Population, Space and Place

WILEY

RESEARCH ARTICLE OPEN ACCESS

Economic Conditions, Education and Parity-Specific Fertility: A Sub-National Regional Study Across 15 Countries in Europe

Jessica Nisén[1,2,3] | Sebastian Klüsener[2,4,5] | Johan Dahlberg[6] | Lars Dommermuth[7] | Aiva Jasilioniene[2] | Michaela Kreyenfeld[8] | Trude Lappegård[9] | Peng Li[2] | Pekka Martikainen[2,3,10] | Karel Neels[11] | Bernhard Riederer[12,13] | Saskia te Riele[14] | Harun Sulak[4] | Laura Szabó[15] | Alessandra Trimarchi[16] | Francisco Viciana[17] | Mikko Myrskylä[2,3,10]

[1]INVEST Research Flagship Centre, University of Turku, Turku, Finland | [2]Max Planck Institute for Demographic Research, Rostock, Germany | [3]Helsinki Institute for Demography and Population Health, University of Helsinki, Helsinki, Finland | [4]Federal Institute for Population Research (BiB), Wiesbaden, Germany | [5]Vytautas Magnus University, Kaunas,, Lithuania | [6]Stockholm University, Stockholm, Sweden | [7]Statistics Norway, Oslo, Norway | [8]Hertie School, Berlin, Germany | [9]University of Oslo, Oslo, Norway | [10]Max Planck – University of Helsinki Center for Social Inequalities in Population Health, Rostock, Germany and Helsinki, Finland | [11]University of Antwerp, Antwerp, Belgium | [12]Austrian Academy of Sciences, Vienna, Austria | [13]University of Vienna, Vienna, Austria | [14]Statistics Netherlands, The Hague, Netherlands | [15]Hungarian Demographic Research Institute, Budapest, Hungary | [16]University of Messina, Messina, Italy | [17]Institute of Statistics and Cartography of Andalusia, Sevilla, Spain

Correspondence: Jessica Nisén (jessica.nisen@utu.fi)

Received: 6 September 2024 | **Revised:** 1 July 2025 | **Accepted:** 8 July 2025

Funding: Nisén was supported by the Academy of Finland, grant nos. 332863 and 320162 (INVEST Research Flagship) and by the Strategic Research Council (SRC) of the Academy of Finland, grant nos. 345130 and 345131 (Family Formation in Flux—Causes, Consequences and Possible Futures, FLUX). Lappegård and Dommermuth acknowledge support from the Research Council of Norway (project nos. 300870 and 287634). Martikainen was supported by the European Research Council under the European Union's Horizon 2020 research and innovation programme (Grant 101019329), the SRC within the Academy of Finland grants for ACElife (#352543-352572) and LIFECON (# 345219). Trimarchi acknowledges support from the French National Research Agency (Grant ANR-16-CE41-0007-01, PI: Laurent Toulemon). Myrskylä was supported by the SRC, FLUX consortium, decision numbers 345130 and 345131, and by the National Institute on Aging (R01AG075208) and the European Union (ERC Synergy, BIOSFER, 101071773). The views and opinions expressed are, however, those of the authors only and do not necessarily reflect those of the European Union or the European Research Council. Neither the European Union nor the granting authority can be held responsible for them. Martikainen and Myrskylä were also supported by grants to the Max Planck—University of Helsinki Center from the Jane and Aatos Erkko Foundation (#210046), the Max Planck Society (#5714240218), University of Helsinki (#77204227) and the cities of Helsinki, Vantaa and Espoo.

Keywords: childlessness | cohort fertility | economic development | education | empirical Bayesian | Europe | fertility rate | GDP | sub-national region

ABSTRACT

There is a longstanding interest in the link between economic conditions and fertility levels. Most research measuring economic development has focused on national-level patterns and period total fertility levels. We aim to extend existing knowledge by carrying out a sub-national regional analysis of the link between economic conditions and parity-specific cohort fertility, while taking into account heterogeneity by educational level. We study three fertility outcomes by women's education: the share of women who remain childless, the mean number of children per mother and the mean number of children per woman. For this analysis, we harmonised register, census and large-scale survey data from 15 European countries, with a focus on women born in the late 1960s. Women's fertility was measured at the end of their reproductive careers and combined with contextual information, including information on the regional GDP (per capita). In our multiple regression models that controlled for country-level factors, we found that GDP was positively associated with childlessness among women with medium and high levels of education. However, GDP was negatively associated with the number of children per mother among women with low

levels of education. These findings show that the relationship between economic conditions and fertility varies depending on the level of education of the women, and it differs between childlessness and continued childbearing. High-income contexts may be less supportive of continued childbearing for women with lower levels of education.

1 | Introduction

Fertility levels vary widely across high-income countries with different country-level contexts. Economic conditions are considered an important factor in these differences (see, e.g., Lee 2003; Sobotka 2011). Until recently, fertility tended to be lower in countries with higher income levels (Bryant 2007; Lee 2003). However, by the beginning of the 21st century, this pattern had reversed among high-income countries, such that further increases in the level of economic development were no longer necessarily associated with lower levels of fertility (Myrskylä et al. 2009; Luci-Greulich and Thévenon 2013). It has been suggested that the reversal of this association among high-income countries is related to more direct factors, such as institutions that support work-family reconciliation and higher levels of gender equality (Myrskylä et al. 2011; Luci-Greulich and Thévenon 2013). While the main body of this line of research has focused on country-level variation, a more recent focus has highlighted differences in fertility levels according to economic development at the sub-national regional level (Fox et al. 2019; Nisén et al. 2021; Wood et al. 2020). Overall, examining patterns within countries has the potential to provide a better understanding of the country-level patterns, as the latter may mask notable within-country variation (Snyder 2001). Furthermore, the role of education in the relationship between economic conditions and fertility is not well elaborated. There is reason to expect that the proposed mechanisms driving the changes in the association, such as institutional support to address the opportunity costs of children, may affect educational groups differently. For example, the availability of childcare may have a stronger positive effect on fertility for highly educated women (Esping-Andersen 2009; Goldscheider et al. 2015; Cherlin 2016).

Moreover, the role of parity has received limited attention in the discussions of the macro-linkages between economic conditions and fertility, as this study has mostly analysed period total fertility rates. This is a limitation given the sequential nature of childbearing decisions (Huinink and Feldhaus 2009; Berrington and Pattaro 2014), and the possibility that different parity transitions have different drivers (Wood et al. 2020). Therefore, total fertility rates obscure substantial variation in terms of parity across countries and educational levels (Zeman et al. 2018; Jalovaara et al. 2022). Unlike cohort fertility rates, aggregate period fertility rates are also affected by shifts in the timing of childbearing, such as the postponement trend (Bongaarts and Sobotka 2012). This study aims to narrow existing research gaps by conducting a sub-national regional analysis that examines three cohort fertility outcomes for women: childlessness, the number of children per mother and the number of children per woman. In doing so, we extend existing research that has examined total cohort fertility rates (Nisén et al. 2021), while taking a closer look at parity-specific fertility. We study women born in the late 1960s in 15 European countries. The analysed data set includes information on educational attainment and region of residence. The latter information allows us to relate these data to regional contextual data, including the level of GDP per capita as a measure of regional economic development. Examining parity-specific measures of cohort fertility enables us to gain a deeper understanding of the relationship between economic conditions and fertility levels.

2 | Background

2.1 | Links Between Economic Conditions, Education and Fertility

In recent decades, empirical studies have documented that the country-level association between economic conditions and fertility reversed among countries that had reached relatively high income levels (Myrskylä et al. 2009; Luci-Greulich and Thévenon 2013). However, the robustness of such a *U*-shaped relationship to different measures of economic conditions has been called into question (Harttgen and Vollmer 2014; Furuoka 2009). A study using data through 2018 did not find a positive association between economic development and fertility (Gaddy 2021, see also Kolk 2019). Generally, the long-standing relationship between (economic) development and fertility has been described as an associational link that can be explained by more direct factors (Bongaarts and Watkins 1996). This interpretation is also present in the discussion on the plausibility of the positive link between economic development and fertility across high-income countries, which has been attributed to the institutional support for working mothers and gender equality that may arise in conjunction with economic development (Myrskylä et al. 2009).

The positive link between economic development and fertility in countries where economic conditions are better, that is, in countries with a high level of economic development, was shown to be contingent on increased fertility at older ages (Myrskylä et al. 2011), which is more common among more highly educated women due to their tendency to delay parenthood (Greulich and Toulemon 2023). Arguments similar to those for the changing association between economic development and fertility were put forward for the changing association between female employment and fertility, which turned at the country level from negative in the 1970s to positive from the 1990s onward (Brewster and Rindfuss 2000; Ahn and Mira 2002; Oshio 2019; Mavropoulos and Panagiotidis 2021; Engelhardt and Prskawetz 2004). This changing relationship also strengthened the empirical foundation for a pro-cyclical, as opposed to a counter-cyclical, (period) fertility pattern (see Butz and Ward 1979) in recent decades (Andersson 2000; Sobotka et al. 2011).

For women with higher levels of education, the opportunity costs of childbearing are greater given their potential to earn higher wages and have steeper career profiles (Gustafsson 2001).

Therefore, institutional support for work-family reconciliation (Rindfuss et al. 2010; Brewster and Rindfuss 2000) may benefit women with higher levels of education more. In practice, this support can enable women to outsource childcare and housework (Raz-Yurovich 2014), encourage the gender-neutral division of work within families, and support gender-equal norms in the society (Esping-Andersen 2009; Goldscheider et al. 2015; Cherlin 2016). Prior evidence from Europe indeed has shown that reconciliation policies, such as public childcare, have positive effects on fertility rates across countries (Bavel and Rózanska-Putek 2010) and regions (Rindfuss et al. 2010; Wood et al. 2020), especially for women with higher education.

Furthermore, it has been suggested that improvements in the institutional framework of childbearing together with changing gender roles have led to decreasing country-level differences in fertility between women with different levels of education. While lower educated women continue to have higher levels of total fertility in many countries (Greulich and Toulemon 2023), educational differences in fertility have attenuated, disappeared, or reversed in some countries (Brzozowska et al. 2022; Van Bavel et al. 2018; Wood et al. 2014), such as in the Nordic countries (Kravdal and Rindfuss 2008; Jalovaara et al. 2018) and Belgium (Neels and De Wachter 2010). Taken together, this evidence points to the possibility that women with higher education may be better able to realise their childbearing desires in contexts with better economic conditions, such as higher levels of economic development. However, the role of women's education in the link between economic conditions and fertility has received limited empirical attention in the context of high-income countries.

2.2 | The Link Across Regions Within Countries

Focusing on the sub-national regional level within countries, the mere existence of a regional contextual effect on fertility remains debated, as population composition and selective migration across regions can also affect the fertility rates in a region (Basten et al. 2012; Kulu 2013; de Beer and Deerenberg 2007). These three factors—contextual effects, population composition and selective migration—are also mutually related and often difficult to empirically disentangle. It has been theorised that changes in country-level family policies and the spatial organisation of work have weakened the longstanding negative relationship between economic conditions and fertility at the regional level as well (Fox et al. 2019). The argument related to family policies refers to the changes in policies addressing the opportunity costs of children. Such support mechanisms may be expected to be more beneficial to women with higher levels of education. Moreover, it has been argued that highly educated women would benefit more from the digital transformation of the labour market than their less educated counterparts (Bogusz et al. 2024; Nisén et al. 2021), because they are more likely to work in occupations that offer more flexible forms of employment such as remote work (Golden 2001). They also have a higher probability of living in economically strong regions where significant numbers of employers offer such flexibility (Fox et al. 2019).

There are also other regional factors associated with economic conditions that may impact women's fertility, depending on their level of education. These include the regional cost of living (e.g., housing), the availability of services supporting work-family reconciliation (e.g., childcare), and regional employment prospects. Women with higher levels of education may be less sensitive to expensive living costs because they are more likely to have high household income levels due to assortative mating (Esping-Andersen 2009; Konietzka and Kreyenfeld 2010). The regional availability of services may have stronger positive effects on the fertility of women with higher education (Rindfuss et al. 2010; Wood et al. 2020). The concentration of the highly educated (Eurostat 2019) and dual-earner couples (de Meester and Van Ham 2009) in economically strong regions could also contribute to more demand for, and thus better availability of, services for families in these regions. Moreover, regional employment prospects (Bujard et al. 2017; Kravdal 2002), which are often better in regions with higher GDP per capita (Dunford 1996), are particularly important for the highly educated. However, there may also be counteracting mechanisms. For example, labour markets in regions with strong economies may be more competitive (Kulu 2013; Kulu et al. 2014), composed of larger high-technology sectors that require employees to make substantial investments early in their careers (Riederer and Beaujouan 2024), and that provide attractive career opportunities that are not easily compatible with childbearing. These mechanisms may also be more relevant for women with higher educational levels.

While the link between regional economic development and period fertility is negative across Europe (Campisi et al. 2020), it has weakened over time and has become positive in some countries (Fox et al. 2019). A recent study showed a reversed *J*-shaped link between human development and fertility in the US that was partly attributable to gender equality and economic uncertainty (Schubert et al. 2024, see, however Ryabov 2015). Moreover, less negative educational gradients tend to be more common in European regions with better economic conditions, that is, higher levels of GDP per capita (Nisén et al. 2021). A Belgian case study indeed showed interaction effects of regional characteristics with women's education, whereby regional income level was negatively associated with second birth hazards for low and medium educated women and was positively associated with second birth hazards for high-educated women, while childcare coverage was positively associated with second birth hazards for medium and high-educated women (Wood et al. 2020). Furthermore, the regional degree of industrial automation was more negatively associated with fertility in European regions with less educated populations (Matysiak et al. 2023). An Italian study found that the degree of complexity of a regional economy—reflecting the diversity of its workforce's skill structure and its potential to grow and create job opportunities in the future—positively affected its current fertility levels (Innocenti et al. 2021). Another recent study found evidence of more negative educational gradients in birth transitions in urban regions of North-Western European countries (Wood et al. 2025). This finding was related to larger migrant populations in urban areas.

2.3 | The Role of Parity in the Link

Given the sequential nature of childbearing decisions (Huinink and Feldhaus 2009; Berrington and Pattaro 2014), it is not

surprising that cohort fertility masks substantial parity-specific variation across countries (Zeman et al. 2018) and educational groups (Jalovaara et al. 2022). The value of parity-specific analysis has also been highlighted in previous studies with a sub-national regional perspective (Fiori et al. 2014; Kulu et al. 2014; Wood et al. 2025). The effect of contextual factors, such as economic conditions may affect fertility differently depending on parity, rather than exerting a universal influence. For example, the prospects for reconciling work and family life may be more important for decisions about higher-order births, as parents with one child have already experienced the relevance of practical arrangements for daily life with children (Bavel and Rózanska-Putek 2010; Klesment et al. 2014; Kravdal 1996; Harknett et al. 2014).

A number of studies have found that regional contextual effects are, overall, stronger on first births than on higher-order births (Fiori et al. 2014; Kulu et al. 2007; Wood and Neels 2019), or vice versa (Kravdal 1996), while others have found no evidence of regional contextual effects (Hank 2002; Hank and Kreyenfeld 2003). These apparent discrepancies may be due to differences in the contextual measures and methodological approaches used. Some studies based on event history analysis may have found stronger effects on first births because the timing of higher-order births is more constrained by the biological age limits on childbearing for mothers (Wood and Neels 2019). Moreover, as childlessness is closely associated with partnership histories (Jalovaara and Fasang 2017), its prevalence across countries and sub-national regions may depend heavily on the conditions affecting partnership formation, for example, local partner markets (Van Bavel 2012; Schacht and Kramer 2016; Pettay et al. 2021). Cultural and normative factors, such as the acceptance of childless lifestyles, may also be more relevant for decisions regarding first births than for decisions regarding subsequent births (Kulu 2013; Fiori et al. 2014).

3 | Aim of the Study

The current study aims to enhance the understanding of the link between economic conditions and fertility in three ways. Specifically, we offer new insights by (1) contrasting three measures of cohort fertility including parity-specific information; (2) looking at the role of women's levels of education in the link between economic conditions and fertility; (3) and studying these questions with an emphasis on a sub-national regional level perspective. In total, we analyse three fertility outcomes: childlessness; the number of children per mother; and the number of children per woman, which is a composite of the two other outcomes. Regional economic conditions are captured by the level of economic development (GDP per capita). This focus is motivated by the broad impact of economic development on societies (Bongaarts and Watkins 1996; Islam and Clarke 2002), and evidence that its relationship with fertility has been shifting. We have the following three research questions.

Does the relationship between economic development and cohort fertility vary depending on women's educational levels? Given the theoretical considerations and previous findings outlined above, we assume that it does (H1). This is broadly based on the expectation that the fertility of women with higher levels of education will be less negatively affected by contexts with higher levels of economic development. Beyond country-level policies and norms, highly educated women may benefit more from the digital transformation of the labour market, as they can often take advantage of the more flexible forms of work that tend to be concentrated in economically advanced regions (Fox et al. 2019).

Is the link different for childlessness than for continued childbearing? We propose that a positive link between economic development and fertility is more plausible for continued childbearing (i.e., the number of children a mother has) (H2). This is because we expect that compared to continued childbearing, childlessness is more affected by factors that influence the chances of finding a partner, as well as cultural and normative factors favouring a childfree lifestyle. In turn, factors that influence work-family reconciliation, such as flexible forms of work, may be more important for continued childbearing, as women who already have children may recognise more readily the value of such flexible work forms for work-family reconciliation based on their existing experience.

Are differences in the economic development-fertility relationship by women's level of education attributable to country-level factors? Since regional-level factors may influence the effect of economic conditions on fertility depending on women's educational level, we hypothesise that educational differences in this relationship are shaped not only by country-level factors, but also by mechanisms operating at the sub-national regional level (H3). In the analysis, we also conduct robustness checks and examine how our results are affected by other regional contextual measures and sub-national migration during reproductive ages.

To answer these questions, we analysed data on the parity-specific cohort fertility of women born in the late 1960s, which were linked to information on women's educational levels and regions of residence at the end of their reproductive careers. An advantage of using cohort fertility as the outcome is that unlike period fertility, it is not affected by the distorting effect of childbearing timing (Bongaarts and Sobotka 2012). Nonetheless, a limitation of the study design is that fertility is analysed as depending on conditions that are measured only at the end of the reproductive career. This limitation of a static study design may be critical especially at the sub-national regional level, given that migration often occurs during reproductive ages (Basten et al. 2012), and given the bidirectional causality between fertility and socioeconomic characteristics for women (Matysiak and Vignoli 2008). We aim to address some of these limitations in the results section.

4 | Data

The study is based on register, census and large-scale survey data covering 15 countries: Austria, Belarus, Belgium, Finland, France, Germany, Greece, Hungary, Ireland, Lithuania, the Netherlands, Norway, Romania, Spain and Sweden. We analysed native women born between 1964 and 1970. Cohort fertility, highest educational attainment, region of residence and

regional level of economic development were measured at the end of the reproductive careers of these women. In most countries, the data reflect the attributes of women as of 2011. The details of the analysed data sources can be found in Table S1. In seven countries, the data are based on censuses; in five countries, the data are based on population registers; and in three countries, the data are based on a microcensus, a large-scale survey, or a combination of the two.

We measured cohort fertility with three outcomes calculated at the sub-national regional level: the share of women remaining childless, the mean number of children per mother, and the mean number of children per woman. These data were derived from self-reports in census or survey data and birth records in register data. The mean age at the measurement of fertility was at least 42 years in all countries. Thus, completed fertility was slightly underestimated in some countries. In census data, women reporting unknown parity may cause small errors in the parity estimates (Sobotka 2017). For Belarus, Germany and Lithuania, for which census or survey data were used, the small numbers of women with unknown parity were redistributed based on the parity distribution of women with known parity.

Information on educational attainment was based on registers in countries providing register data, while in the other countries it was based on self-reports. We distinguished between low, medium and high educational attainment following the International Standard Classification of Education (ISCED) (UNESCO 1999). High refers to education at the tertiary level (ISCED 1997 levels 5–6), including short-cycle tertiary-level education. Medium refers to education at the higher secondary or post-secondary non-tertiary level (ISCED 1997, Levels 3–4). Low refers to education at the lower secondary level or lower (ISCED 1997, Levels 1–2). In Belarus, Greece, Ireland and Romania, the classification was based on the standards used by IPUMS international (IPUMS 2018). To align with the ISCED classification, we categorised technical education college degrees (Greece), third-level non-degree qualifications (Ireland) and short-term post-secondary (associate) degrees (Romania) as tertiary-level education in the IPUMS data (see OECD 2015).

The regional classification covering 116 sub-national regions was based on the Nomenclature of Territorial Units for Statistics (NUTS) classification by Eurostat, a sub-regional categorisation of territorial units in the European Union (Eurostat 2011). The NUTS categorisation is strongly linked to existing administrative divisions in a country, and also considers the general character and population size of the region. For most countries, we used the NUTS 2 level of classification, which covers regions and smaller countries with 800,000 to three million inhabitants.

NUTS 2-level data were analysed for Belarus, Belgium, Finland, Greece, Hungary, Ireland, the Netherlands, Norway, Romania, Spain and Sweden. NUTS 1-level data were analysed for Austria, France, Germany and Lithuania. At the NUTS 1 level, some of the analysed countries would consist of one region only, which would hinder regional within-country analysis and the comparability of regions across countries (see Table S1 for details). In the register data, information on the region of residence was derived from registers on the place of dwelling. In the survey data, this information was self-reported. In the census data, this information was either self-reported or obtained from registers and corrected, where necessary, based on self-reports.

We measured the regional level of economic development using GDP (purchasing power standardised gross domestic product) per capita in 2011 extracted from the Eurostat database (Eurostat 2018), for example, at the point in time when fertility, region of residence and education are recorded in most countries in the datasets included in this study. We also considered other closely related measures, such as employee compensation, which focuses on household income. As employee compensation is highly correlated with GDP across European regions and is not available for all regions in our data set, we decided to use GDP. In the remaining text, GDP refers to logged GDP per capita. In addition, we measured two covariates: the population density (i.e. the number of persons per square kilometer) of a region in 2011 (Eurostat 2025)[1] and the share of women with high levels of education in a region (SHE), which we derived from our cohort data.

5 | Methods

Fertility rates of women by education and region were subject to sampling variation in 9 out of the 15 countries for which full population data were not available. To document variation that reflects true heterogeneity rather than sampling noise, we used a standard method of small area estimation: the empirical Bayesian (EB) estimation (Assunção et al. 2005; Rao 2014; Longford 1999). In this method, statistical power is borrowed from other educational groups and regions in an attempt to limit noise in the fertility rate estimates. We assumed that the fertility outcome in question (number of childless women out of all women, mean number of children per mother/woman) followed a Poisson distribution, and borrowed strength for each educational group (1) from other educational groups within the region, (2) from the same educational groups in other regions within the country and (3) from regularities in education-specific fertility schedules within the country. Shrinkage of an estimate was stronger when the estimate was based on a smaller sample size and was stronger towards (an)other estimate(s) that was/were based on a larger sample size. Additionally, given a correlation between fertility and GDP within countries, greater weight was given to regions that had more similar GDP levels (see Nisén et al. 2021 for details).

Two types of linear regression models were used to analyse fertility rates. The first approach was a simple ordinary least squares (OLS) regression model, which was fitted separately for women with low, medium and high education (Model 1a). In this model, data were pooled across all countries and regions, while the dependent variable was one of the three fertility outcomes and the independent variable was the GDP of a region. This regression described how the level of fertility by education varied by the level of GDP across all countries and regions. The second approach was a model that had the same dependent and independent variables, but also included country fixed effects (Model 1b). This model estimated for each country the within-country association between the level of

fertility of an educational group and GDP, and provided an average of these within-country associations. The results from this model described how, on average, the level of fertility by education related to GDP within countries, net of country-level factors. All results presented are based on EB fertility rates, but the results based on observed rates were almost identical (Table S2). Models 1a and 1b were also estimated using additional regional covariates as independent variables; Models 2 and 3 included one or both of these covariates, along with GDP, in the regression (see Table 3).

In addition, a spatial autoregressive model was employed to test whether our results were sensitive to the geographical clustering across regions. The spatial weights matrix was calculated based on inverse geographical distances between region centres, thereby capturing spatial dependencies. The spatial data of Belarus were collected from the GADM (2025) database version 4.1, while the spatial data of the other regions were collected from Eurostat (Eurostat 2011). The results are reported in Table 3.

6 | Results

6.1 | Fertility Across Countries

To situate our findings, we first document cohort fertility rates at the country level (Table 1).[2] In most countries, women with medium levels of education were the largest educational category among women born in 1964–1970 (not shown). The percentage of childless women among women with low, medium and high levels of education was 16%, 15% and 20%, respectively. In 9 out of 15 countries, childlessness at the country level was most common among highly educated women. In six countries (Belarus, Lithuania, Finland, Sweden and Norway), childlessness was most common among women with low education, or women had similar levels of childlessness across educational groups (Belgium). The mean number of children per mother among women with low, medium and high levels of education was 2.36, 2.02 and 1.98, respectively. In all countries, the point estimate of fertility per mother was highest among the low educated. The differences between the high and medium educated groups were generally small, although the differences were larger in Eastern European countries with comparatively low levels of GDP (Belarus, Romania and Lithuania).

The country average in the number of children per women among low, medium and high-educated women was 1.98, 1.73 and 1.59, respectively (Table 1). Thus, there was a negative gradient in total fertility among the female cohorts studied, and fertility was highest among women with low education in most countries. In Belgium and Finland, the mean number of children per woman was not consistently lower among the highly educated, and in countries such as Sweden, Norway and the Netherlands, the differences by education were small.

Fertility levels varied by the country's economic conditions, with variation being stronger among women with medium or high levels of education. Among mothers with medium or high levels of education, the number of children per mother was generally higher in countries with a higher GDP, while this was not the case among low educated mothers (Figure 1). Correspondingly, there were less negative educational gradients in

TABLE 1 | Fertility and other characteristics by country: Women with low, medium and high education in 15 European countries. Countries arranged by their level of economic development (lowest on the top).

	Childlessness (%)			Children per mother			Children per woman			GDP	High	Pop.
Education	Low	Med.	High	Low	Med.	High	Low	Med.	High	in 2011	educ.[a]	density
Belarus	20	5	9	2.48	1.86	1.57	1.96	1.76	1.43	9900	25	3
Romania	10	11	21	2.55	1.76	1.42	2.28	1.57	1.12	14,050	20	93
Lithuania	17	7	13	2.48	2.04	1.80	2.06	1.90	1.56	16,207	32	48
Hungary	11	10	15	2.73	1.96	1.96	2.42	1.77	1.66	17,153	23	107
Greece	10	15	21	2.33	1.99	1.95	2.09	1.69	1.54	19,781	29	84
Spain	19	19	28	2.10	1.82	1.86	1.71	1.48	1.34	24,777	28	93
France	14	13	17	2.45	2.15	2.12	2.10	1.87	1.76	27,981	35	103
Belgium	16	17	17	2.22	1.98	2.10	1.87	1.64	1.73	29,761	40	364
Finland	21	18	19	2.53	2.45	2.27	1.99	2.00	1.83	31,013	53	18
Germany	24	20	26	2.19	1.90	1.89	1.67	1.51	1.40	32,108	25	225
Sweden	17	13	13	2.45	2.22	2.21	2.04	1.94	1.93	32,874	38	23
Ireland	17	17	25	2.87	2.52	2.52	2.38	2.10	1.88	34,143	34	67
Netherlands	16	16	22	2.26	2.17	2.18	1.89	1.82	1.71	34,209	29	495
Austria	14	18	27	2.31	1.99	1.89	1.98	1.62	1.37	34,675	23	102
Norway	13	10	12	2.39	2.29	2.29	2.08	2.07	2.03	35,268	42	16
Mean[b]	16	15	20	2.36	2.02	1.98	1.98	1.73	1.59	26,012	31	123

[a]Share of highly educated women (%).
[b]The mean refers to the cross-country average.

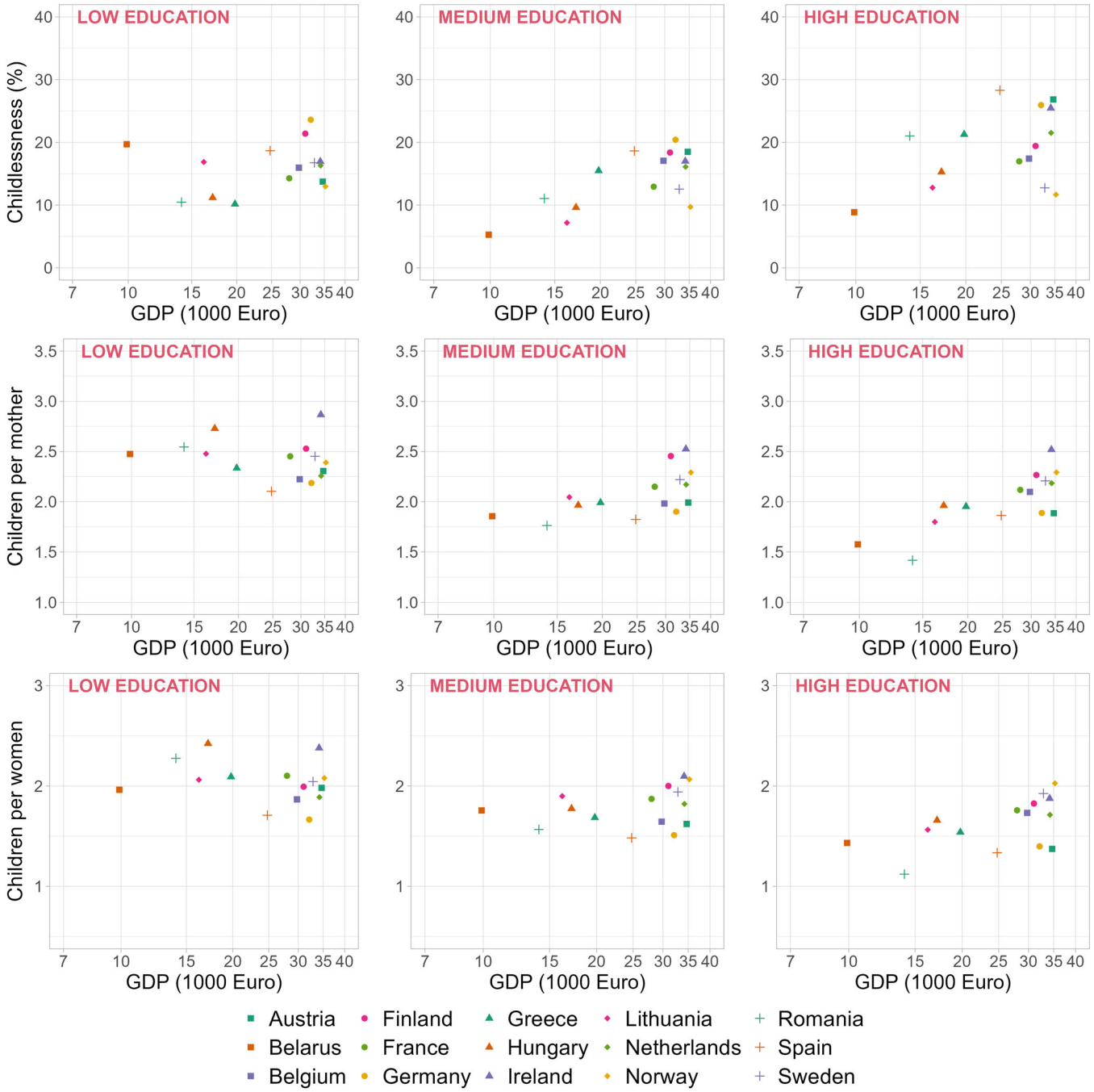

FIGURE 1 | Fertility by country's level of economic development: Women with low, medium and high education in 15 European countries ($N = 116$).

total fertility for women in countries with higher levels of GDP (Table 1). In turn, childlessness varied considerably across levels of GDP, regardless of women's educational levels, but higher levels of GDP tended to be associated with higher levels of childlessness.[3]

6.2 | Fertility Across Regions Within Countries

The cross-regional averages of the three fertility outcomes (first line in Table 2) were close to the cross-country averages (bottom line in Table 1), but there was greater variation across regions than across countries. The proportion of cross-regional variance attributable to country-level factors (Rho[4]) was over 50% across the different fertility outcomes and educational groups. For all fertility outcomes, this proportion was larger among women with higher levels of education, suggesting that country-level factors played a larger role in the fertility of these women. This was especially true for the fertility of mothers, among whom up to 56% (low), 81% (medium) and 92% (high) of cross-regional variation was attributable to country-level factors. Thus, large shares of cross-regional fertility variation remained unexplained by country factors, especially for women with lower levels of education.

Childlessness was positively associated with the level of economic development of the women's region of residence

TABLE 2 | Fertility and other characteristics by sub-national region: Women with low, medium and high education in 15 European countries ($N = 116$).

	Childlessness (%)			Children per mother			Children per woman			GDP	High	Pop.
Education	Low	Med.	High	Low	Med.	High	Low	Med.	High	in 2011	educ.[a]	density
Mean[b]	16	14	19	2.36	2.03	1.99	1.97	1.75	1.62	24,979	31	337
Standard dev.	6	5	7	0.25	0.22	0.26	0.30	0.24	0.28	10,020	10	929
Minimum	7	4	7	1.93	1.51	1.34	1.06	1.19	1.01	7300	16	3
Maximum	33	29	34	3.08	2.65	2.61	2.78	2.29	2.22	56,800	59	7131
Rho[c]	64	68	72	56	81	92	52	64	82	57	67	15
Sigma_u[d]	4	5	6	0.20	0.24	0.29	0.22	0.20	0.26	7812	9	378
Sigma_e	3	3	4	0.18	0.12	0.09	0.22	0.15	0.12	6808	6	906

[a]Share of highly educated women (%).
[b]Means and other descriptive statistics are calculated on the basis of regional fertility rates.
[c]Rho refers to the proportion of the cross-regional variation in the fertility attributable to differences between countries (in %).
It is calculated as rho = country-level variance/(country-level variance + within-country-variance) x 100.
[d]Sigma_u refers to variance between countries, and Sigma_e to variance within countries.

(Figure 2), both globally across regions of all countries (black line) and across regions within countries (blue line). A one-unit increase in the log of GDP was associated with an increase in childlessness of between 3% (low) and 6%–7% (medium to high) points globally, and between 3% (low) and 9% (high) points within countries (Table 3: top panel, Models 1a and 1b). The interaction of education with the slope of the GDP was statistically marginally significant ($p = 0.082$) in the global model and was significant in the within-country model ($p < 0.01$). Overall, the relationship between GDP and childlessness was modest, as there remained substantial variation in childlessness at different levels of GDP.

The number of children was lower at higher levels of regional GDP for mothers with low education, and was correspondingly higher for mothers with medium and high education (black line in Figure 3). A one-unit increase in the logged GDP was associated with 0.20 fewer children among low-educated mothers, and with 0.14 and 0.31 more children among medium and high-educated mothers, respectively (Table 3: middle panel, Model 1a). Within countries (blue line in Figure 3), the number of children per mother was lower at higher levels of GDP across educational groups, but this association was less pronounced among the highly educated. A one-unit increase in the logged GDP was associated with 0.33, 0.19 and 0.10 fewer children among low, medium and high-educated mothers, respectively (Table 3: middle panel, Model 1b). The interaction of education with GDP was significant ($p < 0.001$) in the global model and in the within-country model.

The number of children per woman (Figure 4), which is the result of the two other fertility outcomes, tended to be negatively associated with regional GDP levels. However, among women with high levels of education, there was a positive relationship globally (black line) and—a less pronounced negative relationship within countries (blue line). Globally, a one-unit increase in the GDP was associated with 0.25 fewer children among the low educated and 0.16 more children among the high educated, while there was no association among the medium educated (Table 3: bottom panel, Model 1a). Within countries, a one-unit increase in the logged GDP was associated with 0.36, 0.30 and 0.24 fewer children for low, medium and high-educated women, respectively (Table 3: bottom panel, Model 1b). The interaction of education with GDP was significant ($p < 0.001$) in the global model and in the within-country model.

6.3 | Multiple Regression Results

Results from models including other contextual measures—population density and the share of highly educated women—are presented in Table 3.[5] Higher population density was associated with higher levels of childlessness, especially for women with medium and high levels of education (top panel, Models 1a and 1b). It was also associated with lower numbers of children per mother (middle panel, Models 1a and 1b) and per woman (bottom panel, Models 1a and 1b), regardless of women's educational attainment. The share of women with high levels of education in the region (SHE) was associated with higher levels of childlessness for women with low and medium (but not high) education globally, and for women of all educational groups within countries (top panel, Models 1a and 1b). SHE positively predicted the number of children for mothers with medium and high education, but negatively predicted the number of children for mothers with low education globally; within countries, it predicted lower fertility for mothers, especially for those with less education (middle panel, Models 1a and 1b). Consequently, heterogeneity between educational groups was also present in the relationships of SHE with the total number of children per woman (bottom panel, Models 1a and 1b).

Model 3 includes all three contextual measures (GDP, population density and SHE) simultaneously. Focusing on the within-country models (Model 3b), it is visible that the relationships between GDP and childlessness were modestly attenuated after adjustment for other contextual measures (top panel, Model 3b). However, the educational heterogeneity within countries persisted. Higher regional GDP was associated with higher levels of childlessness only for women with medium and high levels of education. For mothers' fertility, higher regional GDP

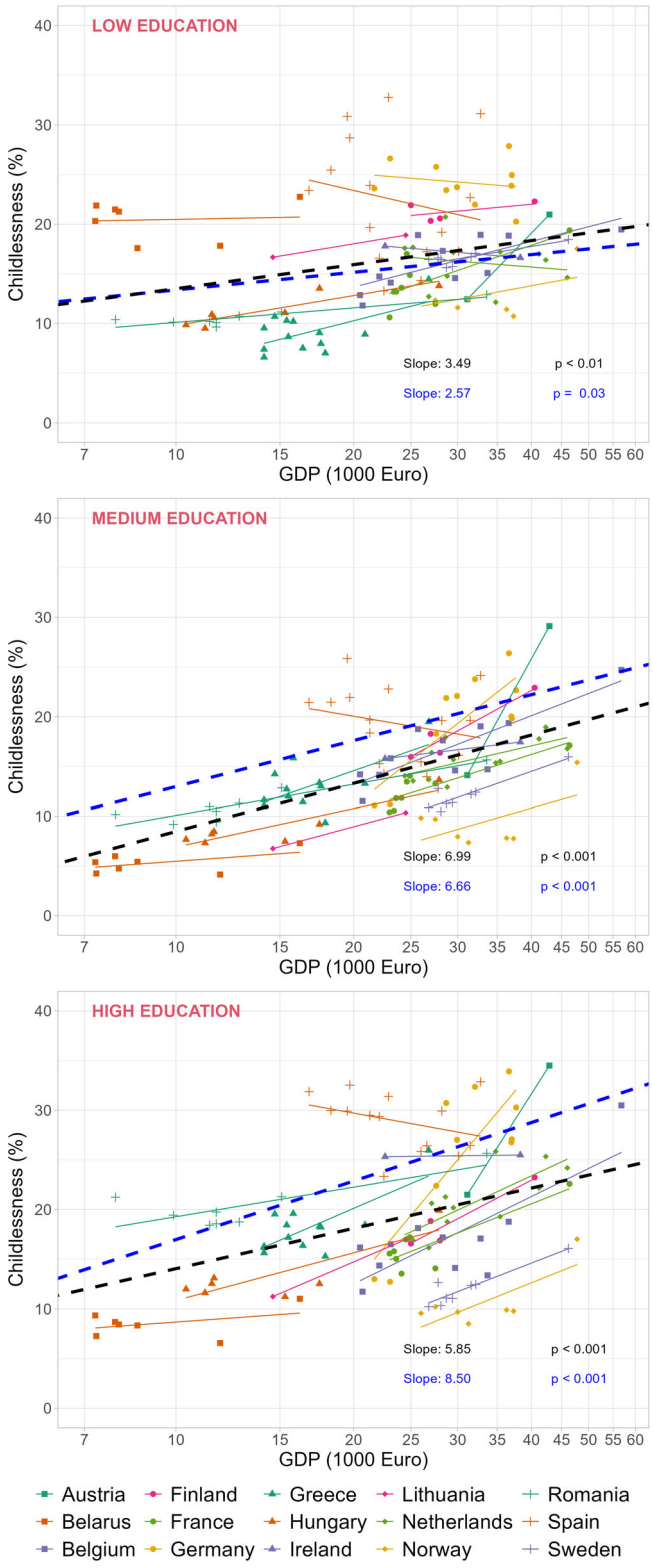

FIGURE 2 | Childlessness (%) according to the level of economic development of the region of residence: Women with low, medium and high education in 15 European countries. Regression lines are fitted for the global trend without (black dashed line) and with (blue dashed line) country fixed effects, and for the within-country trends for each country separately (solid lines) ($N = 116$).

was associated with lower levels of fertility only for women with low education (medium panel, Model 3b). For the number of children per women, adjustments for other contextual measures had similar effects as those for mothers (bottom panel, Model 3b). Net of these adjustments, the negative relationship of GDP with total fertility remained significant only for women with low education, while it was only marginally significant for women with medium to high education. Based on statistical testing, interactions of GDP and education remained significant net of the controls for other contextual measures (Table 3).

Furthermore, net of controls for other contextual measures, population density predicted higher childlessness and lower fertility only for mothers/women with medium to high education, but not for those with low education, in the within-country models (Models 3b). In turn, SHE predicted higher childlessness and lower total fertility for women with low to medium education, but not for women with high education, within countries (Model 3b). We also note that in the global models (Models 3a), a higher SHE was associated with lower levels of childlessness and higher total fertility for women with high education, but not for other women. Taken together, these results indicate that higher aggregate levels of education among women were related to less negative gradients of fertility among women at the country level.

7 | Sensitivity Analyses

As a sensitivity check, we tested whether spatial autocorrelation might bias our model estimates. For this, we applied a spatial regression model. As shown in Table 3 (Models 4a and 4b), the results remained very similar. Therefore, we decided to stick to a simpler OLS specification for our main models. A recent study on period total fertility rates in Europe found that fertility rates measured at the NUTS 3 level (e.g., municipality) are spatially clustered (Campisi et al. 2020). Our measure of region was less detailed, which likely decreased the relevance of a spatial model in our analysis. We further tested for non-linearity in the relationship between (logged) GDP and fertility by including the second-order term of GDP (Table A2; see also Figure S1). In most cases, there was either no evidence of such non-linearity or no statistical power to detect it among the 116 data points. While there were a few exceptions to this pattern, a visual inspection indicated that a linear relationship characterised the data points relatively well across different outcomes and educational groups, and nonlinearity arose strongly from few observations (not shown). Therefore, our interpretation emphasises the linear relationships.

A set of analyses assessed the limitation that GDP was measured at the end of the reproductive career. First, the rank correlation of GDP across the years 2000–2012 indicated strong consistency between different years of measurement (Figure S2), and the correlation between GDP in 2011 and 2000 was very high (0.91). This means that we are likely to obtain similar results using GDP from earlier years, assuming that women are living in the same regions across years (see also Table S2).

TABLE 3 | Linear regression analysis of the fertility rate on the level of economic development and other covariates: Women with low, medium and high education in 15 European countries ($N = 116$).

	Model							
Childlessness (%)	**1a**	**1b**	**2a**	**2b**	**3a**	**3b**	**4a**	**4b**
Low education								
GDP (ln)	3.49**	2.57*	3.22**	1.44	1.97	−1.35	1.57	−1.26
Pop. density (ln)	0.62	0.63*	0.27	0.43	0.38	0.32	0.42	0.32
Highly educated[a]	1.44**	2.43***			0.92	2.51***	0.98†	2.48***
Country FE[b]		Yes		Yes		Yes		Yes
Medium education								
GDP (ln)	6.99***	6.66***	5.93***	4.56***	6.58***	3.43*	6.01***	3.43**
Pop. density (ln)	1.68***	1.44***	1.02***	0.80**	0.96**	0.76**	1.01***	0.74**
Highly educated	1.26*	2.25***			−0.48	1.02*	−0.25	1.02*
Country FE		Yes		Yes		Yes		Yes
High education								
GDP (ln)	5.85***	8.50***	4.16**	6.08***	7.80***	5.96***	7.00***	5.98***
Pop. density (ln)	2.09***	1.78***	1.63***	0.93**	1.29**	0.92**	1.35***	0.91**
Highly educated	−0.60	1.99**			−2.67***	0.11	−2.25***	0.09
Country FE		Yes		Yes		Yes		Yes
Education x GDP (ln)[c]	†	**	†	**	†	**	*	**
	Model							
Children per mother	**1a**	**1b**	**2a**	**2b**	**3a**	**3b**	**4a**	**4b**
Low education								
GDP (ln)	−0.20***	−0.33***	−0.16**	−0.34***	−0.15*	−0.24**	−0.15**	−0.25***
Pop. density (ln)	−0.06***	−0.05**	−0.04*	0.00	−0.04*	0.00	−0.04**	0.00
Highly educated	−0.05†	−0.14***			−0.00	−0.09**	−0.02	−0.09***
Country FE		Yes		Yes		Yes		Yes
Medium education								
GDP (ln)	0.14**	−0.19***	0.22***	−0.12*	0.18**	−0.03	0.17***	−0.04
Pop. density (ln)	−0.05***	−0.05***	−0.08***	−0.02*	−0.07***	−0.03*	−0.07***	−0.03**
Highly educated	0.07**	−0.10***			0.03	−0.07***	0.02	−0.07***
Country FE		Yes		Yes		Yes		Yes
High education								
GDP (ln)	0.31***	−0.10**	0.39***	−0.01	0.35***	0.02	0.33***	0.02
Pop. density (ln)	−0.03†	−0.04***	−0.08***	−0.04***	−0.07***	−0.03***	−0.07***	−0.03***
Highly educated	0.12***	−0.04**			0.03	−0.03†	0.03	−0.03*
Country FE		Yes		Yes		Yes		Yes
Education x GDP (ln)	***	***	***	***	***	***	***	***
	Model							
Children per woman	**1a**	**1b**	**2a**	**2b**	**3a**	**3b**	**4a**	**4b**
Low education								
GDP (ln)	−0.24***	−0.36***	−0.21**	−0.34***	−0.17*	−0.20*	−0.16*	−0.20**
Pop. density (ln)	−0.06**	−0.05**	−0.04*	−0.01	−0.04*	0.00	−0.04*	0.00
Highly educated	−0.07**	−0.17***			−0.03	−0.13***	−0.03	−0.13***
Country FE		Yes		Yes		Yes		Yes

(Continues)

TABLE 3 | (Continued)

Children per woman	Model							
	1a	1b	2a	2b	3a	3b	4a	4b
Medium education								
GDP (ln)	−0.02	−0.30***	0.08	−0.20**	0.04	−0.10†	0.03	−0.10†
Pop. density (ln)	−0.08***	−0.07***	−0.09***	−0.04**	−0.08***	−0.04**	−0.08***	−0.04***
Highly educated	0.03	−0.13***			0.03	−0.08***	0.02	−0.08***
Country FE		Yes		Yes		Yes		Yes
High education								
GDP (ln)	0.16**	−0.24***	0.26***	−0.11*	0.15*	−0.09†	0.14*	−0.09†
Pop. density (ln)	−0.07***	−0.06***	−0.10***	−0.05***	−0.09***	−0.05***	−0.09***	−0.05***
Highly educated	0.11***	−0.07***			0.08**	−0.03	0.07**	−0.03†
Country FE		Yes		Yes		Yes		Yes
Education x GDP (ln)	***	***	***	***	***	***	***	***

Note: Model 1a: Variable, Model 1b: Model 1a + Country FE; Model 2a: GDP (ln) + Pop. density (ln), Model 2b: Model 2a + Country FE; Model 3a: Model 2a + Highly educated, Model 3b: Model 3a + Country FE; Model 4a: Model 3a + Spatial autocorrelation, Model 4b: Model 4a + Country FE.
[a]Coefficient shows the change in the outcome in response to a 10-%-point increase in the share of highly educated women.
[b]FE refers to fixed effects.
[c]Results are shown from separate models for each educational group. The interaction of education level and GDP was tested in a pooled model of the educational groups comparing nested models with and without the interaction term.
*$p < 0.001$; **$p < 0.01$; ***$p < 0.05$
†$p < 0.10$.

Second, to assess the possible impact of selective migration on the within-country results, we compared women who had arrived at different ages in the region of residence at the end of their reproductive career in Sweden and Spain (Figures S3 and S4). Overall, childlessness varied more than the other fertility outcomes depending on the age of arrival. This is reasonable, as sub-national migration and family formation are often closely interrelated life-course steps at early stages of the family formation process, while long-distance moves are less common at higher parities and higher reproductive ages (Dommermuth and Klüsener 2019; Kulu 2008; Michielin 2004).

In Sweden, childlessness was elevated particularly among high and medium educated women who had arrived in the region with the highest GDP (Stockholm) relatively late. This suggests that selective migration contributed to the stronger negative correlation of GDP with childlessness among the highly educated. However, the majority of women were living in the same region at the beginning and at the end of their reproductive lives (74%, 73% and 62% of women with low, medium and high education, respectively). Thus, even among highly educated women in Stockholm, childlessness was only two percentage points lower (16% vs. 14%) overall if women who moved there after age 15 were excluded. The respective difference was smaller among low and medium-educated women. The corresponding results for Spain were subject to larger random variation, but were suggestive of patterns similar to those observed in Sweden.

8 | Discussion

This study examined the relationship between economic conditions and the cohort fertility of women, paying particular attention to differences by educational level. We assessed economic conditions by regional economic development (GDP per capita) and fertility using three measures: childlessness, number of children per mother and number of children per women. For this purpose, we harmonised data from 116 regions of 15 European countries. Our analysis of female cohorts born between 1964 and 1970 showed that higher levels of education and economic development tend to be related to lower fertility, but that these two dimensions show interactions. Within countries, better economic conditions in terms of higher regional GDP were associated with higher levels of childlessness and lower numbers of children per mother. After accounting for other regional factors, GDP was found to predict higher levels of childlessness among women with medium or high education, and lower numbers of children among mothers with low education. Additional results showed that across countries, the relationship of GDP with fertility was positive for mothers with medium to high education, while childlessness was positively associated with GDP levels regardless of education. Taken together, these results indicate that the relationship between economic development and cohort fertility is sensitive to women's educational attainment (H1), and that there is educational heterogeneity in this association within countries as well (H3). In light of the results, we conclude that a positive relationship between economic development and fertility is more plausible for continued childbearing than for first births (H2).

We showed that in Europe, mothers with medium to high (but not low) levels of education were more likely to have more children if they lived in regions with better economic conditions. However, this positive association was strongly influenced by country-level factors: within countries, the fertility rate of mothers was generally lower if they lived in regions with higher GDP. The corresponding differences between and within countries were not as strong for women with lower levels of education, among whom regional GDP levels were more consistently negatively associated with fertility. Future work is

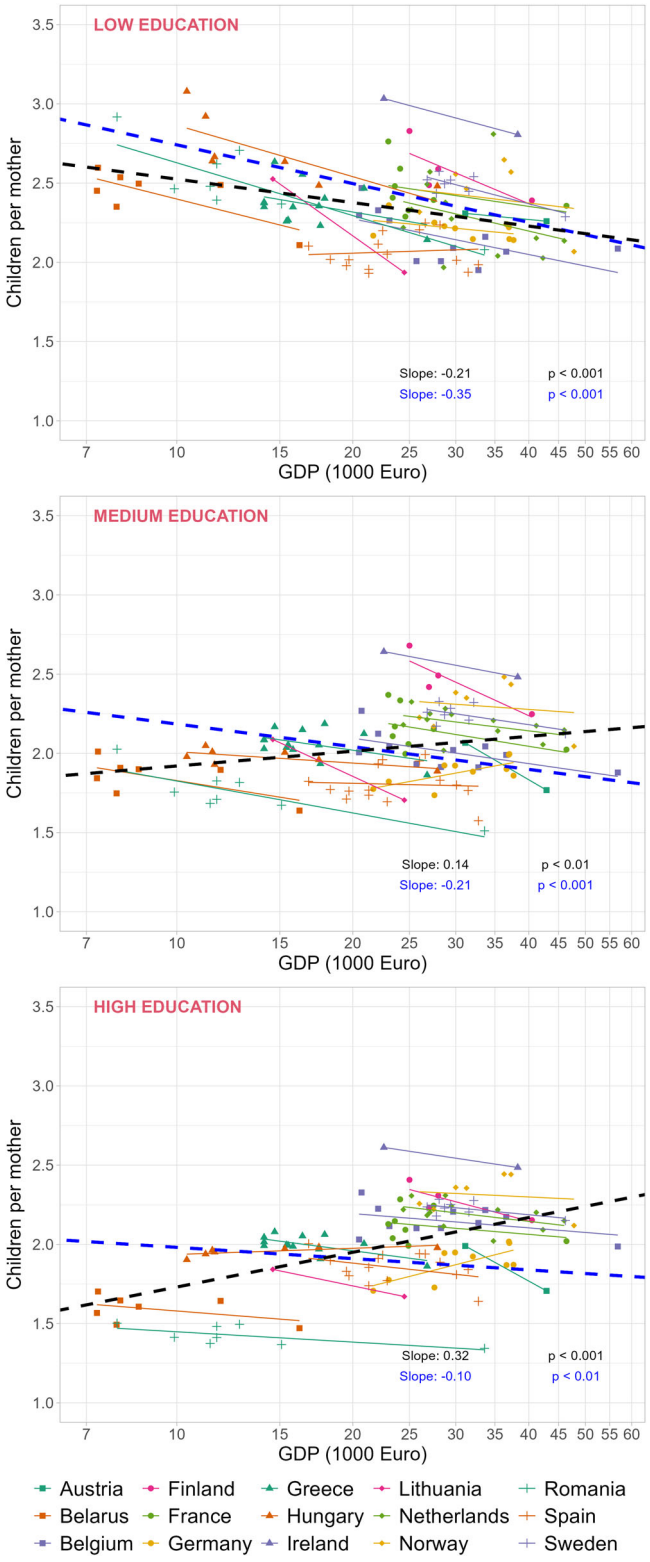

FIGURE 3 | Mean number of children per mother according to the level of economic development of the region of residence: Women with low, medium and high education in 15 European countries. Regression lines are fitted for the global trend without (black dashed line) and with (blue dashed line) country fixed effects, and for the within-country trends for each country separately (solid lines) ($N = 116$).

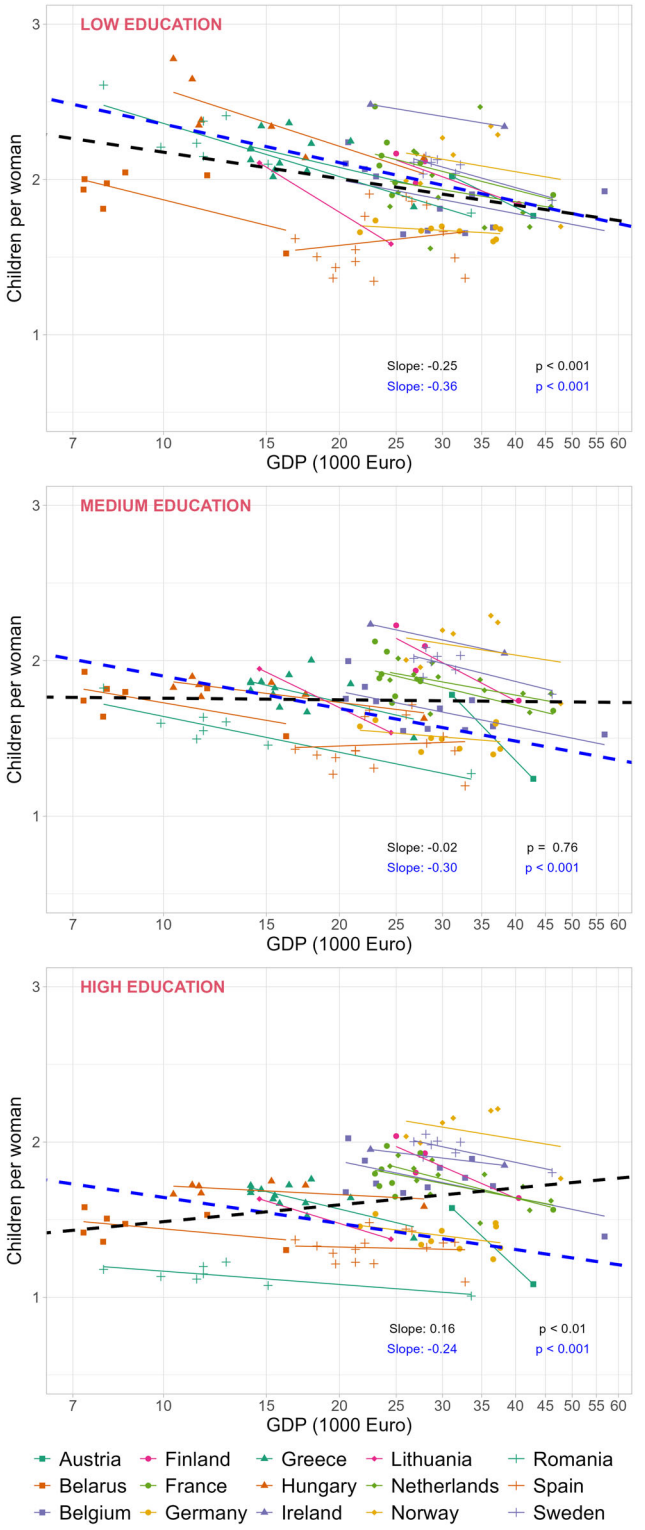

FIGURE 4 | Mean number of children per woman according to the level of economic development of the region of residence: Women with low, medium and high education in 15 European countries. Regression lines are fitted for the global trend without (black dashed line) and with (blue dashed line) country fixed effects, and for the within-country trends for each country separately (solid lines) ($N = 116$).

needed to assess whether factors such as flexible working arrangements (which are more accessible to the highly educated) or the high costs of raising children (which are more pertinent to the less educated) play a role in this educational heterogeneity. More broadly, within-country variation explained a larger proportion of the total regional variation in fertility among women with lower levels of education, highlighting the importance of regional factors for understanding the fertility of less educated women. The findings also suggest that country-level factors (e.g., family policies and gender equality) may have contributed to a positive link between economic conditions and fertility over time mainly in terms of continued childbearing among women with high levels of education.

Childlessness was higher in regions with higher GDP levels among women with all levels of education. Within countries, however, net of controls for other regional factors, higher GDP levels predicted higher levels of childlessness only for women with medium and high levels of education. Our sensitivity analysis indicated the presence of selective migration among childless women, especially those with higher education, to regions with higher GDP during their reproductive years. Therefore, selective migration may have raised the share of (childless) highly educated women in regions with high GDP, which is in line with our model-based results.

Taken together, our results for childlessness and continued childbearing could be seen as suggesting that for women with medium to high education, a more selective entry into motherhood leads to greater heterogeneity in their fertility in regions characterised by better economic conditions. When a smaller share of an educational group enter motherhood, those individuals who do so may be selected in terms of family-proneness, and thus are more likely to have further children (e.g., Kreyenfeld 2002; Brzozowska et al. 2022). This could explain the less negative relationship of GDP with continued fertility for high versus low educated mothers, which was visible especially net of controls for other regional factors. Alternatively, the less negative associations for women with higher education may indicate that economically stronger regional contexts in Europe—and within countries—have a more negative impact on the continued childbearing of women with low levels of education. If we assume that our controls for other regional factors capture selectivity into motherhood, we might conclude that better economic conditions negatively impact continued childbearing only among low-educated women.

In addition, the results indicate that the share of highly educated women was negatively associated with the number of children being born mainly to mothers with low or medium levels of education, rather than to those with high levels of education. In contrast, among women with high levels of education, there was barely any evidence of a negative relationship between educational expansion and fertility. In the global model, a higher proportion of women with tertiary education was even associated with lower levels of childlessness and higher total fertility rates among the highly educated. These relationships were attributable to country-level factors, as the relationships in the within-country models were null or opposite. These findings indicate that country-level educational expansion among women is associated with less negative educational gradients in women's fertility in Europe (see also Greulich and Toulemon 2023).

The role of internal migration and population composition in the current results requires attention. A limitation of this study is that a woman's region of residence at the end of her reproductive career, as measured in this study, may differ from the region where she lived during her prime childbearing years. More educated women have a greater propensity to migrate, and their reasons for moving are more often related to further education and employment (Dawkins 2006; Thomas 2019). In addition, highly educated women tend to concentrate in economic centres (Berry and Glaeser 2005). For less educated women, family-related reasons, such as proximity to relatives, are more relevant to their migration decisions, and their moves are less dependent on regional economic conditions. As mentioned above, based on our sensitivity analysis residential mobility may be associated with elevated levels of childlessness in economically stronger regions, especially among women with high education.

Women in the former communist countries—that is, Belarus, former East Germany,[6] Hungary, Lithuania and Romania—experienced a very particular childbearing context due to the economic and societal crises caused by the fall of the Soviet Union in 1989, during their prime childbearing years (Billingsley 2010; Sobotka 2011). Some of these women had already had a child in the 1980s, which limits the validity of our analysis based on GDP levels in 2011. The capital regions in these countries also experienced strong increases in GDP in the 2000s (see Figure S2). These particularities may affect the generalisability of our findings. The consideration of cultural and normative factors is also limited in this study, although such factors are known to support universal entry into motherhood in these countries (Merz and Liefbroer 2012). However, we assume that cultural and normative factors play a smaller role in an analysis such as this one, which is mostly focused on within-country rather than cross-country differences.

Our data sources also differ across countries: measurement is likely to be more accurate in registers than in census or survey data. Quality assessments of the small sample data sources used in the study for Austria (Neuwirth 2015; Verwiebe et al. 2014; Statistics Austria 2018), France (INSEE 2013, 2014) and Germany (Federal Statistical Office and Statistical Offices of the Federal States 2018) showed relatively high overall response rates (78%–95%), but lower rates among the low educated and in capital regions. We cannot rule out the possibility that measurement error has affected the results of this study, but it is unlikely to invalidate the main conclusions, as the error would have to be differentially selective by education in different countries or regions.

9 | Conclusion

This study aimed to deepen the understanding of the link between economic conditions and fertility by taking into account heterogeneity by education. Our findings show that the relationship between economic conditions and fertility varies depending on the level of education of the women, and it differs between childlessness and continued childbearing. The current findings are relevant in light of the increasing weight of highly educated

women for overall fertility levels in high-income societies (Sobotka et al. 2017). They suggest that in regions of Europe with favourable economic conditions, high levels of childlessness among highly educated women do not necessarily coincide with low levels of continued childbearing within this group. Conversely, high-income contexts may be less supportive of continued childbearing for women with lower levels of education (see also Wood et al. 2020). From the perspective of social inequality, societies should pay more attention to the fertility trends of women with lower levels of education. Furthermore, the present findings may be interpreted to also provide support for the view that continued childbearing among highly educated mothers has contributed to a less negative association between economic conditions and period fertility at the turn of the 21st century. Finally, to cover a large number of European countries in our analysis, it was necessary to use measures from the end of women's reproductive careers, while paying only limited attention to migratory moves during their reproductive lives. In the context of Europe's evolving regional fertility landscape (Campisi et al. 2023), a promising area for future research would be to examine countries with detailed life course data on fertility and migration histories. Since our analysis focused on specific female cohorts born between 1964 and 1970, future studies should assess the relationship between economic conditions and fertility for more recent cohorts.

Acknowledgements

Nisén was supported by the Academy of Finland, grant nos. 332863 and 320162 (INVEST Research Flagship) and by the Strategic Research Council (SRC) of the Academy of Finland, grant nos. 345130 and 345131 (Family Formation in Flux—Causes, Consequences and Possible Futures, FLUX). Lappegård and Dommermuth acknowledge support from the Research Council of Norway (project nos. 300870 and 287634). Martikainen was supported by the European Research Council under the European Union's Horizon 2020 research and innovation programme (Grant 101019329), the SRC within the Academy of Finland grants for ACElife (#352543-352572) and LIFECON (# 345219). Trimarchi acknowledges support from the French National Research Agency (Grant No. ANR-16-CE41-0007-01, PI: Laurent Toulemon). Myrskylä was supported by the SRC, FLUX consortium, decision numbers 345130 and 345131, and by the National Institute on Aging (R01AG075208) and the European Union (ERC Synergy, BIOSFER, 101071773). The views and opinions expressed are, however, those of the authors only and do not necessarily reflect those of the European Union or the European Research Council. Neither the European Union nor the granting authority can be held responsible for them. Martikainen and Myrskylä were also supported by grants to the Max Planck—University of Helsinki Center from the Jane and Aatos Erkko Foundation (#210046), the Max Planck Society (#5714240218), University of Helsinki (#77204227) and the cities of Helsinki, Vantaa, and Espoo. The authors wish to thank the discussant of the 'Cultural and Structural Forces Shaping Family Life' session at PAA 2021, the members of the EAPS Working Group Register-Based Fertility Research, and two anonymous reviewers for their helpful comments. Open access publishing facilitated by Turun yliopisto, as part of the Wiley - FinELib agreement.

Conflicts of Interest

The authors declare no conflicts of interest.

Endnotes

[1]The population density data for Ireland are from the year 2014, while data for Belarus they are from the year 2020 (Belstat 2025).

[2]The country-level averages are calculated as averages of the regional EB estimates, weighted by the regional female population.

[3]Among the low educated, Belarus is an outlier with high levels of childlessness but low levels of GDP.

[4]Rho is the estimated proportion of the variation in the fertility outcome that can be related to differences between countries. It is calculated as rho = country-level variance/(country-level variance + within-country-variance) x 100.

[5]Both the share of women with high education (correlation 0.56) and the population density (correlation 0.42) of a region were positively associated with GDP (in 2011).

[6]Former East Germany is classified here as part of Germany. We acknowledge that grouping former East and West Germany together for these cohorts of women is a simplification, considering that Germany was only unified in 1990.

References

Ahn, N., and P. Mira. 2002. "A Note on the Changing Relationship Between Fertility and Female Employment Rates in Developed Countries." *Journal of Population Economics* 15, no. 4: 667–682. https://doi.org/10.1007/s001480100078.

Andersson, G. 2000. "The Impact of Labour-Force Participation on Childbearing Behaviour: Pro-Cyclical Fertility in Sweden During the 1980s and the 1990S." *European Journal of Population* 16, no. 4: 293–333. https://doi.org/10.1023/A:1006454909642.

Assunção, R. M., C. P. Schmertmann, J. E. Potter, and S. M. Cavenaghi. 2005. "Empirical Bayes Estimation of Demographic Schedules for Small Areas." *Demography* 42, no. 3: 537–558. https://doi.org/10.1353/dem.2005.0022.

Basten, S., J. Huinink, and S. Klüsener. 2012. "Spatial Variation of Sub-National Fertility Trends in Austria, Germany and Switzerland." *Comparative Population Studies* 36, no. 2–3: 615–660. https://doi.org/10.12765/CPoS-2011-08.

Van Bavel, J. 2012. "The Reversal of Gender Inequality in Education, Union Formation and Fertility in Europe." *Vienna Yearbook of Population Research* 10, no. 2012: 127–154. https://doi.org/10.1553/populationyearbook2012s127.

Van Bavel, J., M. Klesment, E. Beaujouan, et al. 2018. "Seeding the Gender Revolution: Women's Education and Cohort Fertility Among the Baby Boom Generations." *Population Studies* 72, no. 3: 283–304. https://doi.org/10.1080/00324728.2018.1498223.

Bavel, J. V., and J. Rózanska-Putek. 2010. "Second Birth Rates Across Europe: Interactions Between Women's Level of Education and Child Care Enrolment." *Vienna Yearbook of Population Research* 8: 107–138. https://www.jstor.org/stable/23025512.

de Beer, J., and I. Deerenberg. 2007. "An Explanatory Model for Projecting Regional Fertility Differences in the Netherlands." *Population Research and Policy Review* 26, no. 5–6: 511–528. https://doi.org/10.1007/s11113-007-9040-y.

Belstat. 2025. *Population Density Across the Territory of the Republic of Belarus*.National Statistical Committee of Belarus, Belstat. https://www.belstat.gov.by/en/.

Berrington, A., and S. Pattaro. 2014. "Educational Differences in Fertility Desires, Intentions and Behaviour: A Life Course Perspective." *Advances in Life Course Research* 21: 10–27. https://doi.org/10.1016/j.alcr.2013.12.003.

Berry, C. R., and E. L. Glaeser. 2005. "The Divergence of Human Capital Levels Across Cities." *Papers in Regional Science* 84, no. 3: 407–444. https://doi.org/10.1111/j.1435-5957.2005.00047.x.

Billingsley, S. 2010. "The Post-Communist Fertility Puzzle." *Population Research and Policy Review* 29, no. 2: 193–231. https://doi.org/10.1007/s11113-009-9136-7.

Bogusz, H., A. Matysiak, and M. Kreyenfeld. 2024. "Structural Labour Market Change, Cognitive Work, and Entry to Parenthood in Germany." *Population Studies* 79, no. 2: 1–27. https://doi.org/10.1080/00324728.2024.2372018.

Bongaarts, J., and T. Sobotka. 2012. "A Demographic Explanation for the Recent Rise in European Fertility." *Population and Development Review* 38, no. 1: 83–120. https://doi.org/10.1111/j.1728-4457.2012.00473.x.

Bongaarts, J., and S. C. Watkins. 1996. "Social Interactions and Contemporary Fertility Transitions." *Population and Development Review* 22, no. 4: 639–682. https://doi.org/10.2307/2137804.

Brewster, K. L., and R. R. Rindfuss. 2000. "Fertility and Women's Employment in Industrialized Nations." *Annual Review of Sociology* 26, no. 2000: 271–296. https://www.jstor.org/stable/223445.

Bryant, J. 2007. "Theories of Fertility Decline and the Evidence From Development Indicators." *Population and Development Review* 33, no. 1: 101–127. https://www.jstor.org/stable/25434586.

Brzozowska, Z., E. Beaujouan, and K. Zeman. 2022. "Is Two Still Best? Change in Parity-Specific Fertility Across Education in Low-Fertility Countries." *Population Research and Policy Review* 41, no. 5: 2085–2114. https://doi.org/10.1007/s11113-022-09716-4.

Bujard, M., and M. Scheller. 2017. "Impact of Regional Factors on Cohort Fertility: New Estimations at the District Level in Germany." *Comparative Population Studies* 42, no. 2017: 55–88. https://doi.org/10.12765/CPoS-2017-07.

Butz, W. P., and M. P. Ward. 1979. "The Emergence of Countercyclical US Fertility." *American Economic Review* 69, no. 3: 318–328.

Campisi, N., H. Kulu, J. Mikolai, S. Klüsener, and M. Myrskylä. 2020. "Spatial Variation in Fertility Across Europe: Patterns and Determinants." *Population, Space and Place* 26, no. 4: e2308. https://doi.org/10.1002/psp.2308.

Campisi, N., H. Kulu, J. Mikolai, S. Klüsener, and M. Myrskylä. 2023. "A Spatial Perspective on the Unexpected Nordic Fertility Decline: The Relevance of Economic and Social Contexts." *Applied Spatial Analysis and Policy* 16, no. 1: 1–31. https://doi.org/10.1007/s12061-022-09467-x.

Cherlin, A. J. 2016. "A Happy Ending to a Half-Century of Family Change?" *Population and Development Review* 42, no. 1: 121–129. http://www.jstor.org/stable/44015618.

Dawkins, C. J. 2006. "Are Social Networks the Ties That Bind Families to Neighborhoods?" *Housing Studies* 21, no. 6: 867–881. https://doi.org/10.1080/02673030600917776.

Dommermuth, L., and S. Klüsener. 2019. "Formation and Realisation of Moving Intentions Across the Adult Life Course." *Population, Space and Place* 25, no. 5: e2212. https://doi.org/10.1002/psp.2212.

Dunford, M. 1996. "Disparities in Employment, Productivity and Output in the EU: The Roles of Labour Market Governance and Welfare Regimes." *Regional Studies* 30, no. 4: 339–357. https://doi.org/10.1080/00343409612331349698.

Engelhardt, H., and A. Prskawetz. 2004. "On the Changing Correlation Between Fertility and Female Employment Over Space and Time." *European Journal of Population* 20: 35–62. https://doi.org/10.1023/B:EUJP.0000014543.95571.3b.

Esping-Andersen, G. 2009. *Incomplete Revolution: Adapting Welfare States to Women's New Roles*. Polity.

Eurostat. 2011. *Regions in the European Union. Nomenclature of Territorial Units for Statistics NUTS 2010/EU-27*. European Union.

Eurostat. 2018. *Gross Domestic Product (GDP) at Current Market Prices by NUTS 3 Regions*. Eurostat. https://ec.europa.eu/eurostat/web/products-datasets/-/nama_10r_3gdp.

Eurostat. 2019. *Population Aged 30-34 by Educational Attainment Level, Sex, and NUTS 2 Regions (%)*. Eurostat.

Eurostat. 2025. *Population Density by NUTS2 Region*. Eurostat. https://ec.europa.eu/eurostat/databrowser/product/page/DEMO_R_D3DENS.

Federal Statistical Office and Statistical Offices of the Federal States. 2018. German Microcensus 2008, 2012, and 2016, Own Calculations.

Fiori, F., E. Graham, and Z. Feng. 2014. "Geographical Variations in Fertility and Transition to Second and Third Birth in Britain." *Advances in Life Course Research* 21, no. 2014: 149–167. https://doi.org/10.1016/j.alcr.2013.11.004.

Fox, J., S. Klüsener, and M. Myrskylä. 2019. "Is a Positive Relationship Between Fertility and Economic Development Emerging at the Sub-National Regional Level? Theoretical Considerations and Evidence From Europe." *European Journal of Population* 35, no. 3: 487–518. https://doi.org/10.1007/s10680-018-9485-1.

Furuoka, F. 2009. "Looking for a J-Shaped Development-Fertility Relationship: Do Advances in Development Really Reverse Fertility Declines." *Economics Bulletin* 29, no. 4: 3067–3074.

Gaddy, H. G. 2021. "A Decade of TFR Declines Suggests No Relationship Between Development and Sub-Replacement Fertility Rebounds." *Demographic Research* 44: 125–142. https://www.jstor.org/stable/27032907.

GADM. 2025. GADM Database. GADM. https://gadm.org.

Golden, L. 2001. "Flexible Work Schedules: Which Workers Get Them?" *American Behavioral Scientist* 44, no. 7: 1157–1178. https://doi.org/10.1177/00027640121956700.

Goldscheider, F., E. Bernhardt, and T. Lappegård. 2015. "The Gender Revolution: A Framework for Understanding Changing Family and Demographic Behavior." *Population and Development Review* 41, no. 2: 207–239. https://doi.org/10.1111/j.1728-4457.2015.00045.x.

Greulich, A., and L. Toulemon. 2023. "Measuring the Educational Gradient of Period Fertility in 28 European Countries." *Demographic Research* 49: 905–968. https://www.jstor.org/stable/48754928.

Gustafsson, S. 2001. "Optimal Age at Motherhood. Theoretical and Empirical Considerations on Postponement of Maternity in Europe." *Journal of Population Economics* 14, no. 2: 224–247. https://doi.org/10.1007/s001480000051.

Hank, K. 2002. "Regional Social Contexts and Individual Fertility Decisions: A Multilevel Analysis of First and Second Births in Western Germany." *European Journal of Population* 18, no. 3: 281–299. https://doi.org/10.1023/A:1019765026537.

Hank, K., and M. Kreyenfeld. 2003. "A Multilevel Analysis of Child Care and Women's Fertility Decisions in Western Germany." *Journal of Marriage and Family* 65, no. 3: 584–596. https://doi.org/10.1111/j.1741-3737.2003.00584.x.

Harknett, K., F. C. Billari, and C. Medalia. 2014. "Do Family Support Environments Influence Fertility? Evidence From 20 European Countries." *European Journal of Population* 30, no. 1: 1–33. https://doi.org/10.1007/s10680-013-9308-3.

Harttgen, K., and S. Vollmer. 2014. "A Reversal in the Relationship of Human Development With Fertility?" *Demography* 51, no. 1: 173–184. https://doi.org/10.1007/s13524-013-0252-y.

Huinink, J., and M. Feldhaus. 2009. "Family Research From the Life Course Perspective." *International Sociology* 24, no. 3: 299–324. https://doi.org/10.1177/0268580909102910.

Innocenti, N., D. Vignoli, and L. Lazzeretti. 2021. "Economic Complexity and Fertility: Insights From a Low Fertility Country." *Regional Studies* 55, no. 8: 1388–1402. https://doi.org/10.1080/00343404.2021.1896695.

INSEE. 2013. Calcul des pondérations de l'enquête Famille et Logements, Note N° 137/DG75-F170/.

INSEE. 2014. Apurements et imputations dans l'Enquête famille et logements 2011, Note N° 714/DG75-F170/.

IPUMS. 2018. Minnesota Population Center. Integrated Public Use Microdata Series, International: Version 7.0. Minneapolis, MN: IPUMS.

Islam, S. M. N., and M. Clarke. 2002. "The Relationship Between Economic Development and Social Welfare: A New Adjusted GDP Measure of Welfare." *Social Indicators Research* 57, no. 2: 201–229. https://doi.org/10.1023/A:1014481414637.

Jalovaara, M., L. Andersson, and A. Miettinen. 2022. "Parity Disparity: Educational Differences in Nordic Fertility Across Parities and Number of Reproductive Partners." *Population Studies* 76, no. 1: 119–136. https://doi.org/10.1080/00324728.2021.1887506.

Jalovaara, M., and A. Fasang. 2017. "From Never Partnered to Serial Cohabitors: Union Trajectories to Childlessness." *Demographic Research* 36: 1703–1720. https://www.jstor.org/stable/26332178.

Jalovaara, M., G. Neyer, G. Andersson, et al. 2019. "Education, Gender, and Cohort Fertility in the Nordic Countries." *European Journal of Population* 35, no. 3: 563–586. https://doi.org/10.1007/s10680-018-9492-2.

Klesment, M., A. Puur, L. Rahnu, and L. Sakkeus. 2014. "Varying Association Between Education and Second Births in Europe: Comparative Analysis Based on the EU-SILC Data." *Demographic Research* 31, no. 27: 813–860. https://doi.org/10.4054/DemRes.2014.31.27.

Kolk, M. 2019. "Weak Support for a U-Shaped Pattern Between Societal Gender Equality and Fertility When Comparing Societies Across Time." *Demographic Research* 40: 27–48. https://www.jstor.org/stable/2672699.

Konietzka, D., and M. Kreyenfeld. 2010. "The Growing Educational Divide in Mothers' Employment: An Investigation Based on the German Micro-Censuses 1976-2004." *Work, Employment and Society* 24, no. 2: 260–278. https://doi.org/10.1177/0950017010362140.

Kravdal, Ø. 1996. "How the Local Supply of Day-Care Centers Influences Fertility in Norway: A Parity-Specific Approach." *Population Research and Policy Review* 15, no. 3: 201–218. https://doi.org/10.1007/BF00127049.

Kravdal, Ø. 2002. "The Impact of Individual and Aggregate Unemployment on Fertility in Norway." *Demographic Research* 6, no. 10: 263–294. https://doi.org/10.4054/DemRes.2002.6.10.

Kravdal, Ø., and R. R. Rindfuss. 2008. "Changing Relationships Between Education and Fertility: A Study of Women and Men Born 1940 to 1964." *American Sociological Review* 73, no. 5: 854–873. https://doi.org/10.1177/000312240807300508.

Kreyenfeld, M. 2002. "Time Squeeze, Partner Effect or Self-Selection?: An Investigation Into the Positive Effect of Women's Education on Second Birth Risks in West Germany." *Demographic Research* 7, no. 2: 15–48. https://doi.org/10.4054/DemRes.2002.7.2.

Kulu, H. 2008. "Fertility and Spatial Mobility in the Life Course: Evidence From Austria." *Environment and Planning A* 40, no. 3: 632–652. https://doi.org/10.1068/a3914.

Kulu, H. 2013. "Why Do Fertility Levels Vary Between Urban and Rural Areas?" *Regional Studies* 47, no. 6: 895–912. https://doi.org/10.1080/00343404.2011.581276.

Kulu, H., A. Vikat, and G. Andersson. 2007. "Settlement Size and Fertility in the Nordic Countries." *Population Studies* 61, no. 3: 265–285. https://doi.org/10.1080/00324720701571749.

Kulu, H., and E. Washbrook. 2014. "Residential Context, Migration and Fertility in a Modern Urban Society." *Advances in Life Course Research* 21, no. 2014: 168–182. https://doi.org/10.1016/j.alcr.2014.01.001.

Lee, R. 2003. "The Demographic Transition: Three Centuries of Fundamental Change." *Journal of Economic Perspectives* 17, no. 4: 167–190. https://doi.org/10.1257/089533003772034943.

Longford, N. T. 1999. "Multivariate Shrinkage Estimation of Small Area Means and Proportions." *Journal of the Royal Statistical Society. Series A, (Statistics in Society)* 162, no. 2: 227–245. http://www.jstor.org/stable/2680580.

Luci-Greulich, A., and O. Thévenon. 2013. "The Impact of Family Policies on Fertility Trends in Developed Countries." *European Journal of Population* 29, no. 4: 387–416. https://doi.org/10.1007/s10680-013-9295-4.

Matysiak, A., D. Bellani, and H. Bogusz. 2023. "Industrial Robots and Regional Fertility in European Countries." *European Journal of Population = Revue europeenne de demographie* 39, no. 1: 11. https://doi.org/10.1007/s10680-023-09657-4.

Matysiak, A., and D. Vignoli. 2008. "Fertility and Women's Employment: A Meta-Analysis." *European Journal of Population* 24, no. 4: 363–384. https://doi.org/10.1007/s10680-007-9146-2.

Mavropoulos, G., and T. Panagiotidis. 2021. "On the Drivers of the Fertility Rebound." *Economic Change and Restructuring* 54, no. 3: 821–845.

de Meester, E., and M. Van Ham. 2009. "Symmetry and Asymmetry in Working and Commuting Arrangements Between Partners in the Netherlands: Does the Residential Context Matter?" *Environment and Planning A* 41, no. 9: 2181–2200. https://doi.org/10.1068/a41246.

Merz, E. -M., and A. C. Liefbroer. 2012. "The Attitude Toward Voluntary Childlessness in Europe: Cultural and Institutional Explanations." *Journal of Marriage and Family* 74, no. 3: 587–600. https://doi.org/10.1111/j.1741-3737.2012.00972.x.

Michielin, F. 2004. "Lowest Low Fertility in an Urban Context: The Role of Migration in Turin, Italy." *Population, Space and Place* 10, no. 4: 331–347. https://doi.org/10.1002/psp.337.

Myrskylä, M., H.-P. Kohler, and F. Billari. 2011. "High Development and Fertility: Fertility at Older Reproductive Ages and Gender Equality Explain the Positive Link." MPIDR Working Paper, WP-2011-017. Max Planck Institute for Demogaphic Research.

Myrskylä, M., H. P. Kohler, and F. C. Billari. 2009. "Advances in Development Reverse Fertility Declines." *Nature* 460, no. 7256: 741–743. https://doi.org/10.1038/nature08230.

Neels, K., and D. De Wachter. 2010. "Postponement and Recuperation of Belgian Fertility: How Are They Related to Rising Female Educational Attainment?" *Vienna Yearbook of Population Research* 8: 77–106. https://www.jstor.org/stable/23025511.

Neuwirth, N. 2015. Generations and Gender Survey Austria Wave 1 & Wave 2: Study Documentation. Vienna: University of Vienna. https://www.ggp-i.org/sites/default/files/documents/ggs-w1_v.4.2.w2_v.1.2.aut.pdf.

Nisén, J., S. Klüsener, J. Dahlberg, et al. 2021. "Educational Differences in Cohort Fertility Across Sub-National Regions in Europe." *European Journal of Population* 37, no. 1: 263–295. https://doi.org/10.1007/s10680-020-09562-0.

OECD2015. *ISCED 2011 Operational Manual. Guidelines for Classifying National Education Programmes and Related Qualifications*. European Union: OECD Publishing.

Oshio, T. 2019. "Is a Positive Association Between Female Employment and Fertility Still Spurious in Developed Countries?" *Demographic Research* 41: 1277–1288. https://www.jstor.org/stable/26850685.

Pettay, J. E., V. Lummaa, R. Lynch, and J. Loehr. 2021. "Female-Biased Sex Ratios in Urban Centers Create a 'Fertility Trap' in Post-War Finland." *Behavioral Ecology: Official Journal of the International Society for Behavioral Ecology* 32, no. 4: 590–598. https://doi.org/10.1093/beheco/arac030.

Rao, J. N. K. 2014. "Small-Area Estimation." In *Wiley StatsRef: Statistics Reference Online*, edited by N. Balakrishnan, T. Colton, B. Everitt, W. Piegorsch, F. Ruggeri and J. L. Teugels, 1–8. https://doi.org/10.1002/9781118445112.stat03310.

Raz-Yurovich, L. 2014. "A Transaction Cost Approach to Outsourcing by Households." *Population and Development Review* 40, no. 2: 293–309. https://doi.org/10.1111/j.1728-4457.2014.00674.x.

Riederer, B., and É. Beaujouan. 2024. "Explaining the Urban–Rural Gradient in Later Fertility in Europe." *Population, Space and Place* 30, no. 1: e2720. https://doi.org/10.1002/psp.2720.

Rindfuss, R. R., D. K. Guilkey, S. P. Morgan, and Ø. Kravdal. 2010. "Child-Care Availability and Fertility in Norway." *Population and Development Review* 36, no. 4: 725–748. https://doi.org/10.1111/j.1728-4457.2010.00355.x.

Ryabov, I. 2015. "On the Relationship Between Development and Fertility: The Case of the United States." *Comparative Population Studies* 40, no. 4: 465–488. https://doi.org/10.12765/CPoS-2015-13.

Schacht, R., and K. L. Kramer. 2016. "Patterns of Family Formation in Response to Sex Ratio Variation." *PLoS One* 11, no. 8: 0160320. https://doi.org/10.1371/journal.pone.0160320.

Schubert, H.-A., C. Dudel, M. Kolobova, and M. Myrskylä. 2024. "Revisiting the J-Shape: Human Development and Fertility in the United States." *Demography* 61, no. 6: 1949–1973. https://doi.org/10.1215/00703370-11680156.

Snyder, R. 2001. "Scaling Down: The Subnational Comparative Method." *Studies in Comparative International Development* 36, no. 1: 93–110. https://doi.org/10.1007/BF02687586.

Sobotka, T. 2011. "Fertility in Central and Eastern Europe After 1989: Collapse and Gradual Recovery." *Historical Social Research* 36, no. 2: 246–296. https://www.jstor.org/stable/41151282.

Sobotka, T., E. Beaujouan, and J. V. Bavel. 2017. "Introduction: Education and Fertility in Low-Fertility Settings." *Vienna Yearbook of Population Research* 15, no. 2017: 1–16. https://www.jstor.org/stable/26506094.

Sobotka, T. 2017. "Childlessness in Europe: Reconstructing Long-term Trends Among Women Born in 1900–1972." In *Childlessness in Europe: Contexts, Causes, and Consequences*, edited by M. Kreyenfeld and D. Konietzka, 17–53. Springer. https://doi.org/10.1007/978-3-319-44667-7.

Sobotka, T., V. Skirbekk, and D. Philipov. 2011. "Economic Recession and Fertility in the Developed World." *Population and Development Review* 37, no. 2: 267–306. https://doi.org/10.1111/j.1728-4457.2011.00411.x.

Statistics Austria. 2018. Standard-Documentation Meta information (Definitions, Comments, Methods, Quality) on Microcensus Since 2004 – Labour Force and Housing Survey.

Thomas, M. J. 2019. "Employment, Education, and Family: Revealing the Motives Behind Internal Migration in Great Britain." *Population, Space and Place* 25, no. 4: e2233. https://doi.org/10.1002/psp.2233.

UNESCO. 1999. *Operational Manual for ISCED 1997 (International Standard Classification of Education)*. UNESCO. 1st ed.

Verwiebe, R., T. Troger, and B. Riederer. 2014. Lebensqualität in Wien 1995-2013. Sozialwissenschaftliche Grundlagenforschung II [Quality of Life in Vienna 1995-2013. Basic Social Research II] In Werkstattbericht 147. Vienna: City of Vienna.

Wood, J., S. Klüsener, K. Neels, and M. Myrskylä. 2020. "Shifting Links in the Relationship Between Education and Fertility." *Population, Space and Place* 26, no. 8: e2342. https://doi.org/10.1002/psp.2342.

Wood, J., L. Marynissen, J. Nisén, et al. 2025. "Regional Differentiation in Women's Educational Gradients in Fertility Around the Turn of the Century: Urban-Rural Differences in Northern and Western Europe." *Vienna Yearbook of Population Research* 23: 1–26. https://doi.org/10.1553/P-4CGN-NZ7F.

Wood, J., and K. Neels. 2019. "Local Childcare Availability and Dual-Earner Fertility: Variation in Childcare Coverage and Birth Hazards over Place and Time." *European Journal of Population*35, no. 5: 913–937. https://doi.org/10.1007/s10680-018-9510-4.

Wood, J., K. Neels, and T. Kil. 2014. "The Educational Gradient of Childlessness and Cohort Parity Progression in 14 Low Fertility Countries." *Demographic Research* 31, no. 46: 1365–1416. https://www.jstor.org/stable/26350100.

Zeman, K., É. Beaujouan, Z. Brzozowska, and T. Sobotka. 2018. "Cohort Fertility Decline in Low Fertility Countries: Decomposition Using Parity Progression Ratios." *Demographic Research* 38, no. 25: 651–690. https://www.jstor.org/stable/26457059.

Supporting Information

Additional supporting information can be found online in the Supporting Information section.