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Research paper

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EDUCATIONALLY HETEROGAMOUS UNIONS AND COUNTRY LEVEL INEQUALITIES IN EUROPE BEFORE AND AFTER 1990

Abstract

Scholars are interested in the association between partnership formation and socioeconomic status due to the link with the reproduction of socioeconomic inequalities. Previous findings showed that highly educated individuals are less likely than low educated to form heterogamous unions, i.e., when partners hold different levels of education. The educational gradient in heterogamy has been linked to the level of societal openness in a country. Still, it is not clear-cut to what extent these findings are generalizable across periods and countries. Using Generations and Gender Surveys (GGS) data of 15 European countries, we analyse the association between the educational gradient in heterogamous union formation and country level indicators of socioeconomic inequalities before and after 1990, applying a two-stage regression approach. We found that people with a low level of education are more prone to form heterogamous unions relatively to the highly educated. The Gini Index mildly explains the variation across countries of the gradient in heterogamy. For unions formed after 1990, we found that an increase in economic inequality is associated with a less steep negative educational gradient in heterogamy. Our study highlights the complexity of studying country level variation in educational assortative mating, all the more that it may entail differences related to the meaning of education in each country.

Keywords: Educational assortative mating; union formation; social inequality; East-West divide; two-stage regression.

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1 Introduction

Trends of educational assortative mating, i.e., the sorting of couples according to partners' level of education, have important societal implications because of the links with changes in social inequality and levels of intergenerational social mobility (Frémeaux & Lefranc, 2020; Mare, 2011; Schwartz, 2009). Changes in educational assortative mating are the result of modernization, the level of societal openness, and development of individuals' preferences on the mating markets (Blossfeld, 2009; Kalmijn, 1998; Trimarchi, 2022).

At the individual-level, past evidence has shown that more educated individuals have the tendency to form homogamous unions more often, relative to the less educated (Blossfeld, 2009; Blossfeld & Timm, 2003; Kalmijn, 1998). To what extent these patterns are observed generally, i.e., for different sexes, or across periods and contexts, is still unclear. In Europe, starting from the 1990s, the growing participation of women in tertiary education, and ensuing increasing women's educational attainment, has led to increasing gender inequality in education in favour of women (i.e., more highly educated women than men) (Van Bavel, 2012; Vincent-Lancrin, 2008). These trends have had consequences on patterns of educational assortative mating. Many European countries have experienced a rise of educationally hypogamous unions, i.e., unions where the woman has a higher level of education than the man, relative to hypergamous ones, where the man is more educated than the woman, while educational homogamy is still considered the most frequent type of educational pairing (Esteve et al., 2012; Grow & Van Bavel, 2015).

European countries, because of their historical background and the changing trends in educational assortative mating, represent an insightful set of contexts to investigate changes of the educational gradient in heterogamous versus homogamous union formation across time. This is especially because of the variation of countries, in terms of both western and post-socialist countries. Given this contextual variation, we contribute to previous work on the association between educational assortative mating and social inequalities in two ways. First, we aim to investigate the educational gradient in heterogamous versus homogamous union formation explicitly differentiating between unions that have been formed before and after 1990. In such a way, we can examine whether there has been a change in this gradient across countries in a period of societal changes. Secondly, we examine whether the variation of the educational gradient in heterogamous union formation can be explained by contextual changes related to increasing economic inequality across European countries after 1990 (Bandelj & Mahutga, 2010).

To this aim, benefiting from rich harmonized survey data coming from Wave 1 of the Generations and Gender Surveys (GGS) of 15 countries, we link these individual-level data to harmonized, comparable, aggregate data based on external sources, i.e., the Standardized World Income Inequality Database (Solt, 2016), and the educational distribution provided by the International Institute for Applied Systems Analysis/Vienna Institute of Demography (IIASA/VID) (Kc et al., 2010; Lutz, 2007). Next, to explore the effect of contextual factors on the individual-level patterns of the educational gradient in heterogamous unions, we apply a two-stage regression approach because, due to the low number of units on the aggregate-level, we cannot apply robust multilevel random effect models (Bryan & Jenkins, 2016). Results showed that low educated individuals are more likely to form heterogamous unions relatively to the highly educated. Next, we found that for unions formed after 1990, stronger economic inequality, indicated by the Gini Index, is associated with a less negative educational gradient in heterogamy.

2 Background

2.1 Educational assortative mating patterns

Education has several dimensions, such as enrolment, level of attainment, field of study (Lappegård & Rønsen, 2005). The dimension of interest in this study is the level of educational attainment, which represents a good proxy for the level of socioeconomic resources of an individual, based on the theory of human capital accumulation. A higher level of educational attainment is associated, in the long-term, with higher earning potential and better economic prospects in terms of occupation and job stability (Becker, 1964; 1985). Moreover, education represents an engine for status enhancement: inequalities in completion of tertiary education drive differentials in employment, income and well-being, since highly educated individuals perform better in terms of labor-market outcomes and healthy lifestyles (OECD, 2017; 2018).

On the individual level, education is one of the main attributes that can make an individual more or less desirable on the mating market (Buss et al., 1990). Assortative mating by educational level has different implications for the individual and for society at large. At the individual level, people with more education tend to form stable unions after a longer search for a suitable partner, which can be an outcome of the years spent accumulating human capital (Oppenheimer, 1988). This could lead to more stable couples, less prone to separation, and a normalization of the dual-earner type of family model (Goldscheider et al., 2015). This is in contrast with what could happen at lower levels of educational homogamy, where couples may be more inclined to a traditional family model, i.e., the male-breadwinner model, more likely spread among families with a low socioeconomic status (Blossfeld & Drobnic, 2001; Esping-Andersen, 2009; Esping-Andersen & Billari, 2015).

At the societal level, individuals mating with partners having the same level of education (i.e., positive assortative mating) would imply an accumulation of advantages or disadvantages endowed in the level of education (Becker, 1991), with ensuing consequences for the reproduction of educational inequalities (Blossfeld, 2009; Boertien & Permanyer, 2019; Schwartz 2009, 2013). Generally, homogamy is facilitated when people come from a similar social background, or have attended the same schools, or were involved in the same religious community (Blossfeld, 2009; Blossfeld & Timm, 2003; Kalmijn, 1991). One way to avoid the accumulation of disadvantages, derived from a low educational level, would be to find a partner with a higher level of education (Blossfeld, 2009; Blossfeld & Timm, 2003). According to the stratification thesis, a more stratified and closed society will offer fewer opportunities to the low educated to improve their social status (Blossfeld, 2009; Kalmijn, 1991).

In fact, homogamy in education is the most typical mating pattern across countries and indicates the level of accumulation of resources within the couple (Boertien & Permanyer, 2019). Heterogamous couples, who are the focus of this study, instead, tend to be less typical in a society relatively to educationally homogamous couples. In the last decades, the distribution of heterogamous couples has been changing due to fact that more highly educated women are on the mating market relatively to the highly educated men (Van Bavel, 2012). This reversal of gender inequality in tertiary education has affected patterns of educational assortative mating, inducing an increase of hypogamous relative to hypergamous couples (De Hauw et al., 2017; Esteve et al., 2012; Grow & Van Bavel, 2015), still homogamy remains the most common pattern.

2.2 Education in the European context

In general, the more educated have better prospects on the labor market. In Europe, the earning advantage of the better educated strongly depends on developments occurring after the Second World War. By the end of the war, European countries were separated in two blocks, with different economic and political systems. The Western block was characterized by a capitalist political and economic system, while Central and Eastern European countries were maintaining a socialist regime.

After the fall of the Soviet Union, centralized socialist regimes were substituted by democracies and free-market economies. This societal transition brought important consequences for the economies of Central and Eastern European countries, since individuals had to cope with challenges such as competition on the labor market, job and housing uncertainty. As a result, in these countries, the value of higher education rapidly increased, due to increasing competition on the labor market (Frejka, 2008).

Despite the adoption of European policies, which aimed at socioeconomic convergence across European countries, socioeconomic inequalities in education persist across Europe. In the last decades, the socioeconomic divide across European countries increased (OECD, 2017), due to differences rooted in institutional and social factors, including "within-country" disparities (Fredriksen, 2012). As scholars have recently pointed out, differential demographic behavior by socioeconomic status may also represent a key factor that drives social inequalities across countries (Choi et al., 2020; European Commission, 2015).

The gender dimension should also be addressed in respect of educational inequalities, and how they have developed across European countries. As already mentioned, in all European countries it has been observed that tertiary educated women have outnumbered tertiary educated men, hence a reversal of gender inequality in higher education (Vincent-Lancrin, 2008), given that in the past men were more educated than women. This novel trend occurred at different timing in Europe. In the Baltic countries, in some Nordic countries, and Central and Eastern countries (e.g., Bulgaria, Poland), the sex ratio (men/women) for tertiary educated people aged 25-29 years old was below one already in the 1970s, while in German-speaking countries, this trend occurred in the first decade of the 2000s (Van Bavel, 2012:9).

This trend has contributed to the increase in hypogamous unions relative to hypergamous ones (Bouchet-Valat, 2015; De Hauw et al., 2017), hence a specific pattern of heterogamous type of union. It remains unclear to what extent it can be associated with variation across countries of the educational gradient in heterogamous versus homogamous union formation more generally. Social inequalities measured in terms of gender gap in tertiary education cannot explain variation in the educational gradient in heterogamy but are rather associated with differences between hypogamy and hypergamy, which is not the focus of this study (see e.g., De Hauw et al., 2017).

The reversal of gender inequalities in education could be considered an indicator of decreasing social inequalities, given that in the past, men were more likely than women to earn a tertiary degree. Decreasing social barriers to access tertiary education for women could imply more generally decreasing social barriers between highly and low educated. To the extent that the reversed gender gap in education implies a facilitation for the low educated to mix-up with the highly educated, heterogamy levels could be affected too. In the next sub-section, we formulate hypotheses at the individual- and contextual-level, focusing on the educational gradient in heterogamy and the role of socioeconomic inequalities.

2.3 Hypotheses

Based on the argument that low educated individuals may improve their social-status by partnering up, then, low-educated may be more prone to enter heterogamous unions relative to homogamous ones. The more educated, instead, put higher value on partners who are at least as educated as they are (Oppenheimer, 1988). Moreover, the environment where low educated people socialize is more heterogenous in terms of individuals' educational achievement relatively to the highly educated, who meet more often at universities (Esping-Andersen, 2009; Kalmijn, 1998; Schwartz & Mare, 2005). Thus, we formulate the first hypothesis (H1), according to which there is a negative educational gradient in heterogamy. Hence, we expect that low educated individuals are more likely to enter educationally heterogamous unions compared to their highly educated peers. We expect this finding to be generalizable across countries.

The second part of this study aims to explore more in depth the variation of the educational gradient in heterogamous union formation, across periods and countries. In doing so, we consider contextual factors that may contribute to explain country-level variation in the educational gradient in heterogamy. Focusing on the time dimension, we look at differences by union-formation period, and we test whether the educational gradient in heterogamy changed for unions formed before or after 1990. The choice of 1990 as cut-off period is justified by the fact that, with the disruption of the Soviet Union, the 1990 marks a period of societal and economic changes in Europe. Moreover, as an ancillary reason, for many European countries the reversal of gender inequalities in education occurred around 1990 (Van Bavel, 2012). Following this rationale for the cut-off year, we test whether the level of economic inequality, and gender inequalities in education, explain variation in the educational gradient in heterogamy across European countries.

Economic inequalities in Europe have increased since the 1990s, and the effect on the educational gradient in heterogamy could take different directions. On the one hand, with stronger inequalities, we could expect that the pressure to improve own social status via partnering becomes stronger for the low educated, as a result the negative educational gradient in heterogamy would become steeper (H2a). On the other hand, when economic inequalities rise, low educated have more difficulties to access social environments of the more privileged, thus, being somewhat forced to form homogamous unions. This process could flatten the educational gradient in heterogamy (H2b).

The association between the reversal of gender equality in education and the educational gradient in heterogamy is also ambiguous. While low and medium educated men may be more likely to mate with highly educated women, low and medium educated women may have more difficulties to find a highly educated man (Bouchet-Valat, 2015; De Hauw et al., 2017). Thus, social inequalities measured in terms of gender gap in tertiary education would not explain variation in the educational gradient in heterogamy. Still, decreasing social barriers to access tertiary education for women could be interpreted as a more general sign of societal openness. Hence, to the extent that the reversed gender gap in education also implies further opportunities for low educated to mix-up with the higher educated, heterogamy levels among the low educated could increase. Then, we would expect that an increasing gender-gap in education, in favor of women, is associated with a steeper negative educational gradient in heterogamy (H3). The rationale for this would be that decreasing social barriers to access tertiary education for women is related to higher levels of societal openness and, hence, more possibilities for the low educated to form heterogamous unions.

3 Data and methods

3.1 Data and sample selection

We used Wave 1 of Generation and Gender Surveys (GGS) – Round I of 15 countries (Austria, Belgium, Bulgaria, Czechia, Estonia, France, Germany, Hungary, Italy, Lithuania, the Netherlands, Norway, Poland, Romania, and Sweden) with available information necessary to the aim of the paper (http://www.ggp-i.org/). The surveys include individuals between 18 and 79 years old, and deal with different topics: fertility and partnership histories, economic activity, attitudes, etc. The GGS are the most recent high quality family surveys available to date, widely used for international comparisons (Gauthier et al., 2018; Vikat et al., 2007). The surveys took place in different years across countries, between 2002 and 2011 (see Table 1 for details).

Since we are interested in the educational gradient in heterogamy, the sample only includes partnered individuals at the time of interview (n=113770). To limit reporting bias due to old-age, we focus on a sample of individuals born after 1945 (n = 92803), also according to previous studies information from cohort born after 1945 is more reliable (Vergauwen et al., 2015). Furthermore, to minimize endogeneity issues between education and union formation processes, we exclude individuals who are too young, and we select individuals who, at interview, are 30 years old or older (n=75910). Still, this choice of the cut-off point for age may introduce selectivity issues, especially for the lower educated people, or for respondents in Eastern European countries, who tend to form unions at younger ages. Hence, I have run robustness checks using 25 years old as cut-off point for age, and results were not affected. Finally, we have dropped individuals in case of missing information about their level of education (n=292), and partners' level of education (n=3501). Overall, the sample totalled of 72117 individuals born between 1945 and 1983.

Partnerships have been classified in two different periods according to the year of union formation, i.e., if the couple formed before 1990, or from 1990 onwards (>=1990). If the year of union formation was missing (about 2% of cases), we have used the year of marriage if available for half of missing cases. For the other half of missing cases, we have imputed the year of union formation using the mean year of union formation for a specific combination of birth cohort, sex and country. In this latter case, the majority of units that were imputed was in Hungary, which had the highest rate of missing information about the year of union formation (13%).

3.2 Measures

Table 1 shows a description of the dependent and independent variables in our sample. The educational pairing variable is defined as the combination of both partners' levels of educational attainment. The dependent variable is dichotomic and it indicates whether partners have the same level of education, i.e., (0) "homogamy", or they have a different level of education, i.e., (1) "heterogamy".

The main independent variable is respondents' level of education. The level of education was harmonized across countries using the International Standard

Classification of Education (ISCED, 1997). We have operationalized educational attainment in three categories (low, medium, high). The first category includes individuals who completed primary plus lower secondary school (ISCED 0, 1, 2). The medium category consists of individuals who attained the upper-secondary and post-secondary level (ISCED 3, 4). Highly educated respondents were categorized as such if they received at least a bachelor's degree (ISCED 5, 6). Additionally, we controlled for respondents' age at survey, age squared, sex, and cohort.

Next, we have accounted for two macro-level variables. These variables are (1) the Gini coefficient, which is an indicator of the level of economic inequality in the country and (2) the gender-gap in tertiary education, which is an indicator of the reversal of gender inequalities in education. Both our independent variables are not yearly specific, but period specific. The Gini Index derives from the Standardized World Income Inequality Database Version 8.2 (Solt, 2016) and it has been averaged for the years before 1990, and after 1990 till 2010.

The gender gap in education for the two periods, before and after 1990, derives from the reconstructions (1970-1995) and projections (2000-2010) of educational distribution provided by the International Institute for Applied Systems Analysis/Vienna Institute of Demography (IIASA/VID) (Kc et al. 2010; Lutz 2007). The gender-gap in tertiary education is measured as the difference in the proportion of highly educated women and highly educated men aged 20-64 years old, before and after 1990. For this indicator, we also have averaged the information available to have one value relative to each period. The latest information used was relative to 2010 since very few unions in our dataset have occurred after 2010. Figure 1 shows scatterplots for the two contextual variables. The x-axis indicates the value of the variables before 1990, and the y-axis, values referring to the period after 1990. The gray dashed lines highlight the linear association between values before and after 1990. Regarding the gender-gap in education, we observe that, generally, a smaller gender-gap in education in favor of men (negative values) before the 1990, result in a less negative or even positive gap (in favor of women) after 1990. Concerning the Gini-Index, the association is less evident: we observe that economic inequality has worsened after 1990 especially in Central and Eastern European countries, while in Western European countries, economic inequality remained mostly similar to levels observed before 1990.

3.3 Methods

To test our hypotheses, we apply a two-step regression approach (Achen, 2005; Gelman, 2005). This approach is useful to examine the role of macro-level factors when multilevel-random effect models cannot be applied because the number of units of analysis is too small (in practice < 30, see e.g. (Bryan & Jenkins 2016).

The first step consists in the estimation of individual-level coefficients of interest. In our case, since our dependent variable is dichotomous (heterogamous union = 1, homogamous = 0), we apply a logistic regression, separately by period of union formation and country, for the likelihood to be in a heterogamous versus homogamous union. Formally, the model can be written in the following way:

$$logit\left(P_{heterogamy,\ period,\ country}\right) = \alpha + \beta_1(age) + \beta_2(age^2) + \beta_3(medium\ education) + \beta_4(high\ education) + \beta_5(female) + \beta_6(cohort) \quad (1)$$

The second step consists in running standard and weighted OLS regressions, separately by period, i.e., before and after 1990. We use as dependent variables the beta coefficients β_4 obtained in the previous stage, which indicates the relative difference in the likelihood to be in a heterogamous union for a highly educated compared to a low educated respondent (the reference category) in each country and period. As weights we have used estimated standard errors of the beta coefficients of interest. Note that there is no major difference in the results if we apply weighted, or standard OLS regression. The independent variables included are the Gini Index and the gender-gap in tertiary education. Formally, we write:

$$y_{(\beta_4\, from\, step\, 1)} = \alpha + \beta_1(Gini\ Index) + \\ \beta_2(\%\ Females\ Highly\ Educated - \ \%\ Males\ Highly\ Educated) + \varepsilon \quad (2)$$

Table 1. Description of the sample

	Austria (2008-2009)	Belgium (2008-2010)	Bulgaria (2004)	Czechia (2005)	Estonia (2004-2005)	France (2005)	Germany (2005)
Union type (%)							
Homogamy	63.7	59.1	72.2	71.3	58.5	58.0	64.2
Heterogamy	36.3	40.9	27.8	28.7	41.5	42.0	35.8
Period of union (%)							
Before 1990	19.4	47.7	64.9	56.6	60.6	52.6	53.5
After 1990	80.6	52.3	35.1	43.4	39.4	47.4	46.5
Sex (%)							
Male	38.6	49.0	43.6	47.9	39.2	45.3	43.2
Female	61.4	51.0	56.4	52.1	60.8	54.7	56.8
Education (%)							
Low	11.5	26.8	20.7	13.5	11.5	25.8	8.3
Medium	67.3	32.9	55.7	69.3	54.2	43.8	60.5
High	21.1	40.4	23.6	17.2	34.3	30.4	31.2
Age (mean)	37.9	46.6	42.4	44.1	44.1	44.7	44.3
Cohort (mean)	1970	1962	1962	1960	1960	1960	1960
N	2695	3757	5877	3655	3199	4452	4378

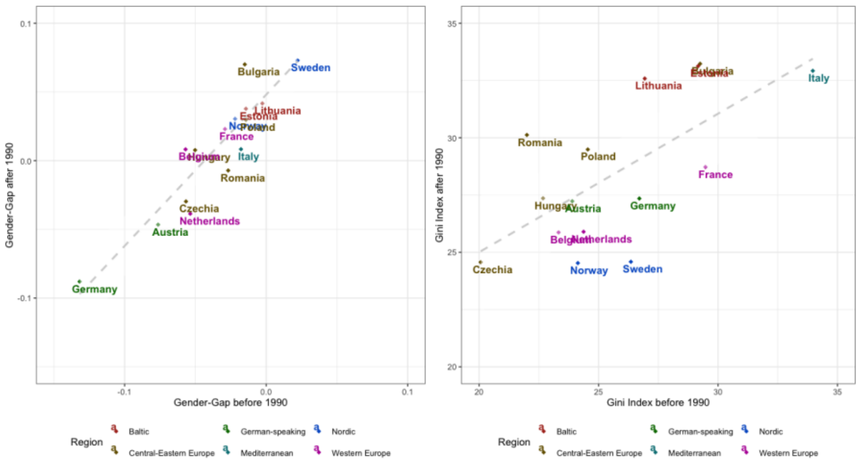
Source: Own elaborations on GGS data. Years of survey are indicated in parentheses for each country.

Table 1. Continued

	Hungary (2004-2005)	Italy (2003)	Lithuania (2006)	Netherlands (2002-2003)	Norway (2007-2008)	Poland (2010-2011)	Romania (2005)	Sweden (2012-2013)
Union type (%)								
Homogamy	68.3	65.0	69.0	54.7	55.0	72.6	71.5	56.8
Heterogamy	31.7	35.0	31.0	45.3	45.0	27.4	28.5	43.2
Period of union (%)								
Before 1990	68.8	64.6	58.2	59.0	49.2	56.8	64.3	42.4
After 1990	31.2	35.4	41.8	41.0	50.8	43.2	35.7	57.6
Sex (%)								
Male	46.9	46.6	55.8	36.0	49.0	45.9	52.4	48.5
Female	53.1	53.4	44.2	64.0	51.0	54.1	47.6	51.5
Education (%)								
Low	18.1	50.7	9.8	32.0	14.4	11.7	28.5	9.2
Medium	64.1	38.5	65.4	32.8	46.4	68.4	60.2	50.6
High	17.8	10.8	24.7	35.2	39.2	19.9	11.3	40.2
Age (mean)	44.8	44.6	44.4	43.2	45.8	48.1	44.8	48.8
Cohort (mean)	1959	1958	1961	1959	1961	1962	1960	1963
N	5618	4656	3774	3440	6953	9125	5948	4590

Source: Own elaborations on GGS data. Years of survey are indicated in parentheses for each country.

Figure 1. Description of contextual variables, averages before 1990 (years 1970-1989) and after (1990-2009)



Source: Own elaborations on IIASA/VID education database (plot on the left); and Standardized World Income Inequality Database Version 8.2 (plot on the right)

4 Results

4.1 First step results

We first discuss results of the logistic regression models fitted in the first step, which modeled the effect of education on the likelihood to enter a heterogamous union. We estimated each model separately by country and period of union formation, controlling for age (and its square), cohort, and sex of the respondent. In all models, the reference category are low educated individuals. To facilitate interpretation, and comparability of logit models (Mood, 2010), in Figure 2 we show average marginal effects of education, and not regression coefficients (note that full logit models, and goodness-of-fit statistics are available in Appendix A, Table A1 and Table A2).

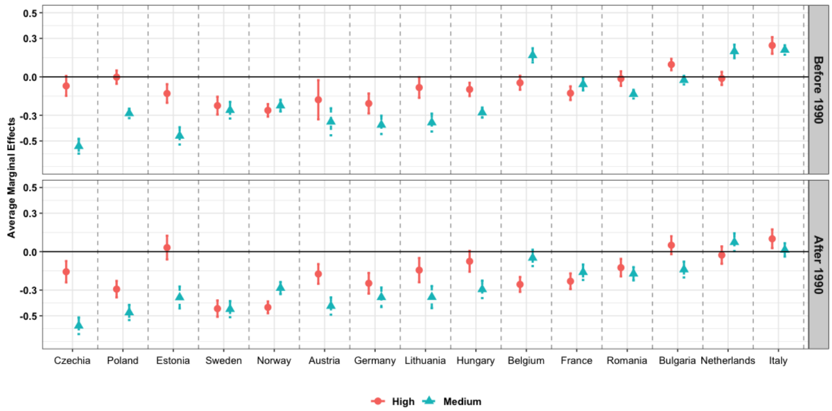
According to our first hypothesis H1, we expected a negative educational gradient in heterogamy, relatively to homogamy. With few exceptions, results are generally in line with this expectation for both periods considered. We found a negative educational gradient in heterogamy for unions formed before the 1990, in all countries, except for Italy. In this latter case, we found that both highly and medium educated individuals were more likely to enter heterogamous unions than their low educated peers. This exception could be due to the educational distribution within the country. In fact, in Italy, low educated individuals are the biggest group, hence medium and highly educated individuals have more difficulties to find a partner with the same level of education.

In Belgium and in the Netherlands, instead, only medium educated are more likely to form heterogamous unions relatively to their low educated counterpart. In Bulgaria, highly educated individuals showed higher rates of heterogamous unions, than their lower educated counterpart. In general, individuals pertaining to the largest educational group are more likely to form homogamous unions. Thus, we observe that in several countries, the educational gradient in heterogamy is U-shaped, being the medium educated group the largest, and having the lower likelihood to form heterogamous unions.

For unions formed in the 1990s, or later, we found that in many European countries, the negative educational gradient in heterogamy remained stable, or became steeper, except for Estonia and Hungary. This implies that low educated individuals were even more likely to form heterogamous unions relatively to the more educated in the period after 1990. This pattern would be in line with our hypothesis H2a, according to which, with stronger inequalities, low educated feel higher pressure to partnering up, so to improve their social status. Still, from a mere structural perspective, increasing rates of participation in tertiary education across all countries might have facilitated the formation of homogamous unions among the more educated. As a result, the propensity of the low educated to form heterogamous unions can be interpreted also as the effort to avoid remaining single. In more recent years, low educated, both men and women, are considered those with higher risk of singlehood (Bouchet-Valat, 2015; De Hauw et al., 2017; Trimarchi & Van Bavel, 2017).

In Estonia and Hungary results go in the direction of the competing hypothesis H2b, according to which when economic inequalities rise, low educated have more difficulties to access social environments of the more privileged, thus, being somewhat forced to form homogamous unions. This process could flatten the educational gradient in heterogamy.

Figure 2. Average marginal effects of education for the probability to form heterogamous versus homogamous union before (upper panel) and after (bottom panel) 1990, reference category: Low education



Source: Own elaborations on GGS data of 15 countries (Wave 1)

4.2 Second step results

The second part of the analyses is mostly exploratory, investigating whether variation in the educational gradient in heterogamy observed in the first step can be explained by country-level socioeconomic factors. To synthetize, we focus on the difference between the extremes of the educational distribution, the high and low educated. Figure 3 and Figure 4 simply shows the association between the estimated educational coefficients (high vs. low), the Gini Index, and the gender-gap in education, respectively, before and after 1990.

Figure 3. Association between estimated odds-ratio in heterogamy (high vs. low educated) and Gini Index before and after 1990

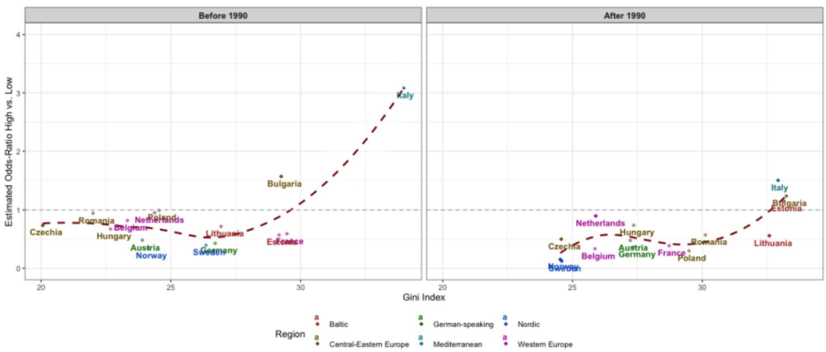


Figure 4. Association between estimated odds-ratio in heterogamy (high vs. low educated) and the gender-gap in education before and after 1990

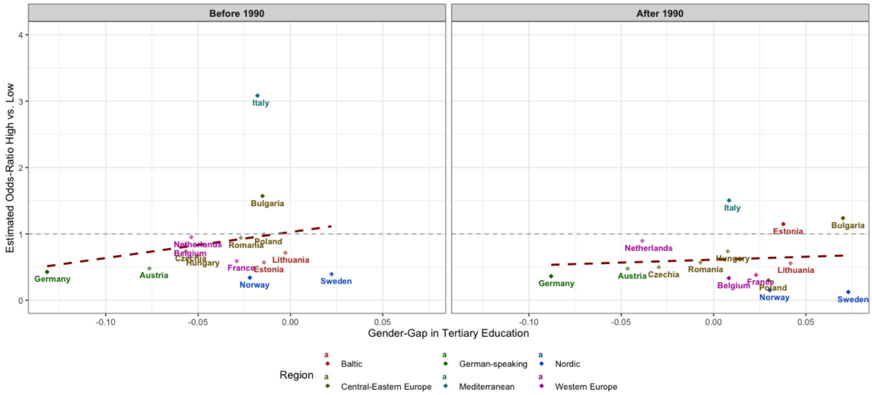


Table 2 shows the results of the OLS regressions, using as response variable the estimated coefficients of the logistic regressions, indicating the difference in the likelihood to be in a heterogamous union relative to homogamous between high and low educated, separately by period, and as independent variables the Gini Index, and the gender-gap in tertiary education (see Appendix B for the regression diagnostics). Results using the other contrast (medium vs. low), do not show any statistically significant effect, and generally go in the same direction as those presented here (see Table C3 in Appendix C).

According to the OLS regression, the economic aspect of inequality does not seem to be strongly associated with variation in the educational gradient in heterogamy across countries. After 1990, income inequality increased in most European countries, we would expect, then, according to H2a, a strengthening in the negative educational gradient in heterogamy. While we do observe that generally the gradient became steeper within country, as already discussed above, we find that variation across countries cannot be explained by the effect of specific economic indicators of income inequality, such as the Gini Index. The Gini Index turns out to be positively associated with the beta coefficients of the difference between high and low educated in the likelihood of heterogamy. A unit increase in the Gini Index is associated with an increase in the estimated logistic regression coefficients of 0.18. In other words, where income inequality increased, the educational gradient tended to flatten, i.e., became less negative. A finding which is in line with hypothesis H2b, according to which when economic inequalities rise the educational gradient in heterogamy flattens, possibly because social barriers become stronger. This relationship holds even if we drop from the OLS regression Italy and Bulgaria, where highly educated are more likely to be in a heterogamous union than the low educated.

It could be that we do not observe any statistically significant effect of the Gini Index before 1990, because its effect could be non-linear, as suggested by Figure 3. Hence, we have alternatively specified the model by including a second-order term for the Gini Index. Results of this model specification are shown in Table C1 of Appendix C. Indeed, the results show a statistically significant effect of the squared term, and the fit surely improves, especially for the period before 1990. However, the inclusion of the squared term is not robust to the exclusion of Italy and Bulgaria. As shown in Table C2 of Appendix C, when running regressions without those two countries' estimates, the non-linear effect is not statistically significant anymore. Non-linear effects are mainly driven by these two data points.

Table 2. OLS regression results

Before 1990	Estimate	Std. Error	Pr (>|t|)
Intercept	-1.91	1.16	
Gini Index	0.06	0.04	
Gender-Gap Education	1.35	4.17	
$R^2 = 0.20$			
After 1990			
Intercept	-5.82	1.20	***
Gini Index	0.18	0.04	**
Gender-Gap Education	-6.07	3.10	.
$R^2=0.61$			

Notes: Signif. codes: < 0.001 '***' < 0.01 '**' <0.05 '*' <0.1 '.'

Concerning the effect of the gender-gap in tertiary education, the association is not statistically significant (at 0.05 level) in both periods considered, results are also robust to the exclusion of Italy and Bulgaria, and non-linearity effects were not detected. The lack of a strong linear relationship could be because the changing gender-gap in tertiary education affects the availability of potential mates with a tertiary degree in a different way for men and women. With an increasing gender-gap in education in favor of women, tertiary educated women become more numerous, hence opportunities for low and medium educated men to form a heterogamous union increase. The same does not necessarily hold for the low and medium educated women, who wish to partner with a highly educated man.

Interestingly, we observe that the sign of the association between the educational gradient in heterogamy and the gender-gap in education changes between periods. Before 1990, a gap in favor of women would be associated positively with the estimated coefficients, meaning that countries with a higher proportion of tertiary educated women than men would have a less negative educational gradient in heterogamy. In the period after 1990, instead, the coefficient is negatively associated to the estimated coefficients in heterogamy. This finding is in line with H3, according to which a - more - positive gender-gap in education is associated with a steeper negative educational gradient in heterogamy. In sum, while increasing income inequality, as indicated by the Gini Index, could somehow represent a barrier for the lower educated to be socially mobile by partnering with someone more educated than themselves, the recent reversal of the gender-gap in education works in the other direction.

5 Conclusions

Patterns of educational assortative mating are of scholarly interest because of their relationship with the reproduction of socioeconomic inequalities in a society. This is due to the ambivalent meaning of education, entailing good economic prospects and valuable cultural resources. Partners with tertiary levels of education who mate homogamously have bigger societal and economic advantages, relatively to partners who mate homogamously at lower levels of education (Blossfeld, 2009; Esping-

Andersen, 2009). The level of heterogamy in union formation is an indicator of societal openness in a society: the higher the level of heterogamy, the fewer barriers exist across social groups. Hence, a society promoting heterogamy encourages social cohesion.

After the fall of the Soviet Union, economic inequalities have increased across European countries, and the new setting has also contributed to changes in educational assortative mating, together with the reversal of gender inequality in education. Still, studies addressing differences across countries and periods in the propensity to form heterogamous unions are rare due to the lack of comparable cross-country data, at both micro- and macro-level. In this study, we have filled this gap, by applying a two-stage regression approach to GGS data of 15 European countries.

At first, we examined the educational gradient in heterogamy versus homogamy by period of union formation, before and after 1990. We chose this cut-off year because it represents a mark of socioeconomic transformation in Europe. As expected, we found that medium and highly educated individuals are less likely to enter heterogamous unions, relatively to the low educated counterpart. We found only few exceptions to this pattern, which holds across all the 15 countries considered. The most striking result is the case of Italy, where both medium and highly educated are more likely to form heterogamous unions than the low educated, a result driven by the fact that the low educated group in Italy is the most numerous. Moreover, in line with the expectations, we found that the negative educational gradient became steeper for unions formed after 1990.

Next, we have explored the association between country-level factors and the educational gradient in heterogamy. In line with our expectations, in the period after 1990, when economic inequalities increased, we found that the Gini Index is positively associated with the educational gradient in heterogamy, meaning that with increasing income inequality the educational gradient became less negative. Regarding the same period, we also found that a gender-gap in tertiary education, favoring women, is associated with a steeper negative educational gradient in heterogamy. This finding implies that in countries with an increasing gap in tertiary education in favour of women, low educated would show an increasing propensity to form heterogamous unions.

Despite the exploratory nature of this analysis, the merit of this study consists in the original exploitation of different contexts characterizing Europe, in terms of space and time. A limitation of this study, however, relates to the fact that it only focuses on the level of education. In fact, with educational expansion, even if partners hold a similar level of education, their life course could be different. For instance, the field of study for a given level of education, implies different career choices for each partner (Esping-Andersen, 2009). The earning potential of each partner is also affected by the field of study, as also indicated by the gender wage gap (Blau & Kahn, 2016). All of this is inherently linked to differences across contexts in the meaning and value of education itself, and how it has been changing over time.

Future studies should focus more in depth on a specific context, to identify the determinants of societal openness and how they are related to mating-market opportunities. When accounting for mating-market opportunities, it would be particularly interesting to also examine gender differences in the educational gradient in union formation, given that preferences and structural constraints differ between genders.

This study also emphasizes the challenge to consider both micro and macro levels of analysis when data availability is a problem to apply sophisticated multilevel analyses. The study of assortative mating, which entails the study of opportunity and constraints in the availability of partners on the mating-market, would be better addressed when focusing on a sub-national level. This is even more so when contextual determinants of assortative mating are considered, such as socioeconomic inequality. In fact, while the period after 1990 has marked a convergence across European countries in terms of socioeconomic indicators, due to structural policies of the European Union, regional disparities within countries have increased (Fredriksen, 2012; Heidenreich & Wunder, 2008).

Finally, with the future round of family surveys this study can be adapted to analyze the effect of more recent events, in particular the Covid-19 pandemic, on the role of mating patterns in the reproduction of social and economic inequalities, and ensuing consequences on social cohesion.

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A Appendix A: First step model results and diagnostics

Table A1 Full first-step logit results and goodness-of-fit models' statistics for the period before 1990.

Variable	Bulgaria	Germany	France	Hungary	Italy	Netherlands	Romania
Age	0,99	0,08	0,76	1,52	-0,08	-1,11	-0,02
Age squared	-0,03	0,02	0,04	-0,14	-0,03	0,14	0,07
Sex (Ref.: Male)							
Female	0,06	0,12	0,09	-0,04	-0,06	-0,15	-0,12
Year of birth	0,08	0,00	0,07	0,09	(omitted)	-0,10	0,02
Education							
Medium	-0,14	-1,60 ***	-0,24 *	-1,24 ***	0,98 ***	0,81 ***	-0,65 ***
High	0,45 ***	-0,85 ***	-0,53 ***	-0,40 ***	1,13 ***	-0,05	-0,06
_cons	-1,83	0,37	-0,96	-1,28	-1,06 ***	0,37	-0,52
N	3817	2341	2342	3865	3007	2029	3824
Log-Lik Full Model	-2195	-1445	-1586	-2309	-1778	-1359	-2274
Log-Lik Intercept Only	-2221	-1515	-1601	-2436	-1865	-1397	-2312
Log-Lik Chi-square = 2*(Log-Lik Intercept Only - Log-Lik Full Model)	51,6	140,6	30,7	255,6	174,5	76,9	77,0
AIC	4404	2903	3186	4631	3568	2732	4562

Notes: Signif. codes: < 0.001 '***' < 0.01 '**' <0.05 '*' <0.1 '.' Year of birth is omitted in the model for Italy because it is fully collinear with the age variable.

Table A1 Continued

Variable	Norway	Austria	Estonia	Belgium	Lithuania	Poland	Czechia	Sweden
Age	1,00	-4,03	-0,80	-0,22	-0,28	1,68	1,69	0,28
Age squared	-0,01	1,38	-0,06	0,02	-0,10	0,10	-0,05	-0,19
Sex (Ref.: Male)								
Female	-0,05	0,25	0,19	0,04	0,19	-0,05	0,01	0,27 **
Year of birth	0,10	-0,29	-0,11	-0,02	-0,05	0,20	0,13	-0,06
Education								
Medium	-0,93 ***	-1,50 ***	-2,01 ***	0,68 ***	-1,65 ***	-1,36 ***	-2,63 ***	-1,08 ***
High	-1,08 ***	-0,73 *	-0,56 ***	-0,20	-0,33 *	-0,01	-0,31	-0,93 ***
_cons	-0,35	1,21	1,45	-0,35	0,48	-2,48	-0,87	0,45
N	3419	523	1940	1791	2195	5185	2070	1946
Log-Lik Full Model	-2305	-318	-1162	-1190	-1214	-2801	-954	-1305
Log-Lik Intercept Only	-2361	-344	-1311	-1221	-1319	-3008	-1225	-1340
Log-Lik Chi-square = 2*(Log-Lik Intercept Only - Log-Lik Full Model)	112,9	51,5	296,9	62,1	211,1	413,7	541,6	68,6
AIC	4624	650	2339	2394	2442	5617	1922	2625

Notes: Signif. codes: < 0.001 '***' < 0.01 '**' <0.05 '*' <0.1 '.' Year of birth is omitted in the model for Italy because it is fully collinear with the age variable.

Table A2 Full first-step logit results and goodness-of-fit models' statistics for the period after 1990.

Variable	Bulgaria	Germany	France	Hungary	Italy	Netherlands	Romania
Age	-1,20	1,43	-0,98	2,45	0,15	-0,65	0,30
Age squared	0,06	-0,02	-0,06	0,08	-0,14	0,35 **	-0,06
Sex (Ref.: Male)							
Female	0,10	-0,04	-0,03	-0,08	0,07	-0,15	-0,10
Year of birth	-0,11	0,13	-0,12	0,23	(omitted)	-0,03	0,00
Education							
Medium	-0,69 ***	-1,49 ***	-0,65 ***	-1,35 ***	0,06	0,30 *	-0,82 ***
High	0,21	-1,01 ***	-0,95 ***	-0,30	0,41 **	-0,11	-0,56 ***
_cons	0,14	-0,59	1,39	-2,24	-0,44 ***	0,01	-0,42
N	2060	2037	2110	1753	1649	1411	2124
Log-Lik Full Model	-1209	-1295	-1393	-1003	-1116	-960	-1216
Log-Lik Intercept Only	-1250	-1340	-1426	-1070	-1121	-972	-1243
Log-Lik Chi-square = 2*(Log-Lik Intercept Only - Log-Lik Full Model)	81,9	90,5	66,7	133,2	10,3	23,7	55,2
AIC	2432	2604	2800	2021	2244	1934	2445

Notes: Signif. codes: < 0.001 '***' < 0.01 '**' <0.05 '*' <0.1 '.' Year of birth is omitted in the model for Italy because it is fully collinear with the age variable.

Table A2 Continued

Variable	Norway	Austria	Estonia	Belgium	Lithuania	Poland	Czechia	Sweden
Age	1,26 *	-0,04	-1,12	-1,39 **	-0,04	0,10	0,68	-0,72
Age squared	-0,06	0,72 **	0,16	0,01	0,00	0,03	0,17	-0,09
Sex (Ref.: Male)								
Female	0,21 **	-0,13	0,00	0,23 *	0,14	0,06	-0,16	0,07
Year of birth	0,11	0,00	-0,09	-0,14 **	0,00	0,01	0,06	-0,10
Education								
Medium	-1,24 ***	-1,83 ***	-1,52 ***	-0,20	-1,52 ***	-2,12 ***	-2,79 ***	-2,10 ***
High	-1,88 ***	-0,74 ***	0,14	-1,10 ***	-0,58 **	-1,21 ***	-0,70 ***	-2,08 ***
_cons	-0,20	0,72	1,30	1,62 **	0,38	0,57	0,35	2,91 *
N	3534	2172	1259	1966	1579	3940	1585	2644
Log-Lik Full Model	-2269	-1313	-765	-1260	-958	-2189	-751	-1728
Log-Lik Intercept Only	-2421	-1422	-860	-1319	-1012	-2352	-964	-1798
Log-Lik Chi-square = 2*(Log-Lik Intercept Only - Log-Lik Full Model)	303,6	216,2	190,4	118,6	106,3	326,8	427,4	140,1
AIC	4552	2641	1543	2534	1931	4391	1515	3469

Notes: Signif. codes: < 0.001 '***' < 0.01 '**' <0.05 '*' <0.1 '.' Year of birth is omitted in the model for Italy because it is fully collinear with the age variable.

B Appendix B: Second step linear regression diagnostics

Table B1. OLS regression diagnostics tests for the assumptions of homoscedasticity and normality.

Period before 1990	*Period after 1990*
Breusch Pagan Test for Heteroskedasticity	**Breusch Pagan Test for Heteroskedasticity**
H_o: Variance is constant	H_o: Variance is constant
H_a: Variance is not constant	H_a: Variance is not constant
Chi2 = 2.0795	Chi2 = 0.00027664
Prob > Chi2 = 0.1492872	Prob > Chi2 = 0.9867298
Shapiro-Wilk normality test	**Shapiro-Wilk normality test**
H_o: Regression residuals are normally distributed	H_o: Regression residuals are normally distributed
H_a: Regression residuals are not normally distributed	H_a: Regression residuals are not normally distributed
W = 0.92917, p-value = 0.2652	W = 0.95929, p-value = 0.68

Based on the results showed in Table B1, the assumptions of normality and homoscedasticity are not violated, and the linear regression model can be considered adequate to fit these data.

C Appendix C: Further second step model specifications and results

Table C1. OLS regression results, including a second-order term for the Gini Index, to test non-linear effects.

Before 1990	Estimate	Std. Error	
Intercept	12,89	5,32	*
Gini Index	-1,06	0,40	*
Gini Index (squared term)	0,02	0,01	*
Gender-Gap Education	1,57	3,32	
R^2 =0.53			
After 1990			
Intercept	12,61	15,12	
Gini Index	-1,11	1,06	
Gini Index (squared term)	0,02	0,02	
Gender-Gap Education	-8,09	3,46	*
R^2 =0.66			

Notes: Signif. codes: < 0.001 '***' < 0.01 '**' <0.05 '*' <0.1 '.'

Table C2. OLS regression results, same model specification as in Table C2, but excluding Italy and Bulgaria.

Before 1990	Estimate	Std. Error	
Intercept	4,08	8,23	
Gini Index	-0,31	0,66	
Gini Index (squared term)	0,01	0,01	
Gender-Gap Education	1,29	2,87	
R^2 =0.15			
After 1990			
Intercept	6,41	17,17	
Gini Index	-0,65	1,21	
Gini Index (squared term)	0,01	0,02	
Gender-Gap Education	-8,03	3,79	.
R^2 =0.54			

Table C3. OLS regression results, using as dependent variable the estimated coefficients (β_3) from first step logistic regression (medium vs. low).

Before 1990	Estimate	Std.Error
Intercept	-3.83	2.27
Gini Index	0.12	0.08
Gender-Gap Education	-0.31	8.15
R^2 =0.15		
After 1990		
Intercept	-3.35	2.23
Gini Index	0.08	0.08
Gender-Gap Education	-2.34	5.77
R^2 =0.1		

Notes: Signif. codes: < 0.001 '***' < 0.01 '**' <0.05 '*' <0.1 '.'