The relationship between education and partnership patterns in the United States and across Europe

Brienna Perelli-Harris

and

Mark Lyons-Amos

University of Southampton

This project was funded by the European Research Council Starting Grant CHILDCOHAB. Thank you to everyone who helped collect, clean, and harmonize the Harmonized Histories data, especially Karolin Kubisch at MPIDR. The GGS data were obtained from the GGP Data Archive and refer to the publication that contains the model survey instruments: United Nations 2005. Generations & Gender Programme: Survey Instruments. New York and Geneva: UN, 2005. Please see www.nonmarital.org for further acknowledgments.

March 2013

DO NOT CITE WITHOUT AUTHORS' PERMISSION

Abstract

Previous studies have demonstrated that patterns of union formation have become more complex in Europe and the United States. Little is known about how relationship patterns differ by level of education within and across countries. In this paper, we use latent class growth analysis to compare the educational distribution of relationship patterns in the United States and across 14 countries in Europe. Latent class growth curves show how individuals can change their relationship status (never partnered, married, premaritally cohabiting, cohabiting, or separated) between the ages of 15-45. Statistical tests determine that 8 classes best fit the data. We then use multinomial logit models to determine whether education is associated with the 8 latent classes. Preliminary results suggest that education is more important for classes that show the postponement of marriage than classes reflecting non-marital family forms. Differences across countries appear to be greater than differences across educational categories.

Numerous studies have shown that over the past few decades family-life trajectories in the United States and Europe have become de-standardized and heterogeneous (Perelli-Harris and Lyons-Amos 2012, Elizinga and Liefbroer 2007, Corijn and Klijzing 2001, Billari and Liebroer 2010). In particular, union formation has become much more complex; rather than simply entering and remaining within marriage, couples are now much more likely to enter into cohabitation, dissolve their unions, and re-partner. Other dimensions of union formation have also changed, including the timing of partnership formation, the duration of cohabiting unions, and the repetition of cohabitation and marriage. Taken as a whole, these changes in the lifecourse have led to new and multifaceted relationship patterns. As a result of the increase in diversity of experiences, the heterogeneity of relationship patterns has increased both within and across countries of Europe and the United States (Elizinga and Liefbroer 2007, Perelli-Harris and Lyons-Amos 2012).

Differences in relationship patterns are likely to be associated with education. Education is often correlated with specific elements of relationship formation, such as entrance into cohabitation (Xie et al 2003, Kalmijn 2010, Oppenheimer 2003, Kennedy and Bumpass 2008, Ni Brochlain and Beaujouan 2012), the timing and intensity of marriage (Goldstein and Kenney 2001), and divorce (Harkonen and Dronkers 2006). Yet the direction and magnitude of the association with education depends on the event and may lead to different associations for relationship patterns as a whole. In addition, the effects vary across countries (e.g. Härkönen and Dronkers 2006, Perelli-Harris and Neels 2012, Ni Brochlain and Beaujouan 2012). Thus, although we expect that education will be correlated with certain relationship patterns, we do not know how or with which specific patterns. Moreover, we do not know the relevance of education compared to country context. Although educational level may be important for determining an individual's partnership pattern, the country that they live in may be far more important.

To compare the educational distribution of relationship patterns across countries, we use latent class growth models. The paper extends previous analyses by Perelli-Harris and Lyons-Amos (2012), which provide a detailed description of latent class growth curve models in the United States and 14 countries in Europe. Latent class growth curves show how individuals can change their relationship status between the ages of 15 and 45. We can examine partnership formation along multiple dimensions, such as transition into and out of mutually exclusive relationship states (i.e. never married, premaritally cohabiting, cohabiting, married, and single after union separation), age at transition, duration of relationship, separation and re-partnering. We also examine change over time: the analysis includes the 1945-54, 1955-64 and 1965-74 birth cohorts. Further, we compare the relative explanatory power of education and country by cohort, to determine whether educational level or context is more important for explaining partnership decisions. Taken as a whole, this study will allow us to think more comprehensively about the association between education and partnerships as they change across the lifecourse, the variation in the influence of education across countries, and the relative contribution of education versus country-context in shaping patterns of union formation.

Theoretical Framework

This paper draws on the study of the lifecourse, which has been essential for understanding demographic change and new patterns of family formation (van Wissen and Dykstra 1999, Willikens 1999, Elder 1985). The study of the lifecourse focuses on how different states and transitions influence each other as individuals age. Ideally, lifecourse analysis takes a holistic approach that examines the timing, sequencing, and quantum of events (Billari 2003). Given our use of latent class growth curves, we are able to incorporate all of these elements into one approach and study multiple transitions as they occur at different ages. We can then ascertain whether education is correlated with certain relationship patterns. This approach allows us to examine the relationship of education on partnership formation along multiple dimensions simultaneously: age (timing or postponement of partnership formation), relationship type (cohabitation versus marriage), and union dissolution and repartnering. We now discuss each of these dimensions and previous research on education in turn.

Timing of relationship formation. Numerous studies have shown that marriage has increasingly been postponed in Europe and the United States (Sobotka and Toulemon 2008, Hoem 2009, Billari and Liefbroer 2010). In many countries, the postponement of marriage is correlated with higher education (Blossfeld and Huinink 1991; Goldstein and Kenney 2001; Thornton, Axinn, and Teachman 1995). Usually, studies aim to test whether women's economic position delays marriage. However, despite delaying marriage, in some countries highly educated women do eventually end up marrying (Goldstein and Kenney 2001). Therefore, we expect that higher education will be associated with patterns of marriage which is postponed but not abandoned.

Type of relationship. The increase in cohabitation has occurred concomitantly with the postponement of marriage and may be facilitating delays in marriage. Multiple studies have documented the rapid increase in cohabitation across Europe and the United States since the 1970s (Kiernan 2004, Perelli-Harris et al 2012, Kennedy and Bumpass 2008, Heuveline and Timberlake 2004). The studies which compare entrance into cohabitation versus marriage conclude that cohabitation is replacing marriage, at least at the beginning of co-residential relationships (Hoem et al 2009, Andersson and Philipov 2002, Perelli-Harris et al 2012). However, it is difficult to know what this new type of relationship indicates: is cohabitation confined to a short-term trial period that converts to marriage, a long-term, stable relationship that is a substitute for marriage, or a short-lived relationship that indicates high-levels of relationship turnover?

Although studies have delved into the relationship between education and cohabitation, the findings are mixed. In the United States, education appears to be inversely associated with cohabitation (Thornton, Axinn, and Teachman 1995, Kennedy and Bumpass 2008). In the United Kingdom, women with high education seem to be the forerunners of cohabitation, but recently women with less education have been catching up (Ni Brochlain and Beaujouan 2012). Thus, we expect differences across countries in relationship patterns that include cohabitation, perhaps falling along East-West European divides.

Separation and repartnering. The evidence for the relationship between education and divorce across Europe and the United States is also mixed. Härkönen and Dronkers (2006) found that the educational gradient for divorce was positive in some countries and negative in others. Steven Martin (2006) found that in the U.S., marital dissolution rates fell among women with a college degree from the mid-1970s-1990s, while it remained high for women with less than a college degree. Fewer studies examine the educational gradient of repartnering in cross-national perspective. The impact of education on repartnering could go either way, with the positive educational effect of entrance into marriage leading to higher rates of remarriage, or the negative educational gradient of divorce resulting in greater numbers of less educated women exposed to the risk of remarriage.

The interrelationship of transitions. Taken as a whole, these individual transitions will cumulate to form holistic relationship patterns; however, we do not know how the net effect of education will play out. Education is not only associated with individual events, but can be associated with multiple events that are correlated over the lifecourse (Dariotis et al 2011). This idea is reflected in lifecourse theory, which stresses that transitions do not occur in isolation, but instead are interrelated, with one transition predicting the occurrence of the subsequent transition (Billari 2003, etc). While few studies have examined relationship patterns as a whole, some studies suggest that multiple events are correlated. For example, studies from the U.S. show that serial cohabitation and multi-partner fertility are correlated with lower education (Lichter et al 2009). Each event could be individually correlated with education, for example the least educated could be more likely to cohabit and more likely to divorce. On the other hand, education could be simultaneously correlated with having multiple unions. Finally, processes for one type of life transition could result in changes to other family formation behaviors. For example, the increase in divorce has most likely led to an increase in cohabitation, as individuals have become less certain about committing to marriage. If divorce is negatively associated with education, the least educated may also be more likely to cohabit. While we may not be able to investigate the historical sequence of these emerging behaviors (e.g. to what extent divorce led to an increase in cohabitation), our holistic approach will let us examine which patterns of union formation are consistently associated with particular educational gradients.

Differences across Europe and the United States, and over time.

For centuries, family patterns have varied across Europe and the United States. For example, Southern European countries have been characterized by "strong family ties" that promote traditional family patterns and marriage, while Northern European countries have exhibited "weak family ties" that result in early home-leaving and high levels of cohabitation (Reher 1998). Eastern Europe has had a distinct family pattern of early, universal marriage and multi-generational households (Hajnal 1965). Nonetheless, many aspects of union formation converged across the continent and in the United States in the 1950s and 1960s, during the "Golden Age of Marriage." During that time, marriage was nearly universal and nonmarital childbearing was very rare in Europe (Kluesener, Perelli-Harris, and Sanchez Gassen 2012), although the timing of marriage and the prevalence of multi-generational households still differed across countries. Starting in the 1970s and 1980s, some countries started to experience new patterns of union formation, including the emergence of divorce and cohabitation, and the delay of marriage. Scandinavia was a forerunner in increases in cohabitation, with France not far behind (Lesthaeghe 2010, Villneuve-Gokalp 1991). These new behaviors are commonly referred to as the Second Demographic Transition, although the universality and underlying reasons for these changes are often contested (Lesthaeghe 2010, Perelli-Harris et al 2010).

Today, the timing, type and process of union formation have changed in nearly all countries, and new pathways to adulthood have emerged (Billari and Liefboer 2010, Perelli-Harris et al 2012). Nonetheless, the pace of change has not been uniform; the timing and sequencing of family formation events do not appear to be converging (Elzinga and Liefbroer 2007, Billari and Liefbroer 2010, Perelli-Harris and Lyons-Amos 2012). These findings suggest that regional and country-patterns have remained entrenched, indicating the persistent effect of social norms, economic conditions, policy context, and culture on union formation behavior. Consequently, it is important to keep in mind the role of contextual factors when investigating the association between education and patterns of partnership. In fact, country variation may be more influential in predicting partnership patterns than education. On the whole, we expect that education will be significantly associated with partnership patterns, but this association will be strongest in the earliest birth cohorts when direct, stable marriage was most common and the variation across countries less pronounced. As partnership formation diverged across countries, due to differential increases in cohabitation and divorce, the role of education relative to country declined. Therefore, we expect that education will be associated with different partnership patterns; however, this association will not be as important as that with country.

Data

We analyze retrospective union and fertility histories from 15 surveys that have been standardized in a dataset called the Harmonized Histories (Perelli-Harris, Kreyenfeld, and Kubisch 2009, and see *www.nonmarital.org*). The data for Austria, Belgium, Bulgaria, Estonia, France, Hungary, Norway, Romania, and Russia come from the Generations and Gender Surveys (GGS), which interviewed nationally representative samples of the resident population in each country. Because the GGS is not available for all countries (or the retrospective histories were not adequate for our purposes), we also relied on other data sources. The Dutch data come from the 2003 Fertility and Family Survey (FFS). The data for the UK are from the British Household Panel Survey (BHPS). The Spanish data come from the Survey of Fertility and Values conducted in 2006[1], and the Polish data are from the Employment, Family, and Education survey conducted in 2006. The U.S. data are from two rounds of the National Survey of Family Growth, conducted in 1995 and between 2006 and 2008. Table 1 shows the number of women aged 15-45 in each survey by cohort for the analysis sample.

<<Table 1 about here>>

Despite slightly different survey designs, the union histories are relatively comparable. Our data include the month of entrance into cohabiting and marital unions as well as separation and divorce. Questions about cohabitation generally refer to co-resident relationships with an intimate partner that last more than three months. Our analysis examines the relationship states that occur between the ages of 15 and 45. However, because most of our surveys interviewed women who were older than 45 at the time of the survey, we compare women born in 1945-54, 1955-64, and 1965-74. In Austria, Poland, and the US, only women up to age 49 were interviewed; thus, we only include one or two cohorts from each survey.

Although the Harmonized Histories surveys are relatively comparable, each survey's sampling strategy differs, which can have different implications for the creation of the latent classes. Some surveys do not require weights (for example, Bulgaria, Poland and Romania), while some surveys include sample weights at the individual level (Austria, France), or both the household and individual level (UK). In addition, some surveys (i.e. Italy) have very large samples, which may dominate the results in a pooled dataset. To analyze the pooled dataset, we have transformed the weighting schemes in order to retain their internal consistency (the surveys are still representative of their own countries), but also provide meaningful cross-national solutions. To create a sample with each survey equally represented, we rescale the weighted population totals so that each survey contributes the same proportion to the total sample. This approach allows the internal validity of the surveys to be maintained (all the weights are adjusted), but ensures no one survey dominates the sample.

Methods

We use a multi-stage process to examine the association between education and relationship patterns. First we determine the optimal number of latent classes that describe different relationship trajectories. Next we use these classes as the dependent variable in multinomial logit models with education included as an explanatory variable. We unpack these results to show the relative contribution of education compared to country-context in influencing the probability of class membership.

LCGM models. To create the growth curves, we first expand the data into person-years. Although person-months would more accurately reflect changes in union status, computational limitations require the use of yearly intervals. We then fit separate trajectories for each union status: never in a union, cohabiting, directly married, married having previously cohabited, and single after being in a previous union[2]. We distinguish between direct marriage and marriage preceded by cohabitation to show how entrance into marriage changes over time. This approach reveals to what extent cohabitation is emerging as a precursor to marriage or as a long-term relationship that lasts until the respondent is 45.

To reiterate, the response variable for the model is defined as the random variable y_i. This variable is defined at every year of the respondent's partnership history.

$$y_{i,age} = s \begin{cases} 0 & Never\ in\ a\ union \\ 1 & Cohabiting \\ 2 & Married\ preceded\ by\ cohabitation \\ 3 & Directly\ married \\ 4 & Single\ after\ separation \end{cases}$$

Respondents switch between these different states as they move along the lifecourse from ages 15-45. If two of these partnerships are present within the same year, then the higher value state is selected (for example, if cohabitation transitions to marriage in the same year, the year is classified as $y_{ij} = 2$ rather than 1). In certain circumstances, the selection of higher states will lead to the truncation of some relationships, for instance if a relationship occurs during the same year as a separation. In order to avoid missing relationships altogether, we force new relationships to be recognised by overwriting years classified as separation with the new relationship status, although again these relationships may be truncated. As a result, short periods of separation could be missed. However, because few respondents have this type of relationship pattern, the underestimation does not substantially bias our results.

We then use the statistical software Mplus (Muthén and Muthén 2004) to calculate growth equations that describe different trajectories. Trajectories are combined to form each latent class, which describe different partnership patterns across the lifecourse. Each woman has a probability of being in each latent class; the more closely her observed partnership history is to the class trajectories, the higher the probability of class membership. The probability of being in partnership s at a given age is defined as $\pi_i^s = \Pr(y_{i,age} = s)$ (see Equation 1). *i* indexes the individual woman. The probability of partnerships across the lifecourse is modelled as a growth equation, where $y_{i,age}$ is a function of age and age^2. A separate growth equation is specified for each class C_j, where *j* indexes the class and there are 1…*J* classes. For logit estimation, we set direct marriage, the most prevalent state, as the reference category (i.e. this logit is omitted to identify the model).

$$ln\left(\frac{\pi^{s}_{i,age}|C_j = j}{\pi^{s=3}_{i,age}|C_j = j}\right) = \alpha^{s}_{j} + \beta^{s}_{1,j}age_i + \beta^{s}_{2,j}age^{2}_{i}$$

$$j = \{1 \dots . J\}, s = \{0 \dots 4\}$$

Eq. 1

In Equation 1, the class specific intercept is described by α^{s}_{j}, while the class specific growth curve is described by $\beta^{s}_{1,j}$ and $\beta^{s}_{2,j}$. All three of these parameters vary depending on membership in a particular class. In Equation 1, the trajectories differ only according to class membership, C_j. [3]

Number of classes. One of the advantages of using Latent Class Growth Curve models is that statistical tests provide objective measures of the number of classes that optimally fit the data. Thus, we can use an inductive approach to allow the optimal number of classes to emerge from the data rather than having to determine the number of classes a priori, which may not accurately reflect the complexity of the data.[4] We rely on the Lo-Mendell-Rubin Likelihood Ratio Test (LMR-LRT Lo *et al*. 2001) to determine the number of classes, mirroring the recommendation of Nylund *et al.* (2007) and applied by Virtanen *et al.* (2011) which continues to add classes until reaching the first non-significant class. The LMR-LRT is similar to conventional Likelihood Ratio tests that interpret p-values below a certain threshold as indicative of an improvement in model fit (i.e. the current model is an improvement over a model with *J-1* classes), where the p-value is adjusted to reflect the fact that the Likelihood does not follow a Chi-Square distribution. Although the Bootstrap Likelihood Ratio test is a superior measure for testing the number of classes due to a lower false positive rate (Nylund *et* al. 1997), this test is considered too computationally intensive in this circumstance.

Education.

Once we have created the latent classes, we assign respondents to the class which has the highest posterior probability of membership for that individual. This is expressed as a random variable, j_i, where the probability of class membership for individual *i* is $\pi_i^j = \Pr(C_J = j)$.We then apply the following multinomial regression model (Equation 2):

$$ln\left(\frac{\pi_i^j}{\pi_i^{j=1}}\right) = \boldsymbol{\beta}^{\mathbf{j}}\mathbf{x}_{\mathbf{i}}' \qquad j = \{1 \ldots . J\}$$

Eq 2.

In this model $\mathbf{x}_{\mathbf{i}}$ is a vector of dummy variables of individual characteristics (education, birth cohort and country) and $\boldsymbol{\beta}^{\mathbf{j}}$ is a set of coefficients measuring their effect on class membership.

While we would prefer to estimate the model based on the pseudo-class method using Mplus (Wang *et al.* 2005, Asparouhouv & Muthén 2007), which takes into account potential uncertainty in class membership, we found this approach to be too computationally intensive. We therefore allocate respondents to a class based on their posterior probability of class membership and estimate multinomial regression models in STATA SE 12. While this is a potential limitation in models where classes are poorly defined (respondents can easily be allocated to the wrong class), the classes extracted in our models show excellent definition based on the class mean posterior membership probability (the lowest is 0.959 for classes 6 and 7). Therefore, it is unlikely that women would be misallocated in our analysis.

As discussed above, our main variable of interest is education, which we specify as three categories that have been standardized across countries. Each survey includes a six-category measure of education based on the International Standardized Classification of Education (ISCED 1997). We collapsed these six categories into three basic categories: low (ISCED 1 & 2), medium (ISCED 3 & 4), and high (ISCED 5 & 6). The lowest education level refers to less than completed basic secondary, medium refers to completed secondary school and any education beyond secondary education but less than completed college (including vocational and technical schools), and higher education refers to a bachelor's or university degree and higher. Although these educational categories may be relatively crude and have context-specific meanings, we use the measure as an indicator of general socio-economic status, which should be relatively similar across countries.

The multinomial model predicts class membership based on education, birth cohort and country. We interact educational level with country and birth cohort, to educational gradients for each national setting and measure change in these gradients over time.

Relative contribution

Our second research question is to assess the relative contribution of education and country to the probability of falling in a given class. The multinomial logistic regression model can be used to predict the probability of class membership; however, because education, cohort and country are interacted with each other, the resulting complexity of the beta coefficients make it difficult to assess whether education or country is the largest contributor to variation in the predicted probabilities. We therefore perform a series of ANOVA tests to determine which factor better explains variability in class membership. Broadly speaking, a higher proportion of variance (defined as partial SS as a proportion of model SS) explained by a factor in the ANOVA is said to indicate a greater contribution to variation in predicted probabilities. This allows us to determine whether education or country is driving change over time in each class.

ANOVAs are performed on the predicted probabilities of class membership for each class generated from the predictive model described in Eq. 2. ANOVA tests make the assumption that the response variable is normally distributed, and we therefore transform the predicted probabilities (which are non-normal)[1]. We perform the analysis by birth cohort, to detect whether there is a change in the contribution of education or country to class, although we do not perform formal tests to determine whether the change is significant. Analysis is performed on a class by class basis, since the trends may vary by partnership form.

Results

[1] The low level of predicated probabilities means that the effect of transformation may vary depending on the choice of link function. To ensure our results are robust, we tested ANOVA results for both logit ($y_i=p_i(1-p_i)^{-1}$) and arcsine $y_i=\sin^{-1}(\sqrt{p_i})$ links, to ensure that divergence at the tail of the transformation does not unduly influence our conclusions (i.e. the conclusion should not be sensitive to the choice of link). Because the arcsine links attained similar results, we only present logit links below.

To begin our analysis, we calculate the optimal number of latent classes that reflect relationships patterns across Europe and for the United States (see also Perelli-Harris and Lyons-Amos 2012). The LMR-LRT p-values indicate that 8 classes optimally fit the pooled data; the addition of an 8^{th} class improves model fit at the 1% level (LMR p-value is below 0.01), but the addition of a 9^{th} class is not significant.[5] Figure 1 shows the 8 class trajectories extracted from the model. Note that the area under the curve represents the probability of being within a relationship state. The blue line shows the probability of being never partnered; the orange line represents the probability of being in cohabitation that does not transition to marriage before age 45; the green line represents the probability of having a direct marriage; the red line represents the probability of being in a marriage that was preceded by cohabitation; and the grey line represents the probability of being single after having separated from a previous relationship. Women can transfer between states at any point, for example, a women may be never married, then directly marry, spend some time single after divorce, and then transfer back into cohabitation or marriage for higher-order unions. Re-partnering is incorporated into cohabitation, premarital cohabitation, or marriage.[6]

<<*Figure 1: Extracted partnership trajectories* >>

Each of the classes represents different patterns of partnership formation. These classes and their sensitivity to robustness checks have been discussed in detail in Perelli-Harris and Lyons-Amos 2012; therefore, we only briefly describe them here. The first four classes are primarily centered around marriage: classes 1 and 2 only include direct marriage, while classes 3 and 4 reflect marriage preceded by cohabitation. Classes 1 and 3 show patterns of marriage that occurs relative early – the marriage trajectory starts to increase in the teens and peaks by age 25. Classes 2 and 4, on the other hand, reflect later marriage; in class 2 direct marriage starts shortly after age 20 and peaks in the late 20s, while in class 4 cohabitation peaks in the mid-20s, with marriage following in the late 20s. Class 5 reflects delayed partnership formation, with a strong increase in cohabitation occurring after age 30, some marriage in the late 30s, and a probability of never experiencing partnerships before age 45.

Classes 6 and 7 reflect partnership patterns that are dominated by separation and repartnering. Class 6 shows a strong increase in direct marriage in the 20s that peaks around age 25 and a gradual increase in being single after separation until over 60% of women are predicted to be single after separation. The trends in cohabitation and marriage preceded by cohabitation provide evidence of repartnering in the 30s. Class 7 starts out with cohabitation followed by marriage, but the class is dominated by a strong trend in single after separation. Although there is a low level of direct marriage, the majority of women in this class are expected to remain single after separation into their 30s and 40s. Finally, class 8 is characterized by cohabitation with a small uptick in being single after separated. Note that this cohabitation class is not identical to the marriage classes, since it shows a strong decline in cohabitation in the 30s, due to transitions into marriage or dissolution (Perelli-Harris and Lyons-Amos 2012).

Education.

As discussed above, the primary goal of this paper is to ascertain whether the 8 partnership classes are significantly associated with different educational gradients. To test whether there is a relationship between education and class by country, we run multinomial models with the 8 classes as the dependent variable and education, country, and cohort as predictor variables. Given that the resulting beta coefficients are difficult to interpret, we present figure 2, which consists of line graphs of the educational gradient for each country by class. Although the models include statistical controls for cohort, the graphs show the average for cohorts born 1945-74. Note that the lack of distinction between cohorts could change the interpretation of the graphs if relationship patterns are changing quickly (see below).

<<Figure 2 about here>>

Figure 2 shows that the probability of falling into different classes differs greatly, regardless of educational level or country. The marriage classes (1-4) are much more common, while the probability of being in the classes representing delayed union formation, separation and cohabitation (5-8) is much lower. This distribution across classes can impact the magnitude of the slope of the educational gradient, rendering it much more difficult to observe educational gradients when the partnership pattern is less common. Nonetheless, some important differences emerge.

First, the educational gradient in the marriage classes (1-4) is much more pronounced than in the other classes. The early direct marriage class (class 1) has a strong negative educational gradient in most countries with the probability of membership in class 1 highest among women with low education and lowest among women with high education. The gradient is particularly steep in Italy, Belgium and Poland (although Poland is based on only one cohort). Estonia is the only country which exhibits a slight upward gradient between low and medium and a flat slope between medium and high, although Bulgaria exhibits a positive gradient for medium education compared to low education, and a downward slope to high education. However, in some countries, for instance Russia and Norway, the trend is weak or ambiguous (i.e. nonmontonic) although at very different levels.

Class 3, which represents early marriage preceded by cohabitation, also shows broadly negative educational gradients, although less pronounced and consistent than for those of class 1. This partially reflects a lower prevalence of class 3; the majority of countries have a predicted probability of class 3 membership below 15%. This low probability of class membership results in a relatively flat gradient in southern European countries such as Spain and Italy. Nonetheless, some countries have a steeper downward gradient: Austria, Bulgaria, Norway and Russia all exhibit gradients of 18% points, 15% points, 10% points, and 9% points respectively.

Classes 2 and 4 indicate that the educational gradient seems to reverse as marriage is postponed, corroborating other findings that indicate that higher education delays marriage (Blossfeld and Huinink 1991; Goldstein and Kenney 2001). Class 2, which traces direct marriage occurring in the 20-30 age range, primarily reflects a positive educational gradient, although clearly this gradient is steeper in some countries than others. In some countries, the upward gradient is strongly pronounced, for example in Poland and Romania, where highly educated women have higher than 45% probability of falling into class 2. In Spain and Italy the prevalence in this class is higher overall, with a very steep educational gradient that increases to a probability of over 50% for highly educated women. Class 2 reminds us of the strong orientation towards direct marriage in Italy and Spain, but also the older ages at marriage, which are some of the oldest in the world (Castro-Martin 2007). In addition, we can see the prominent role of education in leading to these delays. Overall, the contrast in the educational gradients between class 1 and 2 is striking, indicating how education has led to the postponement of marriage.

Class 4, which also indicates delayed marriage, but accompanied by premarital cohabitation, primarily exhibits a positive educational gradient. Nonetheless, many of the countries exhibit a flat gradient, because so few women are predicted to be in this class. Austria, the Netherlands, Belgium and France exhibit steep educational gradients, with a considerable rise in the predicted probability of class 4 membership for higher educated women. Norway has a high prevalence of class 4 membership among highly educated women, but the high prevalence among low education groups means that the gradient is relatively gentle. A similarly gentle trajectory is observed for the United Kingdom, albeit at a lower prevalence.

Surprisingly, class 5 does not seem to have a consistent educational gradient, considering it reflects delayed partnership formation, which was related to higher education in the delayed marriage classes. This lack of consistency may be because the class includes never entering a partnership, which could be associated with very low education and disadvantage. On the other hand, the probability of being in this class is also relatively low for most countries, which could contribute to the mix of gradients. As in the delayed direct marriage class (class 2), Spain and Italy show a steep positive educational gradient (12% points and 15% points respectively). The Netherlands also has a positive educational gradient, although at a lower prevalence. Belgium, which has a high overall prevalence, exhibits a negative educational gradient, although the other high prevalence countries (Norway, the United Kingdom, France) have no detectable gradient. The prevalence in the other countries is so low that it is difficult to detect any trend associated with educational level.

With some exceptions, the educational gradients in the separation and cohabitation classes are relatively flat due to the low probability for women to experience these partnership patterns. For all classes, the probability of being in these classes is less than 20%, with the exception of lower educated women in the U.S. in class 7. Some of the countries do have a higher probability of class 6 partnership patterns than others, for example Hungary, Estonia, Bulgaria and the United States, but nonetheless there is no discernible educational gradient. While the probability of falling into class 7 is low, some gradients do emerge. In particular, the United States stands out with a much higher prevalence than in other countries and with a strong negative educational gradient. Low educated women have a 21% probability of being in this class compared to 13% for women with high education. This finding supports other studies which provide evidence that the U.S. has a high level of divorce compared to other countries (Cherlin 2009, Heuveline, Timberlake, and Furstenberg 2003), and that the educational gradient for divorce has become negative (Martin 2005). Finally, because the probability of experiencing a class 8 cohabitation pattern is relatively low, few educational gradients are evident. For example, the gradients for Estonia and the United States are negative, while the gradients for Austria, Belgium, France, the Netherlands, Spain and the United Kingdom are positive. The gradients for Austria and the Netherlands are particularly steep, with the probability of class membership for higher educated women 7-8% higher than for low educated women.

Cross cohort variation

Although Figure 2 is useful for illustrating the general direction of the educational gradients by class and the probability of experiencing different partnership patterns, it does not show whether the educational gradients are significant and whether they are consistent or changing across cohorts. Therefore, we present table 2, which summarizes the educational gradients by country and cohort. On table 2, a bold U represents a significantly upward educational gradient (the probability of class membership is higher at higher educational levels), while a bold D denotes a significantly downward educational gradient (higher probability of class membership at lower levels). Low education is the reference category for the significance tests; therefore, high and/or medium must be significantly different from low education. Significance tests are based on the overlap of confidence intervals for the predicted probability of class membership (91% confidence interval to detect a difference at the 5% level). Grey Us and Ds represent gradients that were not significant, while dashes indicate no clear gradient.

Overall, table 2 confirms that the educational gradients are significantly negative for the early marriage classes and significantly positive for the delayed marriage classes. However, now we can see which specific countries had gradients that were significant and persistent across cohorts, which had gradients that emerged and then disappeared, and which only recently experienced the emergence of an educational gradient. In class 1, the early marriage class, France, the Netherlands, Romania, Spain, and Italy had consistently negative educational gradients, indicating that early marriage is associated with low education. This effect is similar in Belgium and Hungary, but not for all cohorts. In Poland, the U.S. and Austria, the negative educational gradient is only just emerging. Strangely, Estonia has a significant positive educational gradient for the 1955-64 cohort and a weak positive educational gradient for the 1965-74 cohort; this may be because cohabitation is associated with lower education, so only the higher educated directly married, or it may have to do with Soviet housing policies. The other countries - Bulgaria, Norway, Russia, and the UK – had no discernible pattern for any of the cohorts. This lack of gradient may be because some of the lowest educated were more likely to cohabit than directly marry, or it could be due to small sample size. In any case, the consistency of the negative educational gradient across cohorts is striking.

The persistence of the downward gradient for the early direct marriage class (class 1) is mirrored by the overwhelmingly upward gradient for the delayed direct marriage class (class 2). Austria is the only class with no significant upward gradient for any cohort, and the latter cohort does have a non-significant upward gradient. However, the significance of the positive gradient disappears in the latest cohort in Belgium, France, the Netherlands, Norway, and the U.K., which may reflect the recent shift from direct marriage to premarital cohabitation. Indeed, the educational gradient for class 4 in each of these countries is significantly positive, suggesting that the highly educated in the youngest group are now more likely to start their marriages with cohabitation.

As seen in figure 2, the educational gradient for class 3, which shows marriage preceded by cohabitation, is predominantly negative, similar to the early direct marriage class. The only exception was in the UK, where the 1955-64 cohort had a significantly positive gradient, supported by evidence indicating that cohabitation emerged among the highly educated and then reversed over time (Ni Brolchain and Boujean). In all other countries, the gradient was negative or non-significant. The negative gradient was present in all three cohorts in Bulgaria, Romania, and Austria, and emerged later in Estonia, France, Hungary, the Netherlands, the UK, and Italy. The negative educational gradient disappeared in the U.S. and Russia and became non-significant in Belgium and Spain. All in all, the patterns suggest that premarital cohabitation is not simply practiced by either lower or higher educated women. If we return to the figure tracing the latent class growth models for each class (figure 1), we can see that premarital cohabitation in class 3 starts very early and does not substantially shift the marriage curve, although the curve is not quite as steep as for class 1. Thus, the lower educated may have experimented with cohabitation before marriage, but this experimentation did not delay marriage significantly. Education shapes the timing of marriage, regardless of whether it was preceded by cohabitation.

Although the educational gradients for class 5 were hard to detect on figure 2, on table 2 we can see that delayed partnership formation does have a positive gradient for those countries which have a significant gradient. A few countries exhibit a non-significant negative educational gradient, but the only significant gradients for class 5 are positive. The positive educational gradients were persistent for all cohorts in Estonia and Italy, and emerged in more recent birth cohorts in Austria, Hungary, the Netherlands, Romania, Russia, and Spain. Given the strong educational gradients we observed in the previous four classes that indicated delayed marriage, the positive educational gradients for class 5 are not surprising.

As seen on figure 2, the divorce and separation classes have few significant gradients, primarily due to the low predicted probabilities hampering the power of statistical tests. Only France and Italy show significant downward gradients for the later cohorts. In addition, Estonia exhibits an upward trend in divorce behavior for the 1965-74 cohorts. In class 7, Bulgaria, the Netherlands, Poland, and the U.S. have negative educational gradients for the 1965-74 birth cohorts. Note that Italy exhibits an upward gradient in class 7 membership in the earliest birth cohort most likely reflecting the emergence of divorce among the most highly educated. However, this gradient disappears in later birth cohorts.

The cohabitation class (class 8) also has an inconsistent pattern of educational gradients, partially due to the low probability of practicing this type of behavior. Nonetheless, some countries do have significant educational gradients. The Netherlands and the United Kingdom had upward gradients in the earliest birth cohorts, which supports findings that cohabitation emerged among the most highly educated (Ni Bhrolchain and Beaujouan 2012; Lesthaeghe). Bulgaria, Estonia, Norway, Romania and the United States all show evidence of a downward gradient. Thus, overall, cohabitation seems to be more likely to be associated with a negative educational gradient across classes.

Relative contribution of country versus education

Figure 2 shows how each class is associated with a particular educational gradient for a given country. However, because the models are fully interacted, we are unable to tell from this analysis whether education or country is more important for membership in a given class. Therefore, table 3 presents the results of the ANOVA analysis to determine the relative importance of education and country for each class by cohort. Each analysis presents the relative share of the variation in the predicted probabilities for that class explained by education and country. It also includes the proportion remaining unexplained.

In the class for early, direct marriage (class 1), education was initially very important - it explained half of the variation in predicted probabilities. In later cohorts, however, the relative importance of education declined to explain only around 10% of the variation in predicted probabilities in the 1965-74 birth cohorts. In contrast, cross-national variation increased in importance, from explaining just under a quarter of the variation in the 1945-54 cohorts to nearly 80% in the 1965-74 cohorts. Although our tests cannot show whether the change across cohorts is significant, the magnitude of the difference suggests that in the earliest birth cohorts, education was more important for determining early direct marriage. Then, as countries started to experience delays in marriage at different rates, country setting became more important for explaining variation in this class.

This pattern is similar in the later direct marriage class (class 2), except that the role of education was less pronounced over the 3 cohorts and cross national variation was always dominant. In the 1945-54 cohorts already 64% of the variation was explained by cross national variation. Over time, the country component became even more important, with the share of variance explained by country increasing in the 1955-64 and 1965-74 cohorts. By 1965-74, only about 8% of the variation was explained by education. This again suggests that while education started out as an important explanation for the timing of direct marriage in the early cohorts, country became more important for understanding variation in this class.

Similar to classes 1 and 2, country was the dominant factor in all cohorts of class 3, the class which represents early marriage preceded by cohabitation. However, in this class, education is of only marginal significance. In fact, education explains less than 8% of the variation in all cohorts. In contrast, educational attainment explained a greater proportion of the variation in class 4, which represents the postponed pattern of marriage preceded by cohabitation, although this proportion declined from 20% in early birth cohorts to 12% in the 1965-74 birth cohorts. As in the other classes, country was increasingly more important in explaining class 4 behavior, increasing by 13% points between the oldest and youngest cohorts.

In class 5, late union formation and never partnering, education initially accounts for roughly one quarter of the total variation in predicted probabilities. Thereafter, the relative importance of education declines to between 15%-18% for the 1955-64 and 1965-74 birth cohorts. Similar to other classes, the proportion of variability explained by country increased from roughly 57% in the 1945-54 birth cohorts to 65% to 72% in the 1965-74 birth cohorts. Note that the proportion of variance explained by education in the 1965-74 birth cohorts is higher in class 5 than in any other class. Therefore, although the relative importance of national setting compared to education has declined (as for classes 1, 2 and 4), education is still relatively important when explaining delayed union formation.

For classes 6 and 7, which characterize union dissolution patterns, education is of limited importance in all cohorts, accounting for less than 2% of variance. This suggests that divorce and separation patterns are not correlated with educational attainment, and that country context is far more important. Similarly in class 8 (long-term cohabitation), education is only marginally significant, accounting for no more than 5% of variation in the predicted probability. In contrast, the proportion of variation explained by country increases by roughly 20% points from the 1945-54 to 1965-74 cohorts (at the expense of unexplained variability). This indicates that educational level is only marginally influential in explaining long term cohabiting behavior. Once again the country setting is becoming increasingly important.

Discussion

Education is often considered an important predictor of family formation behavior, both in terms of the timing of entrance into union or marriage (Oppenheimer

2000, Kalmijn 2007) and in predicting the type of union (Ni Bhrolchain and Beaujouan 2012, Cherlin 2009, Perelli-Harris et al 2010) and its dissolution (Harkonen and Dronkers). Here we find that in the United States and 14 countries of Europe, education is essential for understanding union formation patterns that involve the timing of marriage. However, we find less consistent evidence that union formation patterns which include separation and divorce have significant educational gradients. In addition, patterns of union formation dominated by long-term cohabitation do not have consistent significant educational gradients across countries. Therefore, we find that although education seems to be associated with the timing of marriage and union formation, it is less consistently associated with the new forms of partnership behavior that have emerged more recently.

Note that this study has several limitations. First, the number and form of the latent classes are sensitive to the specific countries and cohorts which are included. Also, due to truncation, the youngest cohorts in the 1965-74 cohort would not have reached age 45 depending on the year of the survey in each country. This will have reduced the exposure time for these women, possibly underestimating their prevalence in the separation or divorce classes. These issues were discussed extensively and tested with sensitivity analyses in Perelli-Harris and Lyons-Amos (2012). Second, each survey is subject to errors and limitations that may bias results (see Perelli-Harris, Kreyenfeld, and Kubisch 2010 for a description of each survey). Finally, the lack of statistical significance in any of these classes may be due to the small percent of women falling into these classes. As these classes become more common, more defined educational gradients may emerge. Despite these shortcomings, the study has provided insights into the role of education and country context in partnership patterns.

First, we find that higher education delays marriage. Of the 8 latent growth curve classes that emerged from our models, the two early marriage classes were dominated by negative gradients, while the two later marriage classes were dominated by positive educational gradients. Class 1, which represents early direct marriage, showed evidence of a significant negative educational gradient in all countries except Bulgaria, Estonia, Hungary, Norway, Russia, and the UK. The lack of significance in the Eastern European countries may have been due to the early mean age of marriage which leveled out the educational gradient in this class. In Norway and the UK, the low educated respondents may have started their unions with cohabitation, thereby cancelling out any association between direct marriage and education. In any case, the strong negative association with education was strikingly pervasive in this class. The converse of the negative educational gradient was also evident in the frequency of positive educational gradients in the delay of direct marriage (class 2). All countries had significant positive gradients for most cohorts, and the gradients for cohorts that were not significant were also positive. Only Austria had no evidence of a significant upward gradient in the 1955-64 cohort, although in the youngest cohort the gradient was non-significantly positive for Austria.

Premarital cohabitation did not seem to change the direction of the educational gradients; lower education still led to early marriage and higher education still led to later marriage, despite the period of cohabitation that preceded marriage. In the early marriage preceded by cohabitation class (class 3), all of the youngest cohorts had significant negative educational gradients, with the exception of Belgium, Russia, Spain, and the U.S, where the educational gradient was negative but not significant, and Poland, which had no significant educational gradient. In the class where cohabitation appears to have delayed marriage into the late 20s, the educational gradients are overwhelmingly positive for the youngest cohorts, with the exception of Estonia, where the gradient was positive but not significant, and Romania, where the prevalence of cohabitation was still relatively low. All in all, it does not seem like the practice of premarital cohabitation is necessarily associated with higher education; lower educated women also practiced premarital cohabitation. Instead what is key is the timing of marriage, which is clearly postponed by education.

The delayed partnership and never partnering class (class 5) also shows predominantly positive educational gradients, especially for the youngest cohort, but the results are not consistent. Some countries have non-significant negative educational gradients, such as Belgium, France, and the UK. Thus, although higher education is generally associated with delayed partnership formation, this result is not universal. In addition, the variety of partnership forms in this class makes us wary about concluding that education is related to any particular type of delayed union or not forming a union at all.

We find less evidence that education is important for understanding union formation patterns that include separation and union dissolution before the age of 45. Class 6, which shows direct marriage followed by rising divorce and repartnering in the 30s and early 40s, has only 4 significant gradients for all cohorts and all countries. France and Italy show evidence of significant negative educational gradients, while Estonia has a significant positive educational gradient. Class 7, which is also dominated by separation after premarital cohabitation, has slightly more countries with a negative association with education, but in the youngest cohort only Estonia, the Netherlands, Poland, and the U.S. have negative educational gradients. Finally, the results for the class with long-term cohabitation (class 8) are mixed. Although the majority of significant gradients are negative, only four countries had negative educational gradients in the youngest cohort: Bulgaria, Norway, Romania, and the U.S. Two of the educational gradients in the earliest cohorts are positive, and many of the non-significant results are positive. Overall, the results suggest that the classes showing alternatives to stable marriage, i.e. divorce and cohabitation, are not dominated by strong educational gradients; however, when there are significant gradients, they tend to be negative.

Despite the strong evidence that education leads to delays in marriage but not necessarily the emergence of new behaviors, our final analysis showed that overall, the role of country in the contribution to predicted probabilities is still far more important than education. Regardless of which class was examined, the country component explained far more of the variation than education in each cohort, with the exception of the 1945-54 cohort for class 1 (early direct marriage), when education explained nearly half of the variation. In all other classes, country increasingly explained more of the variance over time, or at least it did not change substantially. In the separation classes, the percent of the variation explained by education was very small, with country explaining nearly all of the variation. This suggests that the variation in country levels of separation and divorce is more important than the difference between low and high education, which is relatively minimal.

Given the findings for each class, we speculate that country is more important than education for predicting class membership, although we are not able to test this directly due to modeling limitations. This implies that the variation across countries is more important than the educational variation within countries. We could surmise, for example, that higher educated Italians are more likely to be similar to lower educated Italians than higher educated Norwegians. This supports other evidence that family formation patterns are not converging across countries, regardless of the emergence of new behaviors in all countries (Billari and Liefbroer 2010). In addition, despite predictions that higher and lower educated women have diverging destinies (McLanahan 2004), the differences across countries continues to be greater. In conclusion, although education appears to be very important for determining the timing of marriage, the increasing variation in behavior between countries has become more important for understanding partnership formation across the lifecourse.

References:

Andersson, Gunnarand Dimiter Philipov. 2002. "Life-table representations of family dynamics in Sweden, Hungary, and 14 other FFS countries: A project of descriptions of demographic behavior." *Demographic Research* 7(4):67-144.

Billari, F.C., Liefbroer, A.C. 2010. "Towards a new pattern of transition to adulthood?" *Advances in Life Course Research* 15(2-3):59-75.

Blossfeld, Hans-Peter, and Johannes Huinink. 1991. "Human capital investments or norms of role transition? How women's schooling and career affect the process of family formation." *The American Journal of Sociology* 97(1):143-168.

Castro-Martin, Teresa. 2010. "Single motherhood and low birthweight in Spain: Narrowing social inequalities in health?" *Demographic Research* 22(27):863-890.

Cherlin, A. 2009. *The marriage-go-round: The state of marriage and the family in America today*. New York: Knopf.

Coale, Ansley J. 1992. "Age of entry into marriage and the date of the initiation of voluntary birth control." *Demography* 29(3):333-341.

Corijn, M., Klijzing, E. 2001. *Transitions to adulthood in Europe*. New York: Kluwer Academic Publishers.

Elzinga, C., Liefbroer, Aart. 2007. "De-standardization of family-life trajectories of young adults: A cross-national comparison using sequence analysis." *European Journal of Population* 23(3):225-250.

Goldstein, Josh .R., Kenney C.T. 2001. "Marriage delayed or marriage forgone? New cohort forecasts of first marriage for U.S. Women." *American Sociological Review* 66(4):506-519.

Härkönen, J., Dronkers, J. 2006. "Stability and change in the educational gradient of divorce. A comparison of seventeen countries." *European Sociological Review* 22(5):501-517.

Härkönen, Juhoand Jaap Dronkers. 2006. "Stability and change in the educational gradient of divorce. A comparison of seventeen countries." *European Sociological Review* 22(5):501-517.

Heuveline, Patrick, Jeffrey M. Timberlake, and Frank F. Furstenberg, Jr. 2003. "Shifting childrearing to single mothers: Results from 17 western countries." *Population and Development Review* 29(1):47-71.

Heuveline, P, Timberlake, J. M. 2004. "The role of cohabitation in family formation: The united states in comparative perspective." *Journal of Marriage and Family* 66(5):1214-1230.

Hix-Small, H., Duncan, T.E., Duncan, S.C., Okut, H. 2004. "A multivariate associative finite growth mixture modelling approach examining adolescent alcohol and marijuana use." *Journal of Psychopathology and Behavioural Assessment* 26(4):255-270.

Hoem, Jan M., Jasilioniene, Aiva, Kostova, Dora, and Muresan, Cornelia. 2009. "Traces of the second demographic transition in selected countries in central and eastern Europe: Union formation as a demographic manifestation." *European Journal of Population* 25(2):123-156.

Kalmijn, Matthijs. 2007. "Explaining cross-national differences in marriage, cohabitation, and divorce in Europe, 1990-2000." *Population Studies* 61(3):243-263.

Kennedy, Sheela, Bumpass, L. 2008. "Cohabitation and children's living arrangements: New estimates from the united states." *Demographic Research* 19:1663-1692.
Kiernan, K. 2004. "Unmarried cohabitation and parenthood: Here to stay? European perspectives." in *The future of the family.* , edited by T.M.S.a.L.R. D. P. Moynihan. New York: Russell Sage Foundation.
Lichter, Daniel T., Zhenchao Qian, and Leanna M. Mellott. 2006. "Marriage or dissolution? Union transitions among poor cohabiting women." *Demography* 43(2):223-240.
Lo, Y., Mendell, N.R., & Rubin, D.B. . 2001. . "Testing the number of components in a normal mixture." *Biometrika* 88:767-778.
Martin, Steven P. 2005. "Growing evidence for a ‘divorce divide'? Education and marital dissolution rates in the us since the 1970s."
McLanahan, Sara. 2004. "Diverging destinies: How children are faring under the second demographic transition." *Demography* 41(4):607-627.
Muthén, B. . 2004. "Latent variable analysis: Growth mixture modeling and related techniques for longitudinal data. ." in *Handbook of quantitative methodology for the social sciences* edited by D. Kaplan. Newbury Park, CA: Sage Publications.
Ni Bhrolchain, Maire, and Eva Beaujouan. 2012. "France and Great Britain: Rising educational participation results in later births." *Population and Societies* 495.
Oppenheimer, V.K. 2003. "Cohabiting and marriage during young men's career-development process." *Demography* 40(1):127-149.
Perelli-Harris, Brienna, Michaela Kreyenfeld, and Karolin Kubisch. 2010. "Technical manual for the harmonized histories database." *MPIDR Working paper.* 011.
Perelli-Harris, Brienna, Michaela Kreyenfeld, Wendy Sigle-Rushton, Renske Keizer, Trude Lappegård, Aiva Jasilioniene, Caroline Berghammer, and Paola Di Giulio. 2012. "Changes in union status during the transition to parenthood: An examination of 11 European countries." *Population Studies* 66(2):167-182.
Perelli-Harris, Brienna and Mark Lyons-Amos. 2012. "The heterogeneity of relationship patterns within and across countries: An examination of the united states and 14 countries in Europe." in *Seminar on First union patterns around the world, organized by IUSSP*. Madrid, Spain.
Perelli-Harris, Brienna and Karel Neels. 2012. "Revisiting the second demographic transition across Europe and the united states: Examining patterns of new family behaviors by education " in *European Population Conference*. Stockholm.
Perlman, M., Jenkins, J., Lyons-Amos, M.J., Leckie, G., Steele, F. . 2012. "Capturing the sequence of interaction between young siblings." *Forthcoming*.
Pickles, A. , Croudace, T. . 2010. "Latent mixture models for multivariate and longitudinal outcomes." *Statistical Methods in Medical Research* 19:271-289.
Reher, David Sven. 1998. "Family ties in western Europe: Persistent contrasts." *Population and Development Review* 24(2):203-234.
Schaeffer, C.M., Petras, H., Ialongo, N., Poduska, J. & Kellam, S. . 2003. "Modeling growth in boys aggressive behavior across elementary school: Links to later criminal involvement, conduct disorder, and antisocial personality disorder." *Developmental Psychology* 39:1020-1035.
Sobotka, T., and Laurent Toulemon. 2008. "Overview chapter 4: Changing family and partnership behavior: Common trends and persistent diversity across Europe." *Demogrpahic Research* 19(6):85-138.
Thornton, Arland, William G. Axinn, and Jay D. Teachman. 1995. "The influence of

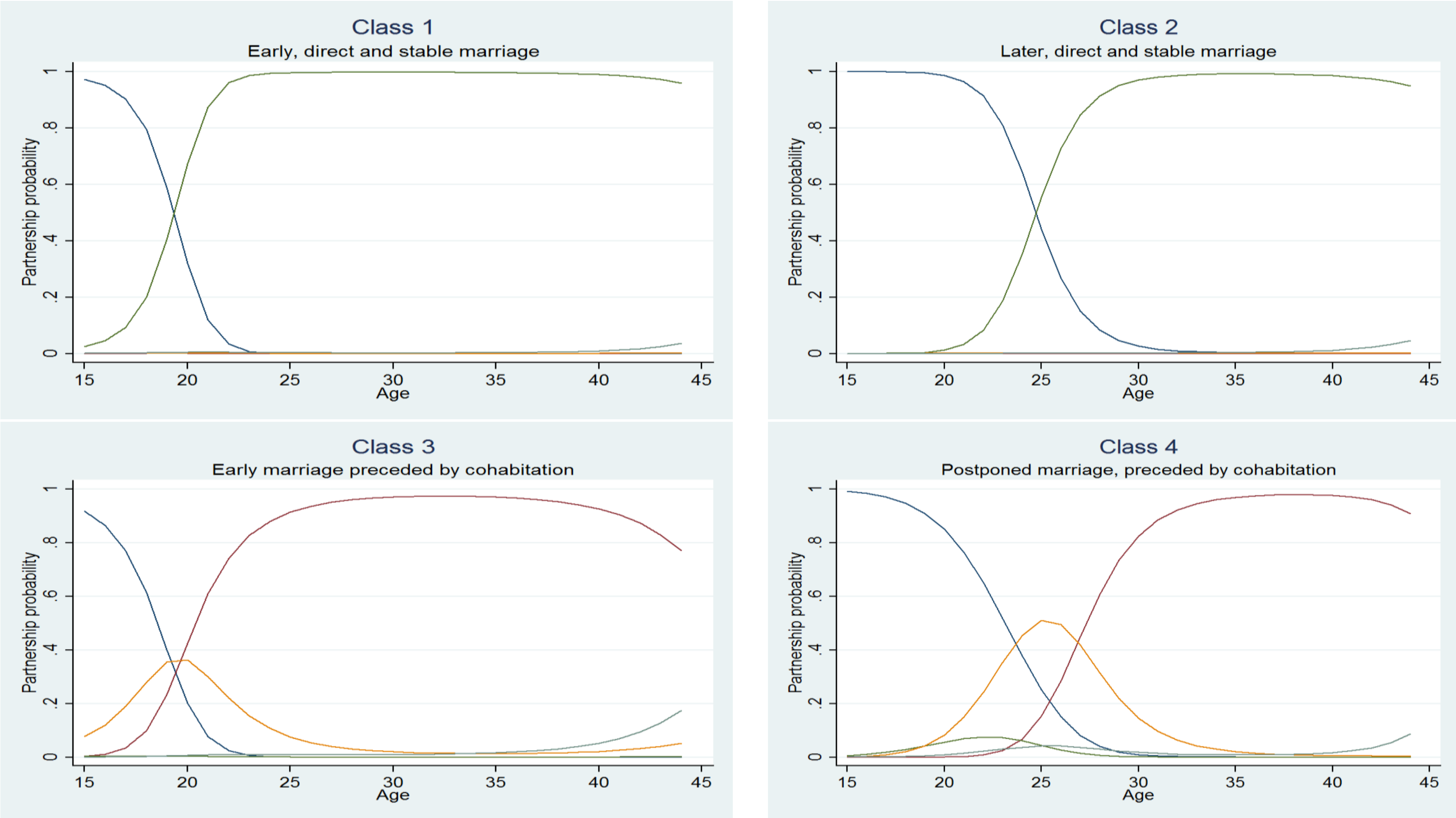
school enrollment and accumulation on cohabitation and marriage in early adulthood." *American Sociological Review* 60(5):762-774.
van Lier, P.A.C., Muthén, B., van der Sar, R.M. & Crijnen, A.A.M. . 2004. "Preventing disruptive behavior in elementary schoolchildren: Impact of a universal classroom-based intervention." *Journal of Consulting and Clinical Psychology* 72:467-478.
Van Wissen, L.J.G, Dykstra, P.A. 1999. *Population issues: An interdisciplinary focus*. New York: Kluwer Academic/Plenum Publishers.
Virtanen, P., Lipiäinen, L., Hammerström, A., Janlert, U., Saloiemi, A., Nummi, T. . 2001. "Tracks of labour market attachment in early middle age: A trajectory analysis over 12 years " *Advances in Life Course Research* 16:55-64.
Wang, C. P., Hendricks Brown, C., & Bandeen-Roche, K. 2005. "Residual diagnostics for growth mixture models: Examining the impact of a preventive intervention on multiple trajectories of aggressive behavior." *Journal of the American Statistics Assoc* 100:1054-1076.
Willekens, F.J. 1999. "The life course: Models and analysis." Pp. 23-52 in *Population issues: An interdisciplinary approach*, edited by L.J.G. van Wissen, P.A. Dykstra, P.A. New York: Kluwer Academic/Plenum Publishers.
Xie, Yu, James M. Raymo, Kimberly Goyette, and Arland Thornton. 2003. "Economic potential and entry into marriage and cohabitation." *Demography* 40(2):351-367.

Table 1. Distribution of Educational attainment in each country by cohort before weighting (frequencies in parentheses).

Country	Educational level			Birth cohort
		1945-54	1955-64	1965-74
Austria GGS	Low		18.8 (31)	14.3 (158)
	Medium		66.0 (109)	65.4 (737)
	High		15.1 (25)	20.3 (229)
Belgium GGS	Low	41.3 (185)	29.9 (169)	14.7 (68)
	Medium	28.1 (126)	35.1 (198)	37.3 (174)
	High	30.4 (136)	34.9 (197)	47.9 (231)
Bulgaria GGS	Low	25.6 (195)	17.3 (195)	14.1 (207)
	Medium	50.5 (384)	55.2 (623)	55.3 (810)
	High	35.6 (181)	27.4 (309)	30.5 (461)
Estonia GGS	Low	13.9 (119)	6.3 (56)	8.2 (71)
	Medium	50.4 (429)	49.7 (438)	55.1 (440)
	High	35.6 (303)	43.8 (385)	36.6 (289)
France GGS	Low	44.0 (349)	29.9 (218)	17.7 (136)
	Medium	36.9 (293)	40.5 (295)	44.3 (342)
	High	19.0 (151)	29.4 (215)	37.9 (304)
Hungary GGS	Low	31.2 (414)	21.8 (250)	15.1 (163)
	Medium	53.5 (709)	58.9 (678)	62.8 (658)
	High	15.2 (202)	19.1 (221)	22.0 (231)
Italy GGS	Low	66.6 (2209)	49.5 (1740)	41.0 (1166)
	Medium	24.2 (804)	40.2 (1417)	47.1 (1361)
	High	9.1 (302)	10.1 (357)	11.8 (336)
Netherlands FFS	Low	51.9 (489)	39.4 (425)	25.2 (248)
	Medium	30.7 (289)	38.6 (418)	50.9 (507)
	High	17.3 (163)	21.9 (237)	23.7 (237)
Norway GGS	Low	16.2 (195)	21.8 (280)	11.8 (171)
	Medium	49.2 (590)	41.1 (528)	37.1 (541)
	High	34.5 (414)	37.0 (475)	51.0 (752)
Poland EFE	Low			42.4 (586)
	Medium			36.5 (505)
	High			20.9 (291)
Romania GGS	Low	54.4 (630)	31.1 (288)	28.3 (310)
	Medium	37.6 (436)	57.5 (535)	61.0 (667)
	High	7.9 (92)	11.3 (106)	10.5 (116)
Russia GGS	Low	8.6 (99)	2.3 (33)	3.3 (35)
	Medium	68.9 (792)	75.6 (1031)	73.1 (747)
	High	22.3 (257)	22.0 (302)	23.5 (239)
Spain SFS	Low	75.8 (723)	53.7 (716)	37.2 (506)
	Medium	15.9 (152)	29.0 (390)	39.9 (551)
	High	8.1 (78)	17.2 (230)	22.8 (318)
UK BHPS	Low	26.3 (201)	12.1 (105)	6.2 (56)
	Medium	15.9 (239)	34.9 (304)	37.7 (341)
	High	42.3 (323)	52.9 (460)	56.0 (551)
US NSFG	Low	12.9 (211[a])	12.5 (496[a])	16.5 (317[b])
	Medium	37.5 (612[a])	40.8 (1596[a])	26.0 (495[b])
	High	49.5 (809[a])	46.6 (1832[a])	57.3 (1094[b])

Note:
a data are from 1995 National Survey of Family Growth
b data are from 2007 National Survey of Family Growth

Figure 1. Latent classes based on models of growth trajectories.



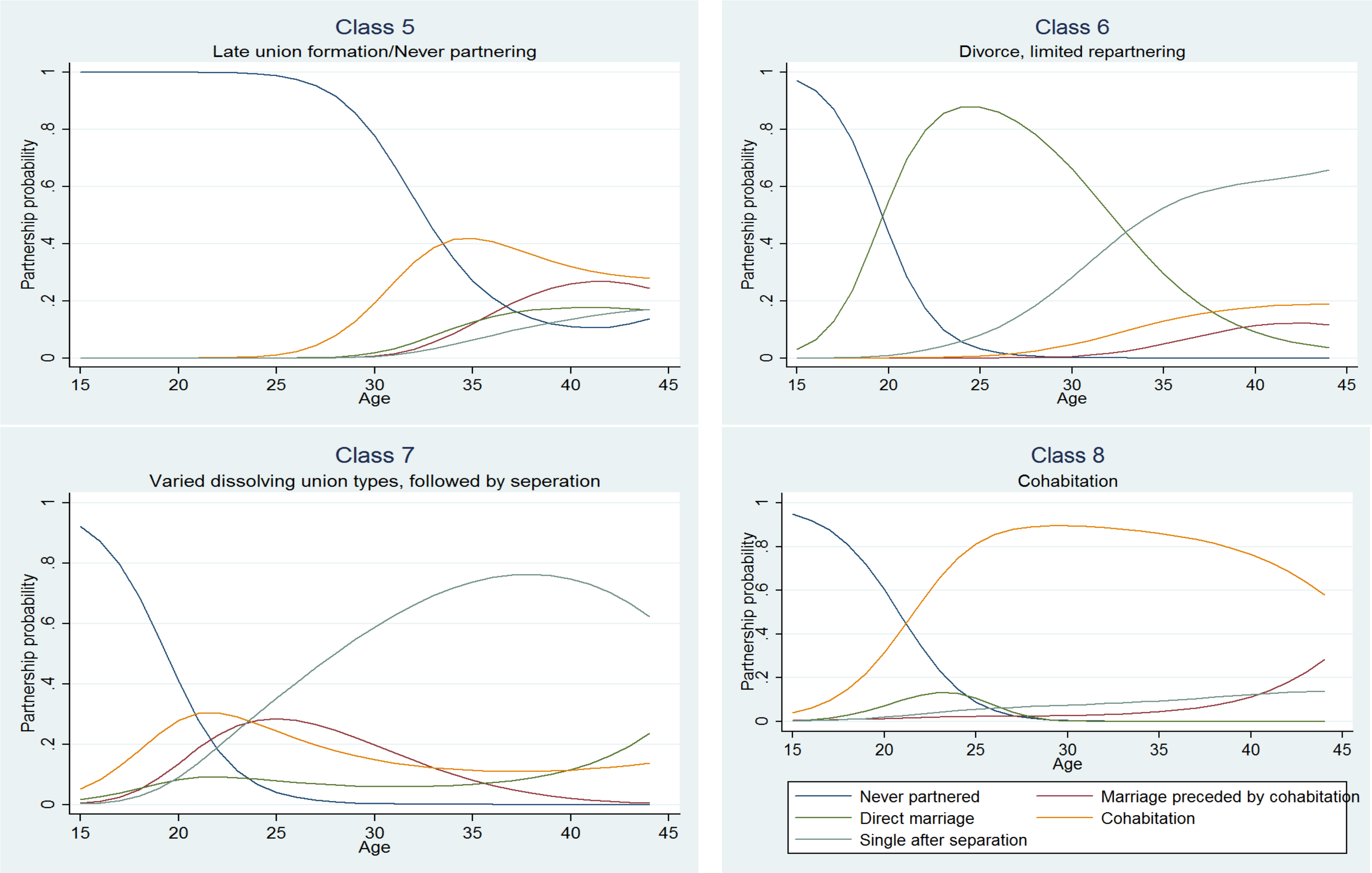
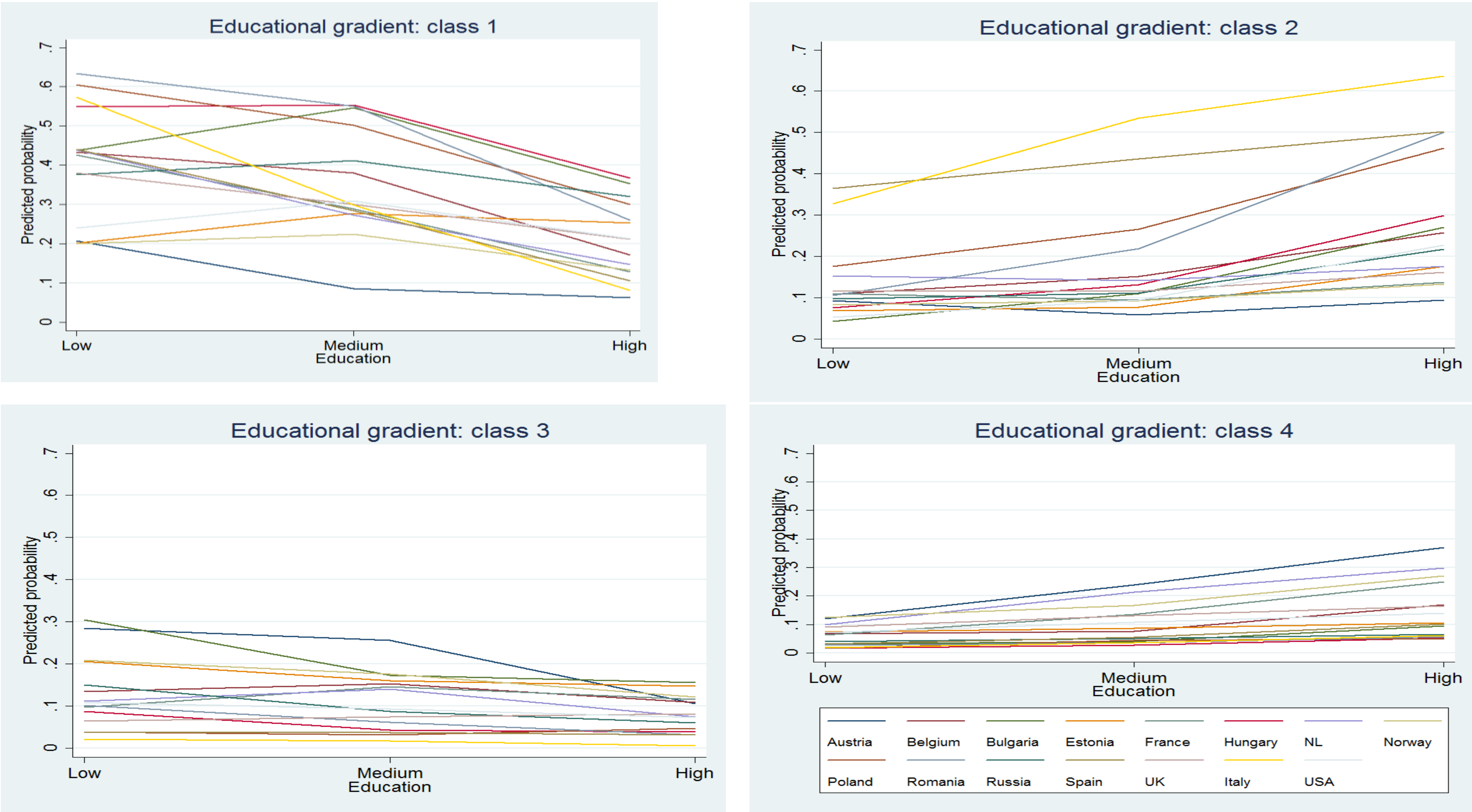
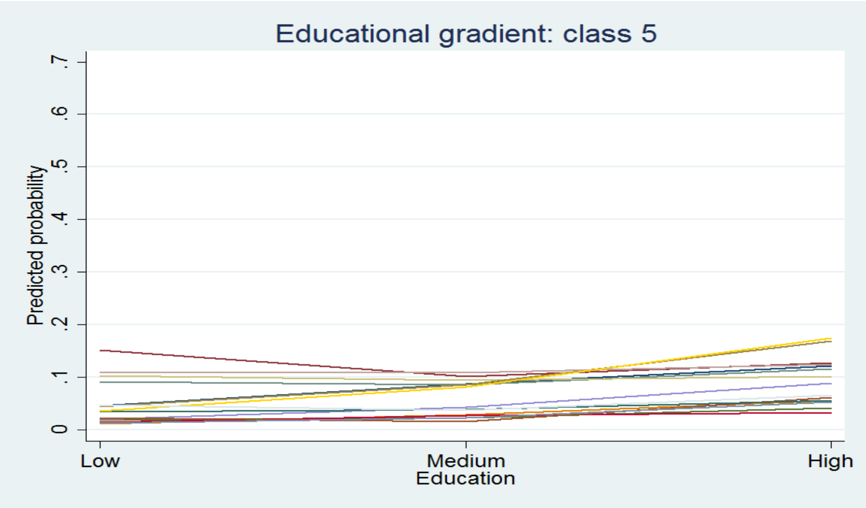
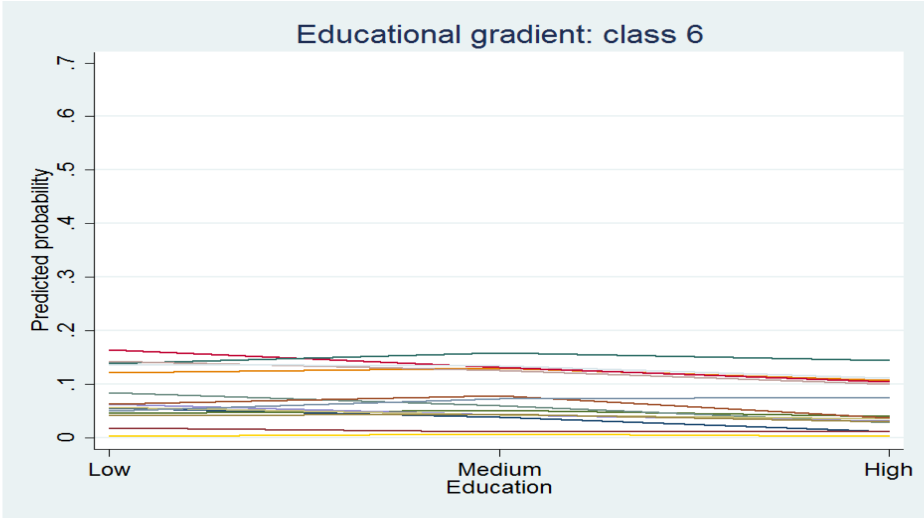
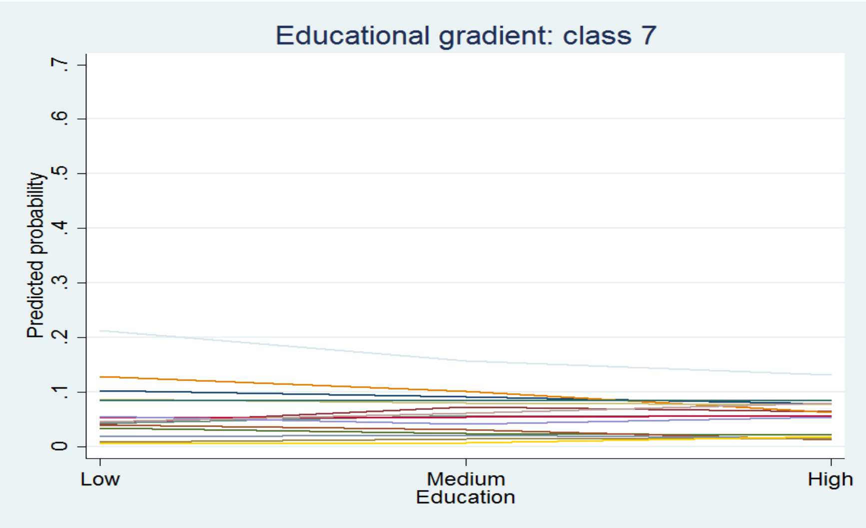

Class 5
Late union formation/Never partnering
Class 6
Divorce, limited repartnering
Class 7
Varied dissolving union types, followed by seperation
Class 8
Cohabitation
Partnership probability
0
.2
.4
.6
.8
1
15
20
25
30
35
40
45
Age
Never partnered
Direct marriage
Single after separation
Marriage preceded by cohabitation
Cohabitation

Figure 2: Educational gradients based on model predicted probabilities (averaged across cohort) by country.




Educational gradient: class 5
Predicted probability
0
.1
.2
.3
.4
.5
.6
.7
Low
Medium
High
Education


Educational gradient: class 6
Predicted probability
0
.1
.2
.3
.4
.5
.6
.7
Low
Medium
High
Education


Educational gradient: class 7
Predicted probability
0
.1
.2
.3
.4
.5
.6
.7
Low
Medium
High
Education

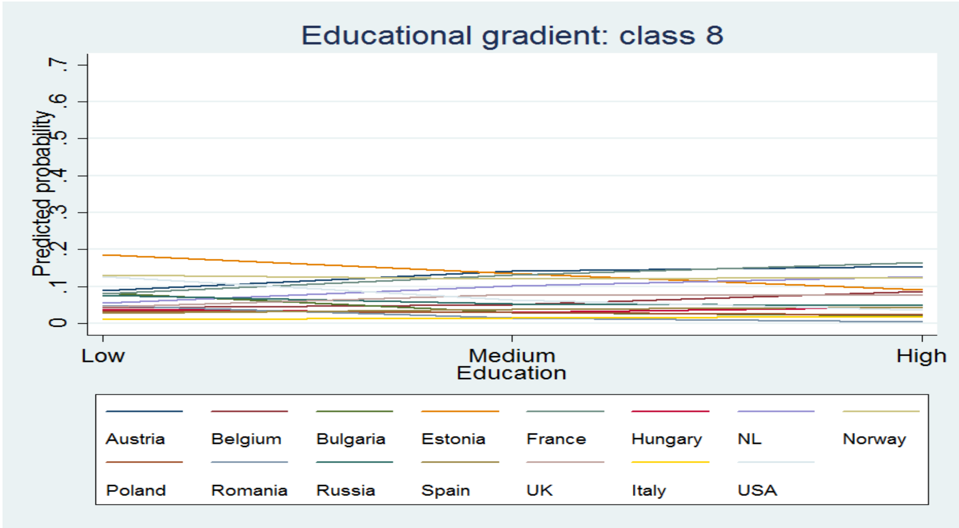

Educational gradient: class 8
Predicted probability
0
.1
.2
.3
.4
.5
.6
.7
Low
Medium
High
Education
Austria
Belgium
Bulgaria
Estonia
France
Hungary
NL
Norway
Poland
Romania
Russia
Spain
UK
Italy
USA

Table 2: Educational gradients by country and birth cohort

	Class 1: Early direct and stable marriage				Class 2: Later, direct and stable marriage				Class 3: Early marriage preceded by cohabitation				Class 4: Postponed marriage, preceded by cohabitation			
	1945-54	1955-64	1965-74	%	1945-54	1955-64	1965-74	%	1945-54	1955-64	1965-74	%	1945-54	1955-64	1965-74	%
Austria		D	D	10.0		-	U	7.1		D	D	23.1		U	U	24.6
Belgium	D	-	D	31.6	U	U	U	18.0	-	D	D	13.2	-	U	U	10.8
Bulgaria	-	-	-	47.2	U	U	U	14.2	D	D	D	19.3	-	U	U	5.4
Estonia	-	U	U	26.1	U	U	U	11.5	D	U	D	16.0	U	U	U	9.2
France	D	D	D	28.5	U	U	U	11.2	U	-	D	12.3	U	U	U	14.6
Hungary	D	D	-	51.8	U	U	U	15.0	D	D	D	5.3	U	U	U	2.9
Italy	D	D	D	42.2	U	U	U	43.6	D	D	D	1.9	U	U	U	2.9
NL	D	D	D	31.1	U	U	U	15.4	D	D	D	11.6	U	U	U	18.7
Norway	-	-	-	18.2	U	U	U	10.8	D	D	D	16.0	U	U	U	20.3
Poland			D	50.4			U	27.0			-	3.8			U	3.4
Romania	D	D	D	55.3	U	U	U	20.5	D	D	D	7.5	U	U	-	3.4
Russia	-	-	-	39.0	U	U	U	13.6	D	D	D	8.5	U	U	U	5.3
Spain	D	D	D	34.2	U	U	U	40.8	D	D	D	3.8	U	U	U	5.0
UK	-	-	-	26.7	U	U	U	13.7	U	U	D	7.8	D	U	U	14.1
USA	-	-	D	25.1	U	U	U	15.6	D	D	D	8.6	U	U	U	11.8

	Class 5: Late union formation/Never partnering				Class 6: Divorce, limited partnering				Class 7: Varied dissolving union types				Class 8: Cohabitation			
	1945-54	1955-64	1965-74	%	1945-54	1955-64	1965-74	%	1945-54	1955-64	1965-74	%	1945-54	1955-64	1965-74	%
Austria		U	**U**	8.9		D	D	3.6		D	D	9.1		U	U	13.6
Belgium	-	D	D	12.6	-	-	D	1.5	U	-	-	6.2	U	U	U	6.2
Bulgaria	**U**	D	**U**	2.8	D	-	-	4.8	U	D	**D**	2.6	D	**D**	**D**	3.6
Estonia	**U**	**U**	**U**	3.8	-	-	**U**	12.1	**D**	**D**	D	9.0	**D**	**D**	D	12.3
France	U	-	D	9.7	D	**D**	**D**	5.9	U	U	D	5.3	U	-	U	12.5
Hungary	U	D	**U**	2.6	D	D	D	13.5	-	-	D	5.5	U	-	D	3.4
Italy	**U**	**U**	**U**	6.7	-	-	**D**	0.5	**U**	U	U	0.8	U	U	U	1.3
NL	U	**U**	**U**	4.4	D	D	D	4.8	U	U	**D**	5.0	**U**	U	U	8.9
Norway	U	D	U	9.9	D	D	D	4.2	U	D	D	8.1	D	D	**D**	12.4
Poland			U	2.9			-	6.3			**D**	3.2			D	3.0
Romania	U	U	**U**	2.2	-	U	U	6.4	**D**	D	D	2.0	**D**	-	**D**	2.7
Russia	U	**U**	**U**	4.3	-	-	-	15.5	D	D	D	8.5	D	-	D	5.2
Spain	U	**U**	**U**	7.7	-	-	-	4.1	U	U	D	1.1	U	-	D	3.3
UK	U	U	D	11.9	D	-	-	11.6	U	U	D	6.9	**U**	-	D	7.3
USA	U	U	U	5.4	D	D	-	12.4	D	**D**	**D**	15.3	**D**	**D**	**D**	5.8

Notes:

U indicates upward educational gradient
D indicates downward education gradient
- indicates inconsistent educational gradient
Bold typeface indicates gradient was significant: Significance tests based on comparison of overlap for confidence intervals adjusted for pairwise test of difference at 5% level (91% confidence interval).
Grey typeface denotes a non-significant gradient
No value indicates that these cohorts were not interviewed in Austria or Poland.

Table 3: Results from ANOVA of education and country by cohort (logit link)

		Education	*Country*	*Residual*
Class 1: Early, direct and stable marriage	*1945-54*	*0.48*	*0.25*	*0.27*
	1955-64	*0.29*	*0.47*	*0.23*
	1965-74	*0.11*	*0.78*	*0.11*
Class 2: Later, direct and stable marriage	*1945-54*	*0.28*	*0.64*	*0.08*
	1955-64	*0.19*	*0.74*	*0.07*
	1965-74	*0.08*	*0.88*	*0.05*
Class 3: Early marriage preceded by cohabitation	*1945-54*	*0.06*	*0.83*	*0.11*
	1955-64	*0.05*	*0.88*	*0.07*
	1965-74	*0.09*	*0.82*	*0.09*
Class 4: Postponed marriage, preceded by cohabitation	*1945-54*	*0.20*	*0.69*	*0.11*
	1955-64	*0.17*	*0.73*	*0.10*
	1965-74	*0.12*	*0.83*	*0.05*
Class 5: Late union formation/ Never partnering	*1945-54*	*0.22*	*0.57*	*0.21*
	1955-64	*0.17*	*0.63*	*0.20*
	1965-74	*0.16*	*0.66*	*0.18*
Class 6: Divorce, limited re-partnering	*1945-54*	*0.02*	*0.96*	*0.03*
	1955-64	*0.02*	*0.96*	*0.02*
	1965-74	*0.02*	*0.95*	*0.03*
Class 7: Varied dissolving union types	*1945-54*	*0.01*	*0.93*	*0.06*
	1955-64	*0.02*	*0.93*	*0.06*
	1965-74	*0.02*	*0.94*	*0.04*
Class 8: Cohabitation	*1945-54*	*0.05*	*0.64*	*0.31*
	1955-64	*0.04*	*0.79*	*0.18*
	1965-74	*0.02*	*0.89*	*0.09*

[1] This survey was conducted by the Centro de Investigaciones Sociológicas, but it is still undergoing processing. Therefore, the CIS holds no responsibility for any inaccuracies found in the data.

[2] Women are considered single at time of separation, not divorce. We also include women whose previous partnerships ended in death of spouse, but there are relatively few cases.

[3] Growth Mixture Models, an extension of Eq. 1, describe individual deviation from the overall growth curve within class *j* via random coefficients, and can extract fewer classes and estimate more parsimonious models. However, it was extremely difficult to obtain convergent solutions for models with random coefficients, since in some classes the probability of certain states was approximated at zero (and hence the variance estimate was difficult to obtain). Therefore the models must be restricted to a LCGM only, which assumes that variation in partnership trajectories is a function of class membership only.

[4] Elzinga and Liefbroer (2007) imply that one of the disadvantages of sequence analysis is that it is difficult to decide on the number of clusters or classes using an inductive approach. LCGM by definition seeks to use an inductive approach to determine the number of classes using model fit statistics.

[5] The number of classes is sensitive to model specification. For example, we first used models with three-year intervals and only six models were estimated. Also, the number of countries can change the number of classes. Hence, the 8 latent classes are specific to this model specification.

[6] We tried adding a trajectory for second and higher-order unions, but only 3classes emerged. Because the model had to fit a class for second unions, the other classes that emerged were too similar to each other and much of the diversity of classes was lost. Therefore, we decided to have respondents reenter cohabitation and marriage after separation in order to show more nuanced classes.