# Variation in the Intersection between Partnership and Fertility: A Comparison across Three Cohorts in 16 Countries

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The intersection between fertility and partnership is increasingly complicated. This is due to increasing variety in partnership forms, diversity in childbearing patterns, as well as the changing relationship between these processes. This paper uses Latent Class Growth Models to evaluate the relationship between partnership and fertility across the US and Europe. The main aims are to establish how the association between partnership patterns and the timing of births varies between countries and across birth cohorts. We analyse retrospective union and fertility histories from the Harmonized Histories database and selecting women age 15-45. Results suggest that the relationship between partnership and birth timing have shifted. However, the nature of this shift varies by country reflecting heterogeneous evolution of partnership-fertility interaction.

## Introduction

Family behaviours in the industrialised world are increasingly complex. This applies to partnership behaviours: women have moved away from universal marriage to incorporate cohabitating relationships which can persist across the lifecourse, convert to marriage, or end in dissolution. The type of union, however, does not capture the entirety of change in partnership behaviour: the timing of entry into union and the disassociation between entry into union and transition to marriage has become less standardized. While much of the demographic literature has focussed on specific partnership behaviours, e.g. entrance into marriage versus cohabitation, the timing of union formation, or exit from marriage (e.g. Billari and Liefbroer 2010, Anderson and Phillipov 2002, Heuverline and Timberlake 2004, Hoem et al. 2009), methodological advances have led to a greater focus on holistic partnership behaviour (Elzinger and Liefbrouer 2007, Perelli-Harris and Lyons-Amos 2013). The advantage of this approach is that variation across the entire lifecourse is captured, incorporating information across a number of dimensions of partnership behaviour such as timing, type (cohabitation or marriage) and duration.

We extend previous lifecourse analysis of womens' partnership patterns (e.g. Perelli-Harris and Lyons-Amos 2013) to incorporate childbearing behaviour. Just as partnership behaviours have changed across cohorts, the pattern of childbearing has shifted. For example, childbearing was historically restricted to formalised marital unions but in certain settings has become increasingly prevalent in non-marital unions (Perelli-Harris et al 2012). The prevailing cultural and legal institutions mean that this behaviour is still rare in some contexts, however (Perelli-Harris and Sanchez-Gassen

2012). The intersection between partnership and childbearing is therefore highly dependent on national context.

The interrelation between partnership and fertility has been addressed cross-nationally from a lifecourse perspective (e.g. Elzinga and Liefbroer 2012, Perelli-Harris et al 2012). However, this previous research does not allow for assessment of the change in the relationship between partnership and fertility. Although the decline in marital fertility demonstrates that the strong association between marriage and fertility has weakened and the increase in cohabitation in childbearing shows a strengthening association between cohabitation and childbearing, it is unclear whether these changes are due primarily to a secular shift in fertility behaviour, or to a shift in partnership, with fertility responding to that partnership shift. This leads us to our primary research question: how are partnership and fertility associated, and how does this association vary across both country and cohort? The analysis allows us to compare both the timing of childbearing as well as parity progression. Noting that the degree to which childbearing behaviour has changed will depend to an extent on the type of partnership behaviour- for instance, the continued importance of childbearing in marital unions compared to greater diversity in cohabiting relationships- we evaluate changes in variation of childbearing across each of the partnership patterns.

We achieve this by using data from the Harmonized Histories dataset to extract Latent Classes for partnership behaviour and Age Specific Fertility Rates for childbearing behaviour. We use age-specific fertility rates to understanding the changing nature of fertility behaviour for partnership classes, since this allows us to examine both the timing and intensity of fertility behaviour within a partnership form. The advantage of

this approach is that we are able to assess how variation in childbearing behaviour has changed by partnership class. We make comparisons across both country and birth cohort, to identify which partnership patterns are associated with the greatest changes in childbearing behaviour, and how this varies across country. Our analysis of age specific fertility rates allows us to examine the timing of first births (tempo), number of children (quantum), and age at terminal childbearing. The Latent Class Growth Curves show different aspects of partnership formation: timing of direct marriage, timing of marriage preceded by cohabitation, delayed partnership formation, union dissolution, and long-term cohabitation. By generating age specific fertility profiles conditional on membership of a certain partnership class, and then comparing these profiles across cohorts, we are able to visualise (and statistically test) changes in childbearing holding partnership behaviour constant.

Note that while our analyses include those who delay partnership into their late 40s or never enter partnerships, it is difficult to specifically analyse births outside of partnerships. Hence, the focus of the analysis is on the changing association between fertility and partnerships, but we acknowledge that a substantial proportion of childbearing in each country occurs to lone mothers (Perelli-Harris et al 2012). All in all, our investigation will shed further light on how the meaning of partnerships have changed overtime with respect to childbearing, and how this has varied by cultural context.

## Theoretical Framework

Over the past few decades, patterns of fertility and partnership have changed in a number of ways. Here we first discuss the emergence of new partnership patterns

across Europe and the United States. We then evaluate the intersection between partnerships and fertility by outlining major changes in the pattern of fertility and discussing how partnerships may have influenced different aspects of childbearing. We also note that childbearing or the anticipation of childbearing may also prompt changes in union status. Thus, the relationship between partnership and fertility is reciprocal, and changes in one may lead to changes in the other.

*Changes in partnership*

Over the past few decades, the institution of marriage has undergone dramatic changes (Cherlin 2009, Perelli-Harris et al 2014, Kiernan 2004). Marriage no longer represents a distinct event in the life course that results in a long-term union. Many couples slide into cohabiting relationships (Smock and Manning 2005). Aside from changes to the temporal ordering for fertility and marriage, the evolution of marriage has meant that the institution is now a very different institution for childbearing. Marriage preceded by cohabitation tend to have higher dissolution rates partially explained by selection effects (Lilliard, Brien, Waite 1995) which have changed in their nature over time from the selection of unstable couples into cohabiting marriages to the selection of very stable couples into direct marriage (Liefbrouer and Dourleijn 2006). That said, there is some evidence of a direct effect of cohabitation in increasing the risk of union dissolution.

*Changes in Fertility and the Association with Partnership*

The interrelationship between marriage and fertility has become increasingly complicated in many countries. The interaction with fertility and cohabitation depends largely on the nature of the cohabiting relationship. For instance, in certain settings

cohabitation is strictly non-fertile, where strong family ties and social pressure mean that union formalisation is a prerequisite for childbearing. Elsewhere, the existence of long term cohabitating relationship coupled with childbearing has meant that cohabitation has taken on a form indistinguishable from marriage (Heuverline and Timberlake 2004). Indeed, in these circumstances, economic indicators of security such as a joint mortgage are regarded as of greater significance than marriage (Holland 2012). The evolution of cohabitation is therefore directly tied to the evolution of childbearing patterns within the relationship form, which is contingent on national setting (Heuverline and Timberlake 2004).

*Timing of childbearing*. In the majority of European countries and the United States, the age at first birth has increased, leading to the postponement of childbearing (Frejka, Toulemon and Sobotka 2008, Kohler, Billari, and Ortega 2001, more Sobotka articles). This has had a profound impact on the age pattern of fertility (Sobotka).

Changes in union formation may have influenced the timing of childbearing in several ways. First, delays in partnership change the exposure to risk; most births occur within couples, and if couples are being formed later, then births could occur later. Second, the type of union could influence the initiation of childbearing. Traditionally, childbearing occurred within marriage, and marriage may be seen as the appropriate setting for childbearing. Increases in the age at marriage will have particular impact where marriage is still a necessary condition for the initiation of childbearing (Reher 1998). In many countries, childbearing occurred soon after marriage; thus countries with early marriage would most likely have early childbearing. However, premarital

cohabitation may have delayed the initiation of childbearing until the couple was married.

It is also important to note that the direction of causality could be in the opposite direction: pregnancy or the intention to have a child could prompt cohabitation or marriage (Perelli-Harris et al 2012, Raley 2001). In many instances, marriage and childbearing are joint decisions (Billari 2001; Wu and Musick 2008; Le Goff 2002, Baizan et al 2004). Marriage and fertility are now seen as associated processes in a staged family building process (Brien *et al.* 1999) where the event ordering, although related, is increasingly uncertain (Wu and Musik 2008).

*Quantum of fertility*. Although the changes in partnership and fertility may be endogenous, with both occurring due to similar underlying causes, delays in partnership formation, changes in type of partnership, and increases in union stability may lead to a lower number of births. First, the general postponement of union formation and/or marriage may result in women having issues with fecundity as they near the end of the reproductive lifespan. These delays in the formation of a stable, long-term relationship may not only postpone the start of childbearing but may limit the number of births a woman might have.

Second, cohabitation may not be seen as a setting conducive to having and raising children. Cohabiting unions tend to be less stable than marriage (Heuveline, Timberlake, and Furstenberg 200x), and may not have the formal sanction of marriage.

Because of these issues, most studies show that birth rates in cohabitation are lower than in marriage. For example, across Europe and the United States, cohabiting women who have a first birth within cohabitation have lower second conception rates than married women (Perelli-Harris 2014). However, the same analysis showed that cohabiting women who married after first birth had similar second conception rates as those married at first birth, suggesting that childbearing prompts marriage, childbearing and marriage decisions are formed jointly, or that the timing of marriage matters less for fertility than the act of marrying. In the end, these lower birth rates may result in fewer births across the lifecourse.

On the other hand, in some settings cohabitation is associated with higher fertility, as it may be practiced by the disadvantaged. Some evidence has shown this to be the case in Eastern Europe (Romania, Bulgaria references).

Third, union instability also has a potential role in impacting fertility (Thompson et al 2012). The increasing prevalence of divorce in European populations and the United States (Galezewska 2014, Cherlin 2009) may result in fewer births. The evolution of marriage towards a less stable relationship and less secure institution may result in couples having fewer children than previsously (Cherlin 2004). The period after union dissolution may not only delay family formation during the search for a new partner, but the new partnership may also be less stable, potentially due to selection(e.g. Lillard, Brien and Waite 1995). In any case,higher order partnerships are increasing likely to be cohabiting unions, which could again reduce fertility (Skew Evans and Grey 2009). On the other hand, repartnering could be an "engine of fertility," since

repartnered couples may want to have another child in their new union (Thomson et al 2012, Beaujouan).

*Cultural explanations for Changes in Union Formation and Partnership*

We also note the somewhat unique situation of Eastern European fertility patterns. Historically fertility was constrained by legal and social norms toward universal early and direct marriage, primaparity was a distinguishing feature of socialist fertility behaviour (refs). The homogeneity of this regime was a distinguishing feature (and in marked contrast to Western regimes (Coale 1992). That said, recent changes in response to the collapse of socialism have shown an increase in diversity of Eastern European counties, with increasing rate of cohabitation, postponement and nonmarriage (Sobotka and Toulemon 2008). There have been associated increases in the proportion of non-marital births, accounted for by both birth to cohabitating couples and single births (also influenced by increasing union dissolution). Timing of birth has also been occurring increasingly late, with some movement toward a more diverse range of parity progressions (Sobotka 2004).

## Data

We analyse retrospective union and fertility histories from 15 surveys that have been standardized in a dataset called the Harmonized Histories (Perelli-Harris, Kreyenfeld, and Kubisch 2010, and see *www.nonmarital.org*). The data for Austria, Belgium, Bulgaria, Estonia, France, Lithuania, 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 UK data are from the British Household Panel Survey (BHPS). The Spanish data come from the Survey of Fertility and Values conducted in 2006, 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. The surveys that comprise the Harmonized Histories have been frequently used in other studies and are generally considered high quality. In particular, fertility and marriage trends from most of the Generations and Gender Surveys reflect trends found in vital registration statistics (e.g. Vergauwen, Wood, and Neels 2012).

Despite slightly different survey designs, the union histories are relatively comparable. Because not all surveys include complete male union histories, we restrict the analyses to women. 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. In the Italian and Austrian surveys, however, there is no minimum duration. Registered unions, or PACS, are recorded in the French GGS, but we include them with marriages because they are officially registered. [i]

Because we are interested in analyzing union patterns across countries and over time, we pool the datasets to create a standard set of latent class growth curves for all countries. The large size of the pooled dataset allows a greater number of classes to emerge than for any individual country alone, thereby facilitating a more precise analysis of heterogeneity within countries. Note that while 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 have no 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 pooled sample. To create a sample with each survey equally represented, we have rescaled the population totals so that each survey contributes the same proportion to the total sample. We have also applied each country's weighting scheme to ensure national representation. This approach allows the internal validity of the surveys to be maintained, but ensures that no one survey dominates the sample.

## Method

*Partnership and birth trajectories*

This analysis build on previous work which analysed the variation in partnership patterns in the European context (Perelli-Harris and Lyons-Amos 2013). We use latent class growth models to determine partnership pattern. Latent Class Growth Models are a form of growth model which separate different trajectories into distinct groups (discrete random effects). This allows us to examine important common patterns between women. Partnership is defined the random variable $y_i$. This variable is defined at every year of the respondent's partnership history for each state, *s*.

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

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 $\boldsymbol{y_{i,age=2}}$ rather than 1). Although the use of yearly intervals leads to the loss of some information, we conducted extensive robustness checks (Perelli-Harris and Lyons-Amos 2013). These checks established that our results are not sensitive to the duration of the interval- smaller intervals of months provide no insight despite the added computational load. The probability of being in partnership *s* at a given age is defined as $\boldsymbol{\pi^{s}_{i,age} = \mathbf{Pr}(y_{i,age} = s)}$ . We model this probability with growth equations which we allow to vary by latent class. Growth equations are defined as in equation 1, with class *J* indexing the latent class:

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

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

Eq. 1

We determine the number of latent classes using the Lo-Mendell-Rubin Likelihood ratio test, in a similar manner to Perelli-Harris and Lyons-Amos 2013.

Fertility is modelled as age specific fertility rates. We define fertility as the random variable $z_i$, where $z_{i,age} = 1$ where woman *i* has a birth at a given age, and $z_{i,age} = 0$ at ages where she does not. From this we define the probability of having a birth at a

given age as $\pi_{i,age}^{z} = \Pr(z_{i,age} = 1)$. Age specific fertility rates are then modelled as a function of age, described in equation 2

$$\ln\left(\frac{\pi_{i,age}^{z}}{1-\pi_{i,age}^{z}}\right) = \alpha^{z} + \beta_{3}^{z} age_{i} + \beta_{4}^{z} age_{i}^{2}$$

Eq 2.

We define this as a quadratic function on the ground that this is consistent with the specification of the partnership growth curves, and that this is the most parsimonious polynomial specification. Non-polynomial specification of age specific fertility rates (for example, where age is represented by dummy variables for each age) were found to be unstable due to a paucity of births at early and older ages.

*Partnership and fertility associations*

We assess the relationship between partnership and fertility by generating age specific fertility profiles conditional on membership of each latent class *j* (described in equation 3). This is based on the manifest fertility behaviour of women allocated to that class, with allocation based on the modal probability of class membership. Since our classes are well defined (the lowest mean probability of class membership is in excess of 0.96) we are protected against class misallocation

$$\boldsymbol{\ln\left(\frac{\pi_{i,j,age}^{z,}}{1-\pi_{i,j,age}^{z}}\right) = \alpha_{j}^{z} + \beta_{3,j}^{z} age_{i} + \beta_{4,j}^{z} age_{i}^{2}}$$

Eq 3.: Class specific baseline model

We term this the class specific baseline model. Our central test of whether there has been a change in the relationship between partnership and fertility is to compare the fit of the baseline model to an extended model, which fully interacts age with birth

cohorts, as specified in equation 4. We consider this evidence of a changing relationship since it indicates that fertility timing and levels have changed relative to partnership behaviour which is conditioned by class membership. We include a full interaction (rather than simply a dummy term for cohort) since this may reflect period influences for higher or lower fertility levels, rather than a change in fertility behaviour relative to partnership formation

$$\ln\left(\frac{\pi^{z,}_{i,j,age}}{1-\pi^{z}_{i,j,age}}\right) = \alpha^{z}_{j} + \beta^{z}_{3,j} age_i + \beta^{z}_{4,j} age_i^2 + \beta^{z}_{5,j} age_i . cohort_i^{45-54} + \beta^{z}_{6,j} age_i^2 . cohort_i^{45-54} + \beta^{z}_{5,j} age_i . cohort_i^{55-64} + \beta^{z}_{6,j} age_i^2 . cohort_i^{55-64}$$

Eq 4: Class specific extended model

Evidence that the class specific extended model is an improved model fit, and therefore that there is a changing relationship between partnership and fertility, is assessed using a likelihood ratio test comparing the Class specific extended model to the Class specific baseline model. Significance is set at the 5% level. This is conducted for each class, to assess whether any change in the relationship is consistent across partnership type.

We note that the change in relationship may vary by national setting. Therefore, we also conduct tests for each country in turn. This allows us to assess whether there is

variation in the changing relationship between partnership and fertility depending on context.

## Results

*Classes extracted*

8 classes of partnership behaviour are used, identical to those in Perelli-Harris and Lyons-Amos (2013) based on the LMR-LRT. These results are presented in Figure 1.

*Classes 1 & 2: Direct marriage, stable throughout.* Class 1 shows a very early marriage pattern, with the bulk of direct marriages predicted to occur before age 20, and all marriages predicted to occur before age 23. The marriages are essentially stable with a tiny uptick in divorce to about 4% at age 44. Class 2 shows a similar pattern, only postponed by about 5 years. Nearly all marriages occur before age 30, with a probability of 99% of the class married in their 30s. Only a tiny percentage is likely to end in divorce.

*Classes 3 & 4: Premarital cohabitation followed by relatively stable marriage.* Classes 3 and 4 represent marriage that was preceded by cohabitation, but class 3 shows an earlier pattern of union formation than class 4. For class 3, nearly all women are predicted to enter into a union by age 27. About a third of the class is likely to experience cohabitation at age 19, with a high probability of transitioning to marriage shortly thereafter. By age 30, the predicted probability of marriage is 97%. Note that there is more than a 20% chance that women in class 3 are likely to experience divorce by age 44, which is much higher than in the early marriage class (class 1). This suggests that women who premaritally cohabited at an early age have higher divorce rates than women who directly married, as has been found in previous studies

(Liefbroer and Dourleijn 2006). The separation line does not climb above 0 until the late 30s, when all women would have already married. Thus, in this class cohabitation only precedes marriage and does not therefore capture behaviours of dissolving cohabiting relationships with marital repartnering. Class 4 has a later pattern of marriage preceded by cohabitation, but in this class the probability of women premaritally cohabiting at age 25 is nearly 50%. The probability of marriage is over 90% among women in their thirties. Fewer women are predicted to have divorced by age 44, probably because they had been married for a shorter period of time or because women who marry later have lower divorce risks than those who marry earlier. Note that class 4 also includes a small bump of women who directly married, separated, and then entered cohabitation followed by marriage, suggesting that early divorces are likely to be followed by cohabitation rather than direct marriage.

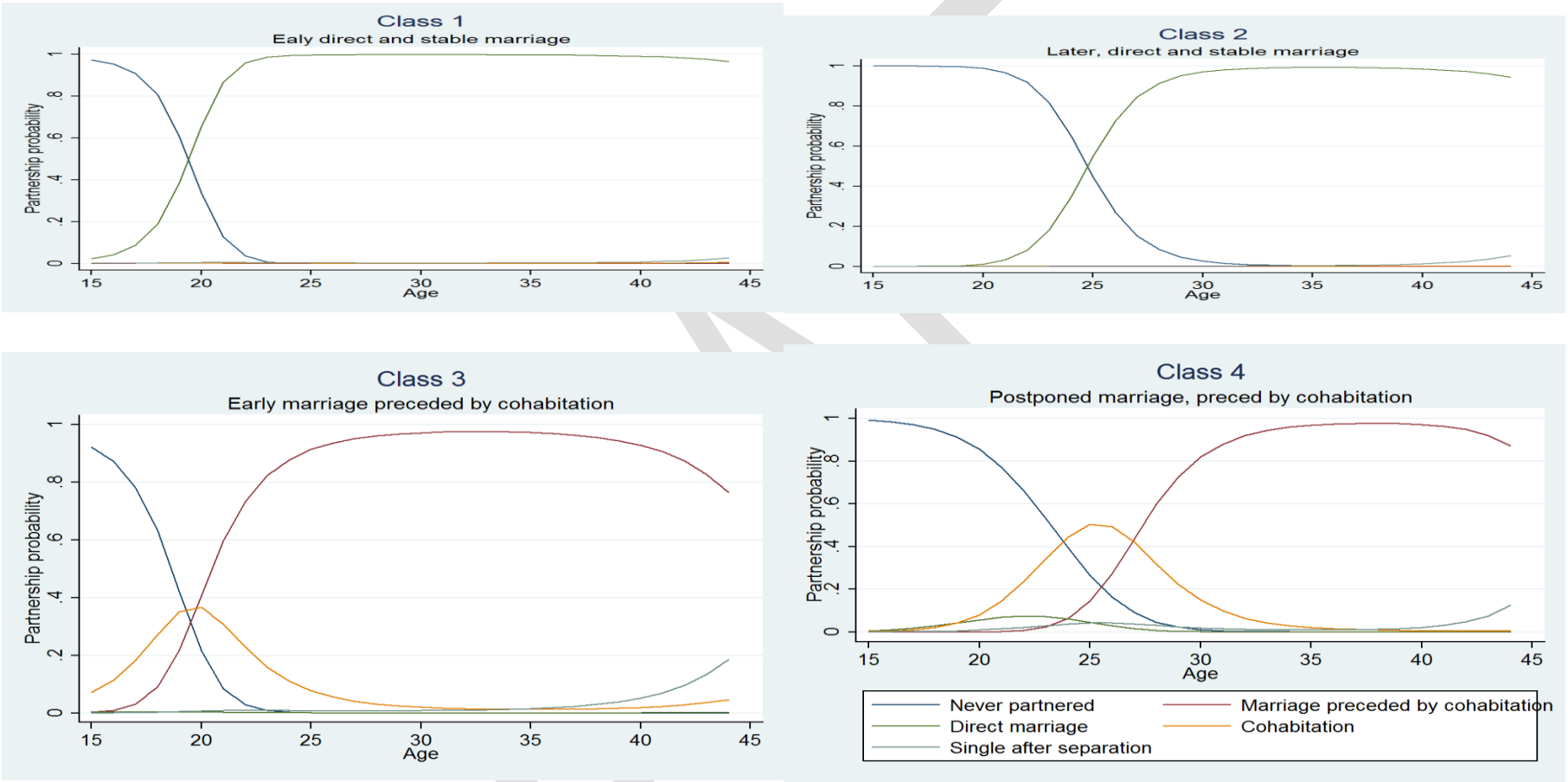
*Class 5. Late union/never partnering.* Class 5 captures late and varied partnership behavior. The never-partnered state extends into the early 30s, with the probability of never being partnered above 95% until after age 27. Marriage preceded by cohabitation starts to increase in the early 30s, with about one third of respondents predicted to be in this type of marriage in their early 40s. Some direct marriages occur in the early 30s, but the probability of directly marrying levels off at around 30% after age 35. Some of the unions also separate, with a steady increase in singles in the mid-30s, but it is difficult to know if those who separate are likely to re-enter a partnership. Although there is a bump of cohabitation between the ages of 25 and 35, this never exceeds 5%. Class 5 also captures those who are never expected to form partnerships before age 44; this class is the only one with a probability of never marrying in the 30s greater than 1%. At age 44, nearly 25% are still unpartnered, with a small uptick that captures anyone remaining unpartnered in the dataset.

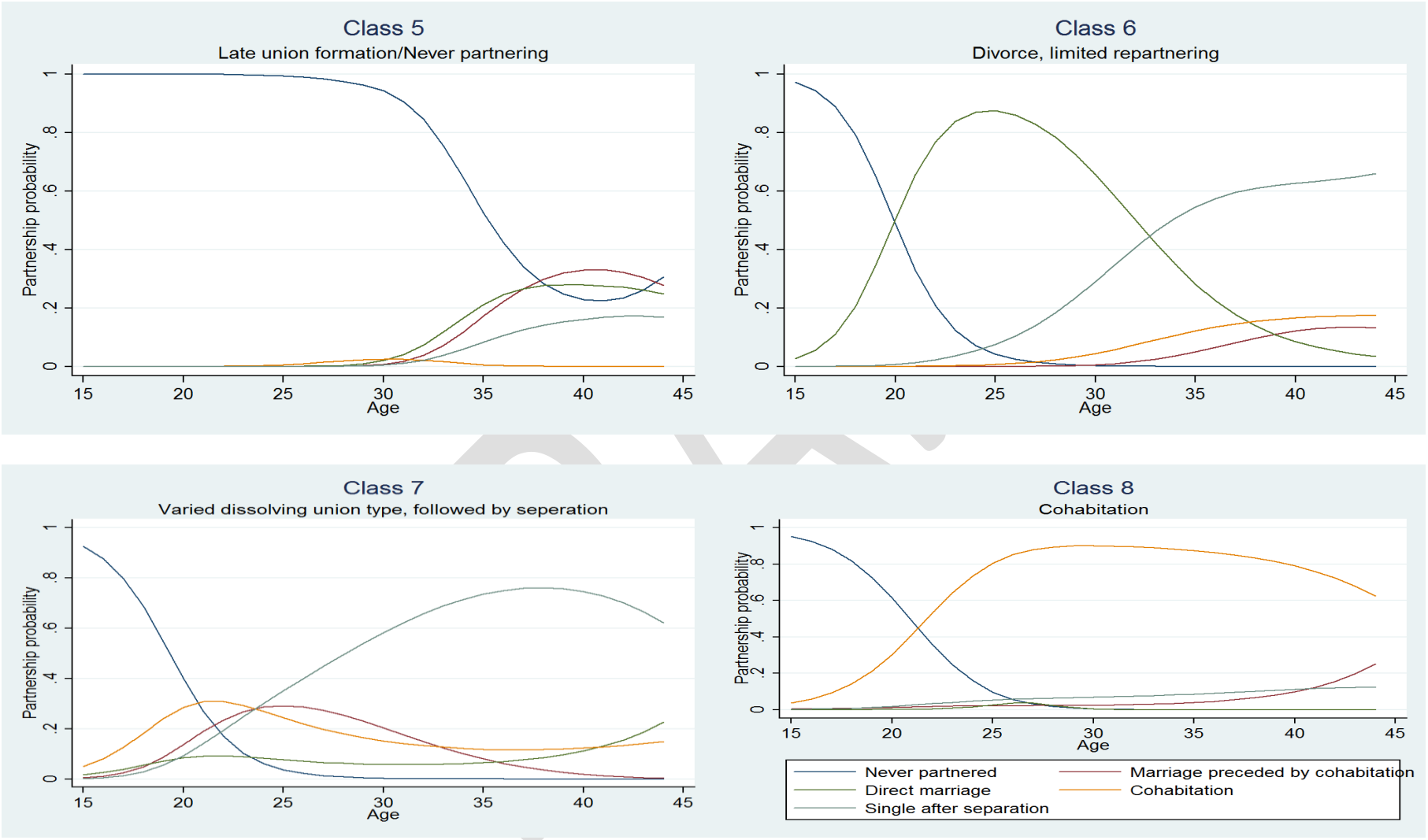
*Classes 6 and 7: Divorce and Separation.* Classes 6 and 7 represent relationship patterns with substantial divorce and separation. In class 6, direct marriage starts early, with a steep increase in the teenage years. The probability of direct marriage then peaks around age 25 at nearly 90%. Starting in the late 20s, divorce starts to increase; we can assume these are divorces from marriage, because they are preceded by marriage, not cohabitation. By the late 40s, over 65% of women are predicted to still be single after separation. Some enter a second (or possibly third or higher) cohabitation or marriage preceded by cohabitation. It is unlikely that women re-enter direct marriage in this class, because the direct marriage trajectory declines so dramatically after age 25. Class 7 has substantial premarital cohabitation and marriage followed by divorce. Cohabitation peaks at age 22 followed by a similar bump for marriage preceded by cohabitation shifted to the right. Direct marriage is also at a low level in this class; it appears that those who separate could directly remarry, because the probability of direct marriage climbs above 20% after age 40. Nonetheless, direct remarriage is at a very low level except in the early 40s. Overall, however, the majority of women in this class are expected to remain single after separation into their 30s and 40s.

*Class 8: Cohabitation.* Because of its predominant cohabitation trajectory, class 8 could be considered the class in which cohabitation is closest to "indistinguishable from marriage." Nonetheless, this class is not completely similar to any of the marriage classes (i.e. classes 1-4). Unlike the marriage trajectories in classes 1-4, the cohabitation trajectory in class 8 does not reach 90% and remain relatively stable. Instead, the cohabitation trajectory peaks around age 29 and begins to decline substantially after the mid 30s, with a low level of separation and a steady increase in

marriage preceded by cohabitation. The marriage preceded by cohabitation trajectory peaks to about a quarter after age 40, suggesting that cohabitation is not a long-term state. This class also includes a small bump of direct marriage and a low level of separation, representing women who directly marry, divorce, and then enter cohabitation. Thus, while long-term cohabitation does have its own class, the class is not identical to a marriage class or even one where marriage is preceded by cohabitation.

*Figure 1: Partnership classes extracted (based on Perelli-Harris and Lyons-Amos 2013)*




Class 5
Late union formation/Never partnering
Class 6
Divorce, limited repartnering
Class 7
Varied dissolving union type, 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

*Association between partnership and fertility*

The fertility profiles for each latent partnership class are presented in this section. We present these profiles with the corresponding partnership profile for comparison, divided by the type of behaviour (marital classes, late union formation, union dissolution classes and cohabitation).

*Marriage classes*

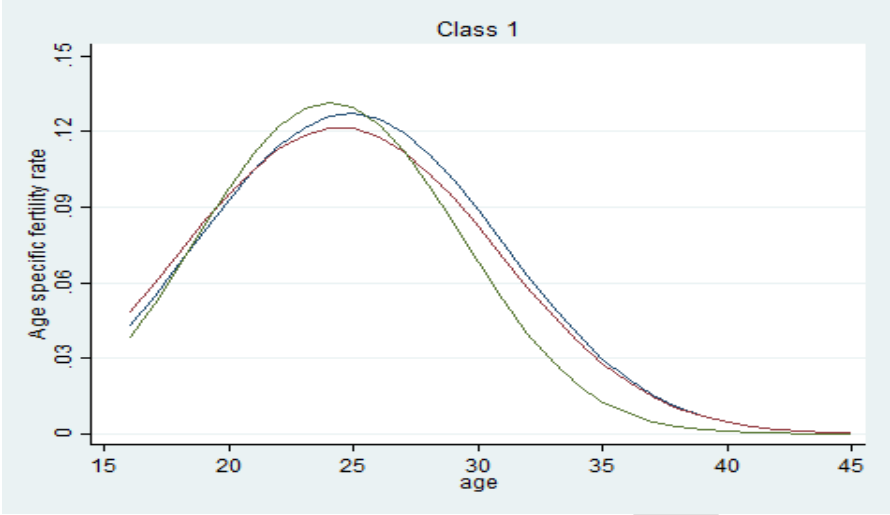
Figure F presents the fertility profile for all classes associated with marriage (classes 1-4). Broadly speaking we see a close correspondence between entry into partnership and peaks in fertility rates. For instance in class 1 (early direct and stable marriage) the peak in fertility rates occurs at roughly age 24, approximately 2 years following the near universal entry into marriage for women in this class. Similarly in class 2 (later direct and stable marriage) the peak in fertility is delayed relative to class 1, occurring at age 30, some 2 years following the attainment of universal marriage in this class around age 28.

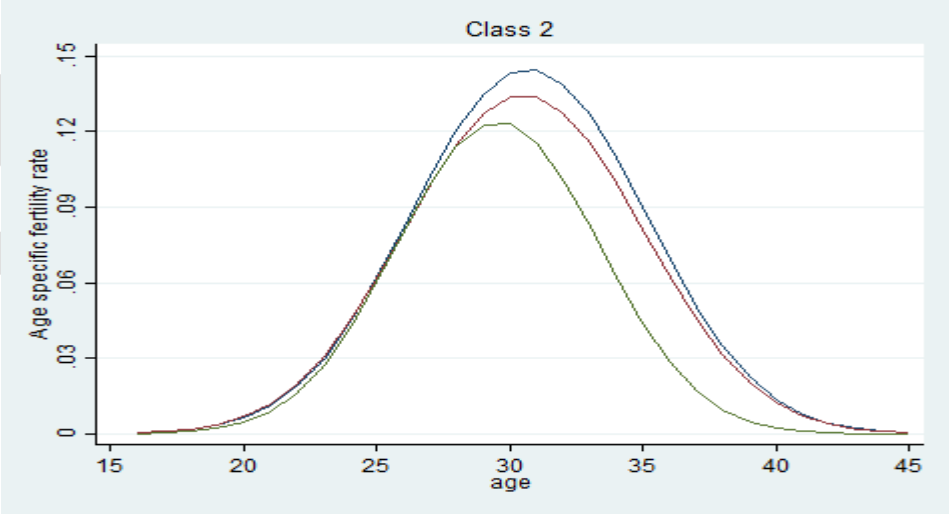
We note a similar trend for the marriage classes where marriage was preceded by cohabitation. In class 3 (early marriage), the peaks of the fertility rate around the age of 25, which corresponds to the peak in the probability of being married. In class 4 (later marriage preceded by cohabitation) the peak in both the probability of being married and in fertility both occur somewhat later at roughly age 30. It is worth noting that there is far more variation in fertility behaviour prior to marriage than was observed in the direct marriage classes. For early cohorts (1945-54), the fertility rate is generally higher than observed for women in classes 3 and 4 (where marriage was preceded by cohabitation) than for direct marriage classes. However, the fertility rate

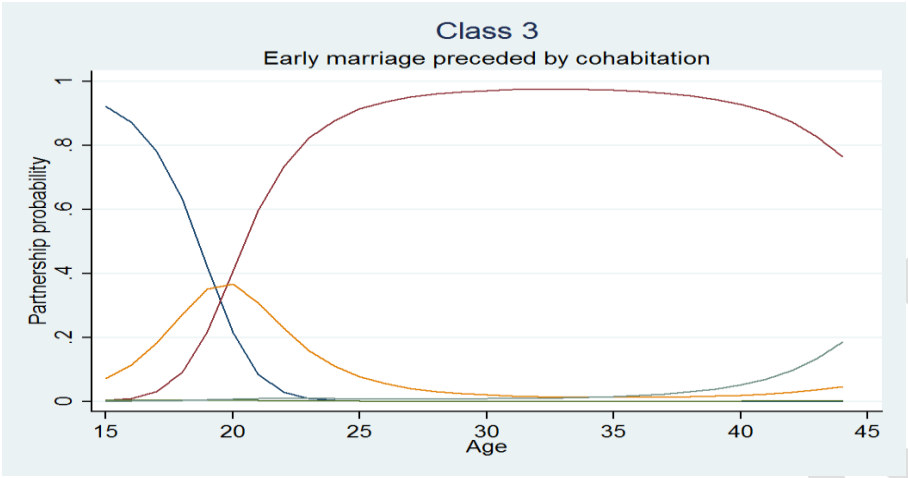
at pre-marriage ages tends to be lower among later birth cohorts, indicating a decling incidence of fertility prior to union formalisation, and a movement toward a fertility pattern more like that of the direct marriage classes.

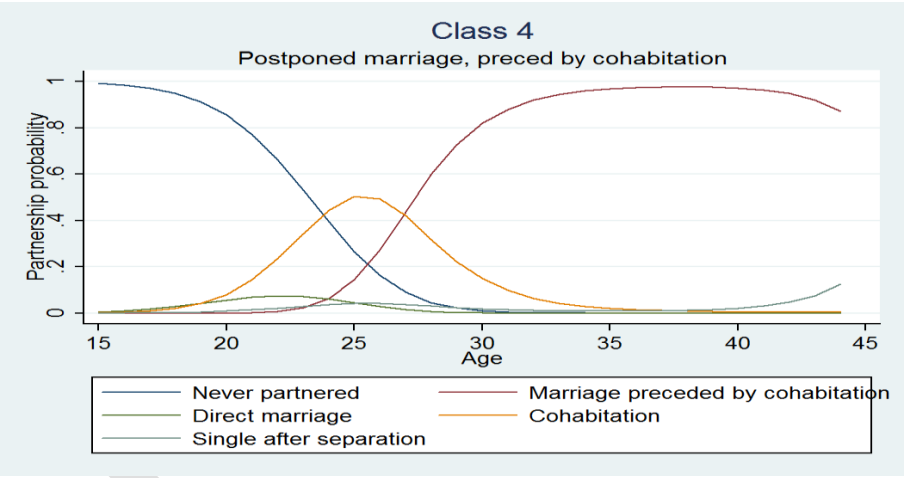
Figure F: *Fertility and partnership profile for marital classes (1-4)*

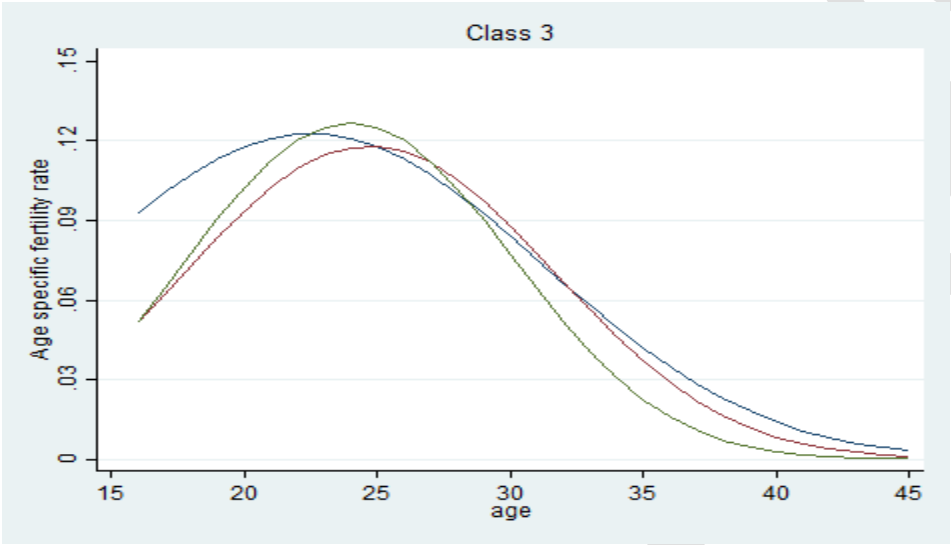


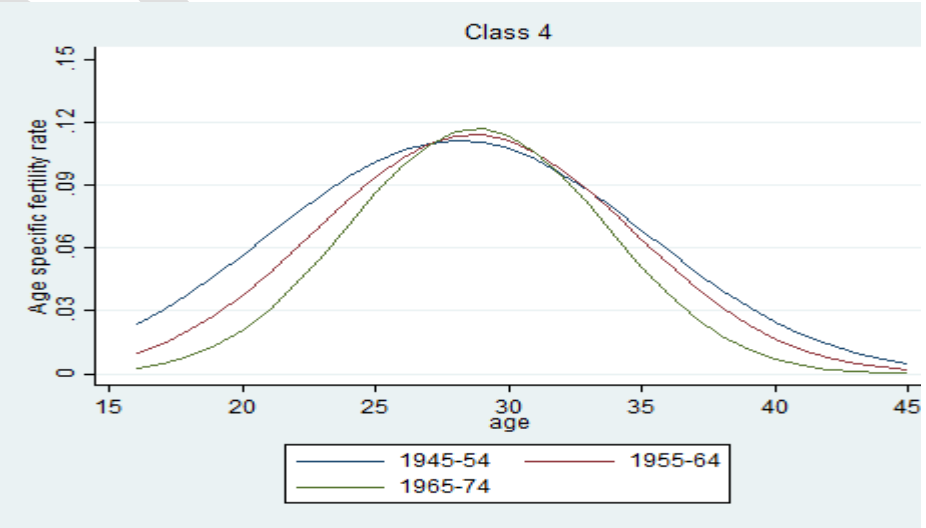



Class 3
Early marriage preceded by cohabitation
Partnership probability
0
.2
.4
.6
.8
1
15
20
25
30
35
40
45
Age


Class 4
Postponed marriage, preced by cohabitation
Partnership probability
0
.2
.4
.6
.8
1
15
20
25
30
35
40
45
Age
Never partnered
Marriage preceded by cohabitation
Direct marriage
Cohabitation
Single after separation


Class 3
Age specific fertility rate
0
.03
.06
.09
.12
.15
15
20
25
30
35
40
45
age


Class 4
Age specific fertility rate
0
.03
.06
.09
.12
.15
15
20
25
30
35
40
45
age
1945-54
1955-64
1965-74

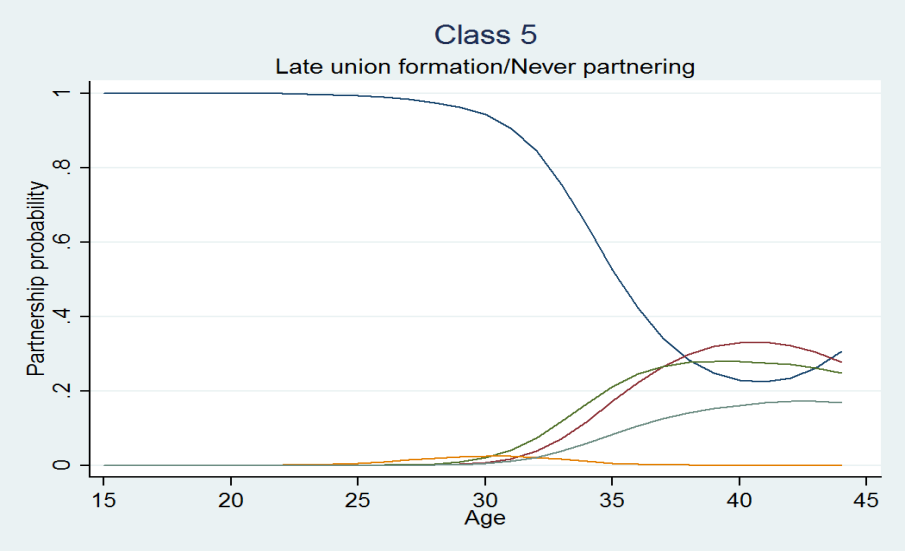
*Late union formation class*

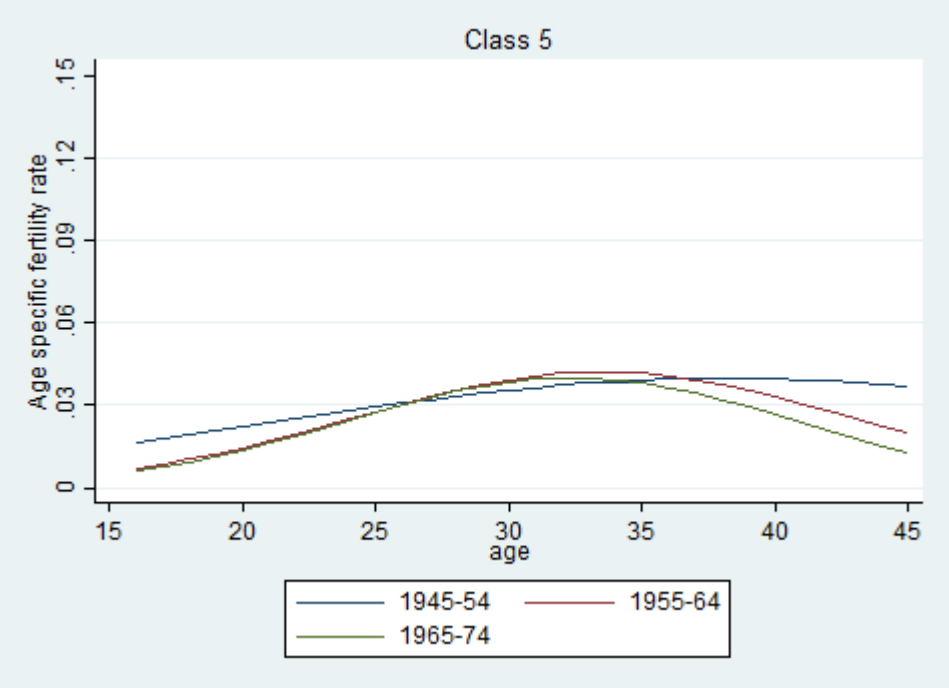
Figure E presents the fertility profile based on membership to partnership class 5 (late union formation). We note that fertility rates in this class are considerably lower than hitherto observed: classes 1-4 all demonstrated fertility peaks in excess of 0.12 per year, while the highest level seen in class 5 is not above 0.05. Broadly speaking fertility rates remain extremely low until the probability of being never partnered begins to decline, around the age of 27. Thereafter there is a slight peak in fertility rates, corresponding roughly to the peak in the probability of direct marriage. We note there are some differences in the cohort profiles, with a more even profile for the 1945-54 birth cohort, and a more distinct rise and fall in the 1955-64 and 1965-74 profiles.

*Union dissolution class*

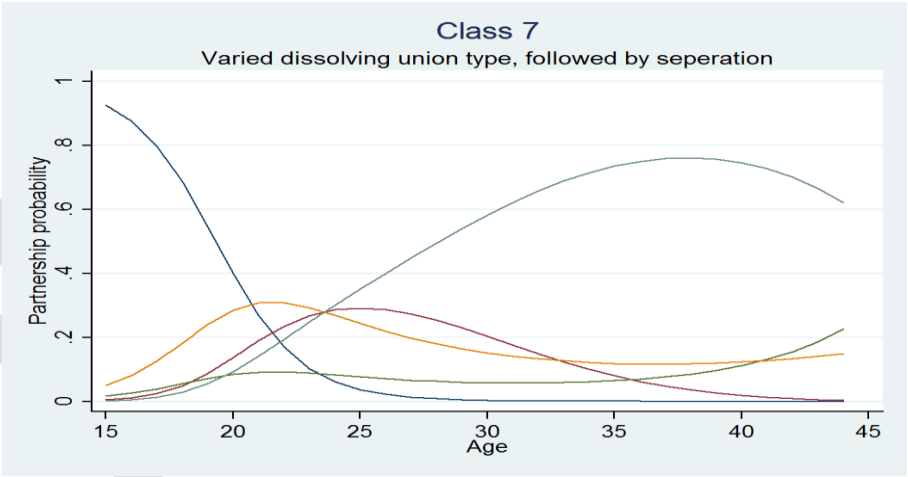
Figure Z presents the fertility profiles for the union dissolution classes, 6 (divorse limited repartnering) and 7 (varied dissolving union types). Broadly speaking, the trends observed in these classes are consistent with those seen in the direct marriage classes and marriage preceded by cohabitation classes respectively. For class 6, there is a clear correspondence between the peak in age-specific fertility and the age at which the probability of marriage peaks. Similar to classes 1 and 2 the fertility profile then falls off, with little childbearing after separating. In class 7, fertility is highest at approximately age 24, which corresponds to the age at which there is a high probability of either non marital cohabitation or marriage that was preceded by cohabitation. Again, we note that fertility prior to these peaks of partnership probability varies across birth cohort, with relatively high fertility among the oldest 1945-54birth cohort, and falling rates thereafter.

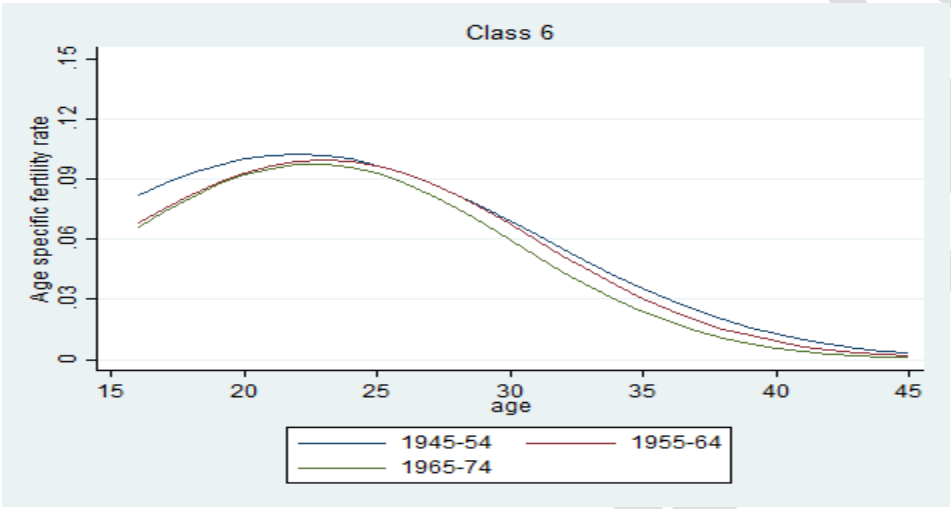
*Figure E: Partnership and fertility profiles for late union formation partnership class*

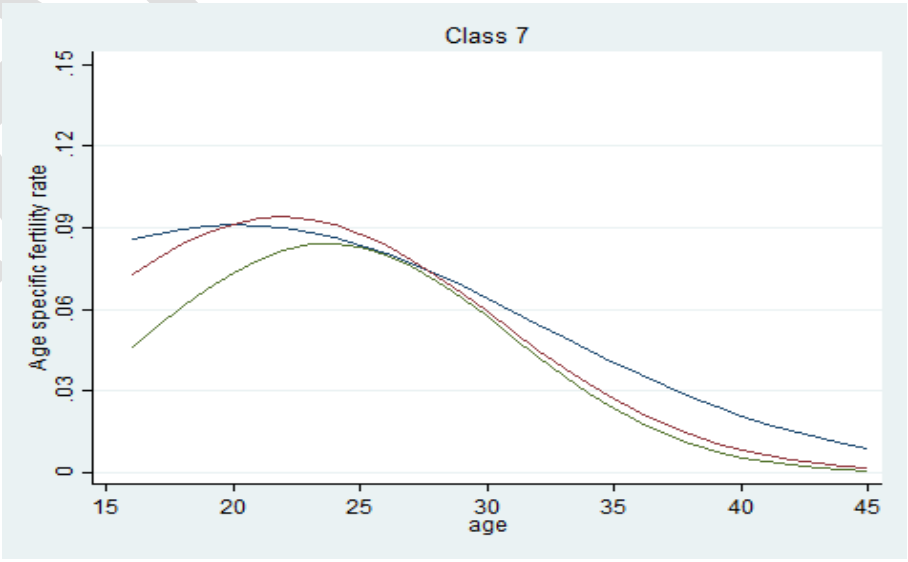



Class 6
Divorce, limited repartnering
Partnership probability
0
.2
.4
.6
.8
1
15
20
25
30
35
40
45
Age


Class 7
Varied dissolving union type, followed by seperation
Partnership probability
0
.2
.4
.6
.8
1
15
20
25
30
35
40
45
Age


Class 6
Age specific fertility rate
0
.03
.06
.09
.12
.15
15
20
25
30
35
40
45
age
1945-54
1955-64
1965-74

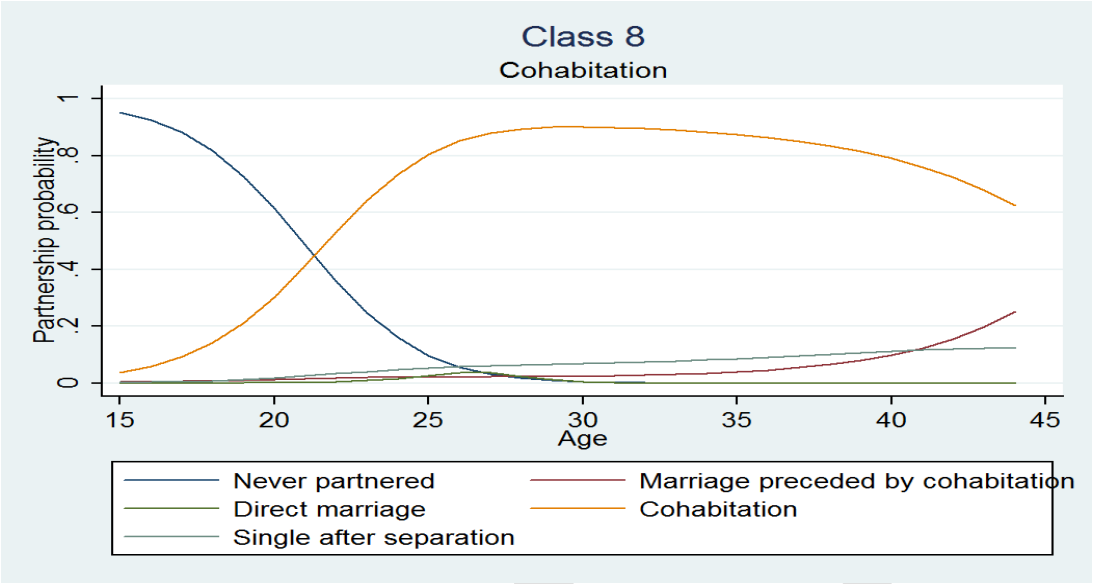

Class 7
Age specific fertility rate
0
.03
.06
.09
.12
.15
15
20
25
30
35
40
45
age

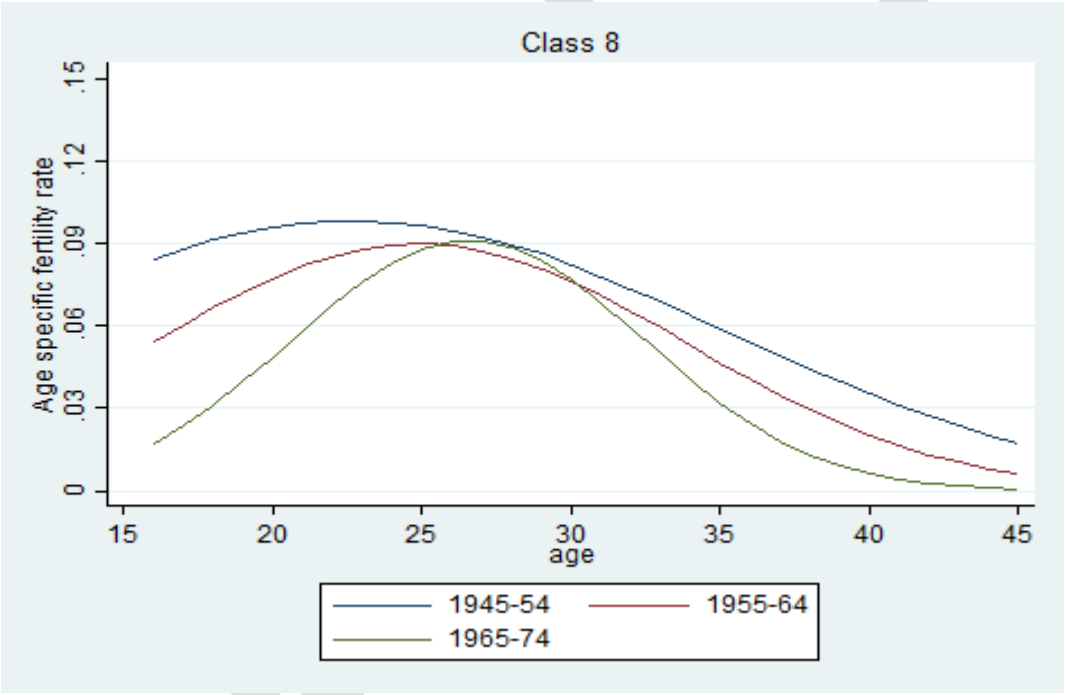
*Cohabitation class*

Figure D presents the fertility profile for the cohabitation class with the partnership profile included for reference. We note considerable change in the profile of the fertility profile for this class, particularly at early ages. For the 1945-54 cohort there is a relatively high level of fertility, which is level until around age 22 before declining. In contrast, the 1955-64 birth cohort exhibits a rather lower level of fertility in the teenage years, which increases slightly peaking around age 25. The 1965-74 birth cohort exhibits the lowest level of teenage fertility, which increases drastically until age 27, where there is a peak and following decline.

This pattern indicates a considerable shift in the relation between partnership and fertility. In early cohorts, we note that the highest fertility rates occur prior to higher probability of cohabitation, for example in the 1945-54 cohort the peak in fertility is at age 25, while the median age for entry into a cohabiting union occurs later at age 23. This perhaps indicates that union formation was precipitated by pregnancy or childbearing. In contrast, for the youngest cohort, we see that the curve for fertility mirrors that of the cohabitation curve, with a similar lag to that observed in marital classes (classes 1-4)

*Figure D: Partnership and fertility profiles for cohabitation partnership class*



*National variation*

Table C presents p values for likelihood ratio tests comparing the baseline to the extended models. In this instance, a low p-value is taken to indicate significant improvement in model fit, and hence evidence of a changing relationship between partnership and fertility. In the table, high p-values (i.e. those above 0.05) which indicate that the extended model does not improve model fit are highlighted in bold typeface, while those with moderate p-values (i.e. where the improvement in model fit is significant at the 5% but not 1% level.

Broadly speaking in the marriage classes (1-4) there is evidence of a changing relationship between partnership and fertility. The majority of p-values are below 0.05, indicating significant improvement of the extended model over the baseline model. We do note some exceptions. Specifically, Romania exhibits no evidence of the extended model improving fit, Estonia has high p-values for all classes except class 3, and the extended model improves fit for only classes 1 and 2 for Estonia.

For other partnership forms, evidence of a changing relationship between partnership and fertility is somewhat weaker. For class 5 (late union formation) only Italy, Norway and Romania show strongly significant results, all other countries providing only moderate evidence of a shift in fertility pattern, or in the case of Estonia, the Netherlands, Russia, the UK and US no evidence of an improved fit of the extended model at all. A similar pattern emerges in the partnership dissolution classes, with both classes 6 (4 p-values below 0.01) and 7 showing (3 p-values below 0.01)

demonstrating a minority of countries have changing fertility patterns within these classes.

Class 8 (cohabitation class) demonstrates greater evidence of a shift in fertility patterns. Only 4 countries (Bulgaria, Estonia, Lithuania and Romania) show very high p-values, indicating some evidence of a changing relationship between fertility and long term cohabitation in the majority of settings. That said, this evidence is not strong: only in France, Italy, the Netherlands, Norway and Russia have very low p-values, with the majority of countries demonstrating weak evidence in favour of improved model fit with the extended model (p c. 0.01-0.03)

*Table C: P-values for likelihood ratio tests for change in fertility profile across cohort by country and class*

| Country | Partnership Class | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| Belgium | 0.01 | 0.01 | 0.00 | 0.00 | 0.01 | 0.00 | **0.63** | 0.03 |
| Bulgaria | 0.00 | 0.00 | **0.29** | 0.02 | 0.01 | **0.38** | **0.75** | **0.13** |
| Estonia | **0.70** | **0.70** | 0.00 | **0.31** | **0.23** | 0.00 | 0.00 | **0.25** |
| France | 0.00 | 0.00 | **0.07** | 0.00 | 0.01 | 0.40 | 0.00 | 0.00 |
| Italy | 0.00 | 0.00 | 0.03 | 0.00 | 0.00 | **0.45** | **0.53** | 0.00 |
| Lithuania | 0.01 | 0.01 | **0.87** | **0.19** | 0.04 | 0.00 | **0.12** | **0.11** |
| NL | 0.00 | 0.00 | 0.00 | 0.00 | **0.15** | **0.09** | **0.62** | 0.00 |
| Norway | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | **0.70** | 0.00 |
| Romania | **0.34** | **0.34** | **0.32** | **0.26** | 0.00 | 0.01 | 0.04 | **0.18** |
| Russia | 0.00 | 0.00 | 0.00 | **0.19** | **0.14** | 0.00 | 0.00 | 0.00 |
| Spain | 0.00 | 0.00 | **0.30** | 0.03 | 0.01 | **0.21** | **0.35** | 0.01 |
| UK | 0.00 | 0.00 | **0.33** | 0.00 | **0.20** | 0.02 | **0.57** | 0.01 |
| US | 0.00 | 0.00 | 0.02 | 0.00 | **0.31** | 0.00 | 0.01 | 0.01 |

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**Conclusions**

This paper examines the relationship between partnership and fertility behaviour in a comparative settings. Specifically, we aim to establish whether shifts in fertility and partnership behaviour at a national level have resulted from shifting behaviours which remain fundamentally related, or whether the interrelationship between these demographic processes has also shifted. We build on previous work which established latent classes of partnership behaviour, and assess the change in fertility behaviour within this class by comparing age-specific fertility rates across birth cohorts.

In general, we identify a close relationship between union formation and fertility behaviour. In all partnership classes, the peak in age specific fertility was close to the peak in the probability of the relevant partnership form. This effect was consistent across birth cohort and country, indicating a universal relationship between membership of a partnership and childbearing. Significantly, we are not able to identify a class with widespread partnership behaviour and a lack of corresponding fertility; the only class we detected with low fertility rates was characterised by late union formation.

One significant finding was the changing fertility rates in the teenage years for women who cohabited. Typically, in the oldest birth cohort (1945-54) teenage fertility was appreciably later birth cohorts within the same class. This pattern was consistent across classes where cohabiting unions were later formalised (classes 3 and 4) and where women remained unmarried (class 8). In fact, the fertility rates among later birth cohorts had started to resemble those in the directly married classes (classes 1

and 2) for the latest cohort in both level and age profile. This is indicative that, at least from the perspective of fertility behaviour, cohabiting unions are more closely resembling marital ones whether they are later formalised or not.

We also observed the converse trend: for a majority of countries we have strong evidence of a change in the age specific fertility pattern among partnership classes characterised by marriage (classes 1-4). Since marriage remains the dominant form of partnership in the majority of countries, and also these classes are the most prevalent in our analysis (Perelli-Harris and Lyons-Amos 2013), we conclude that at least part of the shift seen in fertility behaviour in countries over time is due to a movement of fertility in isolation from trends in partnership behaviour. Similarly, the fact that there exists at least some evidence that the fertility profiles for women in class 8 (cohabitation) indicates that the rise in cohabitation does not explain changing fertility rates alone, but rather the shift in fertility within cohabitation is important.

In contrast there is little evidence of a shift in fertility behaviour for women who either partner late, or dissolve their unions. This latter point is potentially significant, given the increasing rise in union dissolution rates, either marital or non-marital. Also of significance is the fact that many countries in the post-Socialist bloc exhibited weaker evidence of a change in fertility behaviour regardless of partnership form. While these countries experienced a tumultuous transition from planned to free-market economies, with demographic behaviour changing in response to wider economic and social upheaval, it is not clear that there has been much alteration in the relationship between partnership and fertility in these settings. However, while at present the movement away from homogenous partnership careers (Sobotka 2004),

whether these countries will maintain this relationship or will experience a similar uncoupling of fertility and partnership to Western nations remains to be seen.

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