	−0.79	−0.76	−0.78	−0.69	0.27	−0.38	−0.27	−0.83
Hungary	Gr			0.0145							0.03225
Ireland	Corr	−0.87	0.86	0.86	0.81	0.70	0.71	−0.29	0.63	0.45	0.85
Ireland	Gr	0.04823	0.02467	6.994e−05	0.0001094						0.03247
Italy	Corr	−0.91	−0.07	0.17	0.44	0.90	0.57	−0.22	0.67	−0.58	0.40

2009–2022		0–0.001	0.001–0.01	0.01–0.05							
Summa:	45	2	8	6	8	3	1	0	4	3	10
strong	4	0	0	1	1	0	0	0	0	1	1
medium	5	0	2	1	2	0	0	0	0	0	0
small	36	2	6	4	5	3	1	0	4	2	9
		B	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**
Italy	Gr		0.04721	0.04063	0.04272				0.04047	0.01171	0.02199
Latvia	Corr	0.56	−0.65	−0.75	−0.60	0.74	0.57	−0.11	0.64	−0.40	−0.55
Latvia	Gr				0.02523	0.02979			0.02455		0.03322
Lithuania	Corr	−0.21	0.04	−0.06	−0.02	0.86	0.77	0.32	0.49	0.47	0.62
Lithuania	Gr								0.004321		
Luxembourg	Corr	−0.91	0.26	−0.42	0.57	−0.59	−0.46	−0.03	0.96	0.08	0.47
Luxembourg	Gr										
Malta	Corr	−0.91	0.85	0.70	0.72	0.68	0.77	0.06	−0.44	−0.33	0.88
Malta	Gr										
Netherlands	Corr	−0.90	0.60	0.45	0.94	0.68	0.64	−0.11	0.93	−0.30	0.84
Netherlands	Gr				0.01137						
Poland	Corr	0.11	−0.38	−0.67	−0.77	−0.16	−0.40	0.10	−0.06	0.07	−0.49
Poland	Gr				0.003418						
Portugal	Corr	0.74	−0.87	−0.90	−0.92	−0.86	−0.58	0.23	−0.62	−0.03	−0.90
Portugal	Gr										0.03485
Romania	Corr	0.78	−0.92	−0.86	−0.68	−0.69	−0.78	0.23	−0.73	−0.46	−0.80
Romania	Gr			0.03127	0.001706	0.04413				0.0002811	0.0003783
Slovakia	Corr	0.89	−0.93	−0.81	0.34	−0.64	−0.39	−0.14	−0.66	−0.53	−0.06
Slovakia	Gr									0.03227	
Slovenia	Corr	0.47	−0.29	−0.55	0.08	−0.08	0.25	0.42	0.31	−0.22	−0.17
Slovenia	Gr		0.03552				0.0103				0.01959
Spain	Corr	−0.75	0.54	0.17	0.29	0.63	0.10	0.09	0.84	0.31	0.12
Spain	Gr										
Sweden	Corr	−0.77	0.06	−0.59	−0.66	−0.29	0.00	−0.07	0.92	0.20	0.05
Sweden	Gr										

Source: compiled by the author

If the significance value for the test is $p < 0.1\%$, then a strong causal connection is detected, between 0.1% and 1% a medium causal connection is detected, and between 1% and 5% a small causal connection is detected.

Looking at the EU27 countries as a geographical unit, I was able to detect 1 low-strength causal connection: the difference between fertility rates and the relative income poverty rate for households with and without children. As mentioned earlier, I found a medium positive correlation for this indicator. So, looking at the Union as a whole, an increase in income deprivation for those with children increases fertility and a decrease in deprivation decreases fertility, although the correlation is only medium. This cannot be explained by anything other than the fact that, across the EU as a whole, more children are born in lower income households.

From 2009 onwards, this indicator has a detectable causal connection with fertility in nine Member States, with a positive correlation in two cases and a negative correlation in seven cases. Among the indicators, it has a causal connection in most countries. A small causal connection is found with a very high positive correlation with Ireland and a medium positive correlation with Italy. In these countries, it is true that fertility is boosted by increasing income disadvantage with children, i.e. those in better income

positions are less likely to have children. Furthermore, there is a strong causal connection with a very high negative correlation in Romania, a small causal connection with a very high negative correlation in Portugal, Hungary and the Czech Republic, a high negative correlation in Latvia and Bulgaria, and a small negative correlation in Slovenia. In these seven countries, fertility increases when the income disadvantage of having children decreases, i.e. there is no higher relative income poverty risk for those who have children.

The second most causal connection with fertility was the difference between child and childless households in the AROPE indicator according to the methodology used in the EU2020 strategy and the female unemployment rate, both for eight countries. For AROPE, a strong causal connection with a very high positive correlation was found in Ireland, a small causal connection with a very high positive correlation in the Netherlands, a high positive correlation in Austria and a medium positive correlation in Italy. In these Member States, more children are born when the excess risk of child poverty increases. We find a medium causality with a very high negative correlation in Poland and the Czech Republic and a high negative correlation in Romania and Latvia. Here, fertility increases when the excess risk of child poverty decreases.

Looking at the female unemployment rate, we find a medium causality with a very high negative correlation in Germany and a low causality with a very high negative correlation in Bulgaria, a medium negative correlation in Croatia, a low negative correlation in Denmark and Slovenia and no correlation in Italy. In these Member States, fertility increases when the female unemployment rate decreases. Furthermore, we find a medium causality with a very high positive correlation in France and a low causality with a very high positive correlation in Ireland. Here, the increase in fertility is caused by an increase in female unemployment.

The other indicators gave less causal relationship with fertility than these.

In Cyprus, Estonia, Finland, Greece, Luxembourg, Malta, Spain, Sweden and Cyprus, there is no detectable causal relationship between fertility and any of the indicators included in the survey.

In summary, the causal analysis shows that there are three factors that are causally related to fertility in a third of the 27 Member States, i.e. that cause higher or lower fertility. These are:

K: difference in relative income poverty rate between households with and without children – for nine Member States and the EU as a whole

C: female unemployment rate in the 20–64 age group – eight Member States

E: difference between AROPE2020 households with and without children – for eight Member States

Cluster analysis

By including the correlation coefficients of the above three factors, a hierarchical cluster analysis was performed using Ward's method, which is one of the methods to measure the closeness between clusters. This method characterises clusters by their midpoints in a similar way to other methods, but measures the closeness of two clusters by the

increment in the total squared error resulting from their merging. Like the K-means method, the Ward method minimises the sum of the squared distances of the points from their cluster centres.

This allowed us to organise the EU Member States into three different clusters and seven sub-clusters within each cluster.

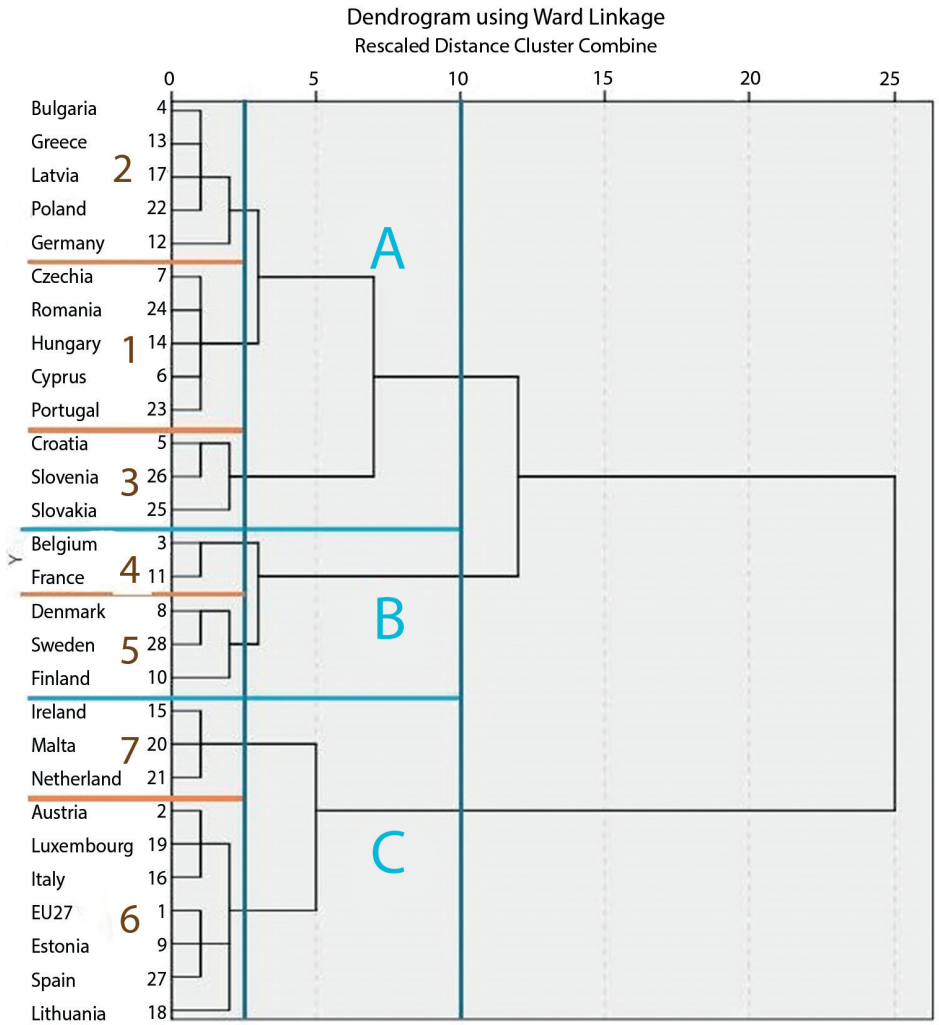

Figure 2: Ward dendrogram

Source: compiled by the author

In cluster A countries, fertility is negatively related to female unemployment and the difference in relative income poverty rates, and mostly also to the poverty surplus. Portugal, Germany, Greece, Cyprus and, apart from Estonia and Lithuania, the countries of

the Eastern Bloc are included. Their main feature is that they had much lower fertility rates in the period 2009–2015 than today.

We can break down these 13 countries into the following three sub-clusters:

In the countries of group "1" we also find a very high negative correlation with female unemployment, excess child poverty risk and excess relative income poverty. Here, clearly, an increase in fertility is associated with an increase in female labour force participation and a decrease in the poverty risk of having children – working and non-poor women have more children.

For the countries in group "2", fertility has a very large negative relationship with female unemployment and still has a large negative relationship with the excess risk of child poverty and the excess relative income poverty – working households and households at lower risk of poverty.

In group "3" countries, fertility has a large negative connection with female unemployment, negative with excess relative income poverty of children, but already positive with excess poverty of children – working households and households not living below the poverty line who take on the risk of excess poverty.

For cluster B countries, fertility is negatively correlated primarily not with relative income poverty, but with the excess risk of poverty between those with and without children. The three Nordic countries, and France and Belgium belong to this group. They still have higher fertility rates than the EU average, but they are already suffering a serious decline. The lowest fertility rate in the last decade and a half was measured in 2022.

The five Member States can be divided into the following two sub-clusters:

In the countries of group "4", fertility has a small positive connection with excess child poverty risk and excess relative income poverty, but a very large positive connection with female unemployment – more women who are not working and not at risk of poverty have children.

In the countries of group "5", fertility has little or no association with female unemployment and income inequality, but a large negative association with the excess risk of child poverty – no matter, working or not, but not at risk of poverty have children.

In cluster C countries, the fertility rate is positively related to relative income poverty, meaning that the poor have more children. Nine countries belong to this cluster, the Mediterranean countries except Greece and Portugal, plus Ireland, the Netherlands, Austria, Estonia and Lithuania. It even includes the European Union if we consider it as one country. Their fertility rates have been falling steadily and significantly, and most are already below the EU average. Both in these countries and in the European Union as a whole, fertility was at its lowest in 2022.

The nine countries can be broken down into the following two sub-clusters:

In group "6" countries, there is a medium positive connection between fertility and the surplus relative income poverty rate, and a smaller but positive connection with the other two indicators – those with surplus relative income poverty have more children.

The countries in Group "7" are the opposite of Group "1", i.e. fertility has a very strong positive correlation with all three factors – those who are not employed and at risk of poverty have more children.

Summary

Based on the above, the following answers can be given to the three research questions described in the first chapter:

1. Which of the indicators related to women's labour market participation and family living conditions, household income and financial situation in the European Union and the Member States are most strongly related to fertility?

As detailed in the previous subchapter, the correlations between the 10 indicators and fertility are shown in the table below (Table 3). (The numbers represent the number of Member States.) For 9 indicators, correlations are found in more than three quarters of the countries, and for 5 indicators, correlations are at least high in more than half of the countries. For almost all indicators, however, the direction of correlation is different, with the same indicator showing a positive correlation for several countries and a negative correlation for several others.

Table 3: Summary of fertility correlations

	positive	**negative**	**total**	**at least large**
B – female employment rate 20–64	14	13	27	19
E – AROPE2020 with children – childless	9	15	24	18
F – AROPE2030 with children	10	14	24	17
C – female unemployment rate 20–64	11	13	24	16
I – gender pay gap	15	10	25	16
D – AROPE2020 with children	8	14	22	13
K – difference in relative income poverty rate between child-headed and childless households	9	14	23	12
G – AROPE2030 with children – childless	11	11	22	11
J – difference in relative income poverty rate between genders (18–64)	7	14	21	3
H – real GDP per capita growth	9	6	15	1

Source: compiled by the author

2. For which factors can we also show a causal relationship, i.e. which factors cause a change in fertility?

As detailed previously, the Granger test revealed a total of 45 causal relationships, i.e. 45 cases where there was evidence of causality between an indicator and fertility. These are presented in Table 4 below. (The numbers represent the number of Member States.) Three indicators were found to have a detectable causal relationship with fertility in at least one third of the countries.

Table 4: Summary of Granger test causality

	total	strong	Medium	small
K – difference in relative income poverty rate between child-headed and childless households	9	1	0	8
C – female unemployment rate for 20–64-year-olds	8	0	2	6
E – AROPE2020 with children – childless	8	1	2	5
D – AROPE2020 with children	6	1	1	4
I – gender pay gap	4	0	0	4
F – AROPE2030 with children	3	0	0	3
J – difference in relative income poverty rate between genders (18–64)	3	1	0	2
B – female employment rate 20–64	2	0	0	2
G – AROPE2030 with children – childless	1	0	0	1
H – real GDP per capita growth	0	0	0	0
in total:	45	4	5	36

Source: compiled by the author

3. How can Member States be grouped into clusters?

As described earlier, the cluster analysis carried out by the Ward method distinguishes three clusters and seven sub-clusters as shown in the following figures (Figure 3 and 4).

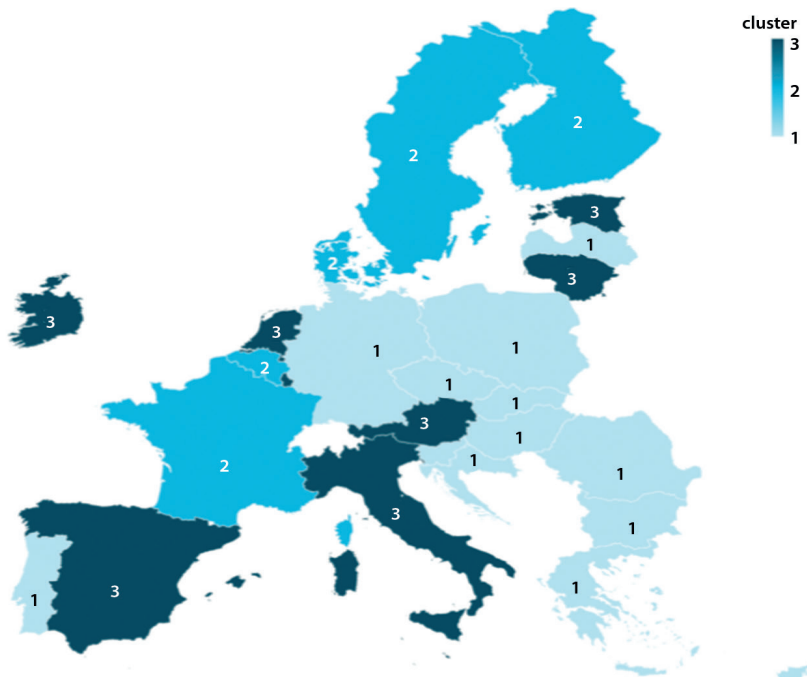

Figure 3: Cluster distribution of EU Member States by fertility and female unemployment and the risk of additional poverty or additional relative income poverty due to childbearing

Source: compiled by the author

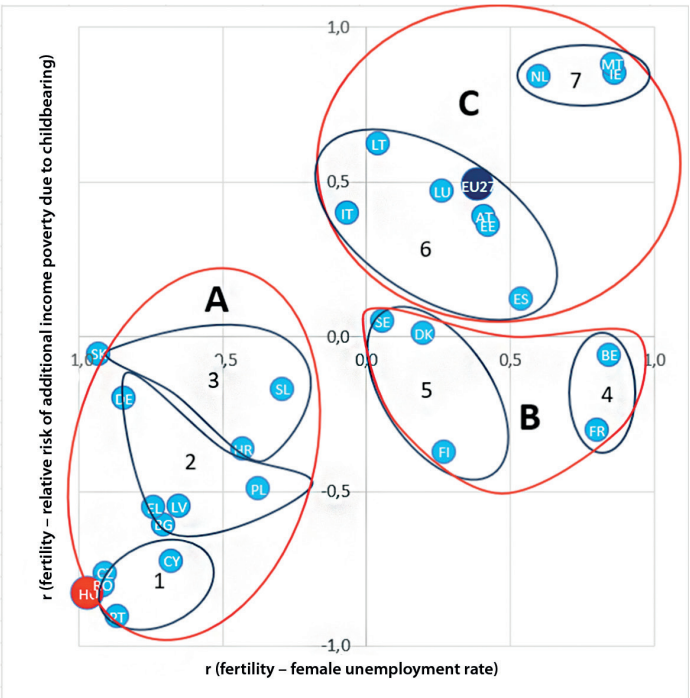

Figure 4: Cluster distribution of EU Member States by fertility and female unemployment and the relative risk of additional income poverty due to childbearing

Source: compiled by the author

In the case of clusters, different emphases should be given to the participation of women in the labour market and to the development of measures to improve the income and living conditions of families and households.

In Group A countries, increased attention should be paid to ensuring that women can keep their jobs after childbirth, are not threatened with unemployment and are able to face the challenges of the workplace as they did before having children. Furthermore, a family support system must be developed that can keep the relative income poverty rate of households with children at the level of those without children, i.e. that does not imply additional income poverty as a result of having children. For sub-clusters 1 and 2 of the group, it is also important that the AROPE2020 complex indicator does not increase with childbearing. For countries in sub-cluster 3, the indicator is currently increasing with childbearing.

In Group B and C countries, fertility is positively correlated with female unemployment. Group B countries and sub-cluster 7 of C, Lithuania and Luxembourg had the lowest fertility rate ever in 2022, but the other countries also had the lowest fertility rate since 2009. All countries in cluster B have the increase of AROPE2020 indicator, i.e. poverty associated with an increase in childbearing, and therefore fertility is now falling. And for cluster C, childbearing is associated with relative household income

poverty surplus, which is now being taken up by fewer people. The European Union as a whole is also included in this group, which explains the recent significant decline in overall childbearing. It would be beneficial for these groups, as well as for the EU as a whole, to provide additional assistance to those who are not at risk of poverty, with the aim of promoting childbearing. Furthermore, it is essential to ensure that employed women receive adequate support to establish a positive correlation between employment and fertility growth in the near future. One potential approach could be the introduction of a significant income tax credit for individuals with children or the provision of other non-welfare benefits.

The study thus confirmed the paradox already observed, i.e. that in cluster A countries, female labour market participation is associated with increased fertility, and vice versa in the other two clusters. As women's labour market participation is nowadays rising everywhere, we can see an increase in fertility in cluster A countries and a decrease in fertility in the others.

In the second chapter I have listed several studies that have analysed fertility and the labour market situation of women. The present research explains how it is possible to be right both to argue that women forego having children in order to keep their jobs (the example of Italy, Bettio and Villa, 1998)[24] and to argue that fertility increases when women have secure jobs. A discrepancy was identified in the various literature. The study demonstrated that in approximately half of the Member States, a negative correlation between unemployment and fertility was observed. Conversely, in almost half of the Member States, a positive correlation was identified. A substantial body of literature posits that an uptick in the employment rate is associated with a decline in fertility. For instance, Hondroyiannis (2010) makes this assertion.[25] The results of our study indicate that a negative correlation exists in almost as many Member States as a positive one.

It could be stated that the claims made in the previous literature are applicable only to certain groups of countries and are not generalisable.

The present study also confirms previous literature that more people have children when parents have a sense of security and confidence in the future. One factor of this sense of security is employment security, another is the security of maintaining income levels, or, in the other direction, the probability of avoiding relative income poverty, or the risk of poverty (AROPE) or the probability of avoiding poverty. If a country's family support system includes effective measures focusing on these areas, fertility will improve.

The UN indicators for sustainable development include both the employment rate and the AROPE indicators. Country-specific recommendations for measures to improve these indicators are periodically drawn up by the European Union. It is recommended that the above context be taken into account when developing these measures.

Further scientific research on this topic, even on a country-by-country or country-group basis, is also worthwhile, as it can shed light on how to initiate developments that not only improve the specific sub-region of the region, but also have a positive impact on demographic processes.

[24] BETTIO–VILLA 1998.
[25] HONDROYIANNIS 2010.

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