Serial monogamy:

An increasingly common pathway to childlessness[1]

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ABSTRACT

Childbearing, union entry and union dissolution are strongly interrelated processes. A conventional finding in the literatures on union formation and fertility links remaining childless to never having entered a union. A new pathway to childlessness may emerge with increasing union dissolution rates. The increasing incidence of union dissolution means that more and more persons have the opportunity to enter multiple unions throughout their life courses. At the same time, dissolution is known to hinder realization of fertility intentions. This study addresses the link between having had a certain set of union experiences and childlessness. Using a combination of sequence and cluster analysis on union histories for men and women born 1928-66 from the Norwegian Gender and Generation Survey (N=8 494), I construct a holistic taxonomy of experiences with coresidential unions of all kinds, and assess the correlation between an individual having experienced a certain type of union history and the likelihood of remaining childless at age 40. Preliminary results confirm that never having entered a union is a strong predictor of childlessness for all cohorts. However, serial monogamy – having had multiple unions – emerges as a new route to childlessness in younger cohorts.

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1. Introduction

Union formation and -dissolution and childbearing are strongly interlinked processes (Brien, Lillard & Waite 1993). Before the second demographic transition, non-marriage strongly increased the probability of remaining childless (Shorter, Knodel, & Van De Walle 1971). Never having lived with a partner remains a strong correlate of childlessness also in younger cohorts (Koropeckyj-Cox & Call 2007), but as union stability decrease, additional pathways to childlessness may emerge. Particularly, experiencing several unions of relatively short duration may increase the probability of remaining childless.

Norway is among the forerunners of the second demographic transition, displaying profound changes in patterns of family formation over the last cohorts: Among men and women born the late 1920s, first unions were exclusively marriages – intended to last for life and with strong normative expectations for childbearing (Noack 2010). In younger cohorts, union entry is not necessarily linked to an intention of childbearing in the near future. Lower union stability means that first unions are increasingly likely to be dissolved before a first child is born (Wiik & Dommermuth 2011). Thus, (repeated) union dissolution(s) emerges as a potential hindrance to entering parenthood. In spite of these substantial changes in partnership dynamics, changes in the link between union history and childlessness during the second demographic transition remain largely unexplored.

I use union and fertility histories for Norwegian men and women born 1927-1966, taken from the Norwegian GGS (N (study sample) = 8 493). Using sequence analysis, I create a holistic taxonomy of union experiences where individuals' different union histories are grouped into clusters similar in occurrence, sequencing and timing of events. To address the link between union history and childlessness, I use cluster membership as the main explanatory variable in

a logistic regression model taking the probability to remain childless as the dependent variable. The regression results reveal that membership in two of the clusters strongly predict childlessness: The conventional finding remaining unpartnered and the novelty living with multiple partners (henceforth denoted serial monogamy). Unsurprisingly, the proportion classified into the serial monogamy cluster increases markedly over cohort. Serial monogamy has thus become an increasingly important pathway to childlessness.

This study shows that new pathways to childlessness emerge as the second demographic transition unfolds – while the old pathways are no less travelled. The new patterns of partnership formation and -dissolution that emerge during the second demographic transition may be intrinsically linked to elevated levels of childlessness.

2. Theoretical framework and empirical background

2. 1 The emergence of serial monogamy

Partnership dynamics – the entry into and dissolution of unions – has changed substantially over the last decades. Postponed parenthood combined with a stable age at entry into first union means that moving in with a partner need no longer be linked to childbearing in the near future. Due to combination of high rates of union dissolution and high rates of repartnering, individuals still spend a substantial amount of time in coresidential unions – but union histories have become increasingly complex (see e.g. Wiik & Dommermuth 2011).

Serial monogamy – defined as experiencing a series of coresidential unions during the part of the life course where most childbearing takes place – is likely to emerge if union dissolution rates are high and union dissolutions happens disproportionally to certain types of individuals.

Becker (1991:341) suggests such proneness could stem either from a "quarrelsome temperament" or from being inefficient at searching in the partner market: Inefficient searchers will (on average) end up with poorer matches and thus a higher risk of union dissolution. On a similar note, the theory of the second demographic transition suggests that individuals who hold strong post-materialist values will have a lower threshold for dissolving unions than individuals with more traditional family values (Lesthaeghe 2010).

Empirical studies have documented a large number of determinants of union dissolution, of which many are characteristics of the spouses (as opposed to structural and relationship characteristics) (Lyngstad & Jalovaara 2010). Some individuals will have an above-average likelihood of dissolving their unions due to having combinations of many dissolution-promoting characteristics. Unless these individuals also are particularly reluctant to repartner, they are likely to have multiple experiences of union formation throughout their life courses. In support of this expectation, experiencing multiple unions is indeed found to be increasingly common (see e.g. Cohen & Manning 2010 (US); Bukodi 2012 (UK); Wiik & Dommermuth 2011 (Norway)).

2. 2 Union entry and childlessness

Even after the second demographic transition, the vast majority of first births are to coresiding couples (Perelli-Harris, Kreyenfeld, Sigle-Rushton, Keizer, Lappegård, Jasilioniene, Berghammer & Giulio 2012). The reasons for this are likely both a practical and normative: The combined efforts of two adults in caring and providing for a child normally exceeds the resources one parent alone can supply, and also among young persons, two-parent families remain the context considered most favourable for childbearing (Thornton & Young DeMarco 2001). As living with a partner facilitates childbearing, individuals who intend to have

a(nother) child will have more to gain from entering a union than individuals who do not (Becker 1991). Individuals who are positive towards childbearing are therefore likely to be selected into unions.

In sum, individuals who never enter a union are expected to be more likely to remain childless. Previous studies have consistently confirmed this expectation (Keizer, Dykstra & Jansen 2008; Koropeckyj-Cox & Call 2007). As there is no reason Norway should be an exception to this pattern, I expect a strong positive correlation between remaining unpartnered and remaining childless.

2. 3 Union dissolution and childlessness

Having experienced union dissolution is associated a higher probability to remain childless (Keizer et al 2008). Three mechanisms are likely to be important drivers of this correlation: First, union dissolutions hinder realisation of fertility intentions (see e.g. Hayford 2009; Liefbroer 2009). When a union is dissolved, a new partner must be found before a child can be conceived, leading to postponement – or possibly even abandonment – of fertility intentions. Second, weak childbearing desires may lower union stability, as the cost of dissolving a union will be lower for individuals who intend to remain childless. Intending to remain childless may also increase union stability if the partner holds conflicting intentions: Thomson & Hoem (1998) find that in presence of disagreement, most couples end up not having a(nother) child. Individuals with a firm intention to remain childless may thus experience that their partner leaves the union to search for a partner willing to enter parenthood. Finally, children are considered the prime example of "marital specific capital": The gain of having children is reduced if a union is dissolved (Becker 1991: 329). Most

empirical studies find that couples with (young) children have lower divorce risks than do childless couples (see e.g. Lillard & Waite 1993; Andersson 1997).

Despite the fact that experiencing a union dissolution is linked to a higher probability to remain childless, a more detailed analysis may reveal that the link between union dissolution and childlessness depends both on *when* the union is dissolved, and *how many* union dissolutions an individual experiences.

Keizer et al (2008) find that the probability of remaining childless increases with the number of years spent as single. Similarly, in a study based on sequence analysis, Mynarska, Matysiak, Rybińska, Tocchioni & Vignoli (2013) find that childlessness is higher in clusters characterized by long durations spent as single. As the time spent as single between unions increases with number of unions (all else equal), the probability of remaining childless is expected to increase with the *number* of previous unions. In support of this, Thomson, Winkler-Dworak, Spielauer & Prskawetz (2012) find that union dissolutions reduce completed fertility through increasing the time spent as single. Individuals who have experienced several union dissolutions may also be systematically different on from those who never dissolved any union on social and psychological variables. To the extent that individuals with weaker childbearing desires are more likely to dissolve unions – but no less likely to repartner – weak childbearing desires could indeed facilitate serial monogamy.

The age at which the union is dissolved may also matter for fertility consequences. Thomson et al (2012) find that the potential for fertility recuperation through repartnering is higher if unions are dissolved at young ages. The same study also finds that the effects on completed fertility are largest if unions are dissolved at young ages. However, as first births are more

easily recuperated than higher-order births, the effect of early union dissolution on the transition to parenthood could still be fully cancelled out by fertility recuperation.

Based on the mechanisms outlined above, I expect that the link between union dissolution and childlessness depend on several aspects, including the number of unions dissolved and where and in which contexts these union dissolution(s) took place. Experiencing multiple union dissolutions is expected to increase the probability of remaining childless. On the other hand, experiencing a union dissolution at young ages followed by a repartnering need not increase the probability to remain childless.

2.4 Potential differences by sex

The probability of never entering a union and/or having had multiple partners may differ between sexes. Remarriage rates are consistently higher among men than among women (also in the main childbearing years)[3], indicating that while some men have more than one partner during their childbearing years, other men remain unpartnered. In support of this, Jokela, Rotkirch, Rickard, Pettay & Lummaa (2010) find a larger variance in the number of partners among men than among women in the US – indicating that serial monogamy as well as remaining unpartnered is more common among men. As men are more likely than women to remain childless (see e.g. Figure A1 in Appendix for an example from Norwegian official statistics), one could indeed expect union histories strongly associated with childlessness to be more common among men than among women.

[3] See e.g. the remarriage rates for Norwegian men and women in the period 1978-2012 (Statistics Norway, ssb.no/statbank, Table 05737).

The proportion remaining childless given a certain union experience may also vary between men and women. There is some evidence that union entry has a more positive effect on men's fertility intentions than on women's intentions. While most men intend to have children (for the US see Heaton 1999; for Norway see Lyngstad & Noack 2005), qualitative research indicates that men to a larger extent than women transform their intentions into more concrete plans together with a partner (Marsiglio 2007). Men who have never lived with a partner may thus be more likely to never develop concrete plans for childbearing, which in turn may translate into lower fertility. Thus, one may expect that never having lived with a partner is a stronger predictor of childlessness for men than for women.

The extent to which serial monogamy increases the probability of remaining childless may also differ between men and women. Jokela et al (2010) find that having multiple partnerships increases fertility for men in the US, but not for women. However, the sex differences are driven by differences at higher parities, while the correlation between number of unions and the probability to enter parenthood is similar across sex. On the other hand, as women have usually retained the main care for children after a union is dissolved (see e.g. Skevik 2006), women may have more to gain than men from having a child while in doubt of the future of a relationship. In sum, whether – and if so, how – the correlation between serial monogamy and childlessness differs by sex remains an empirical question.

3. Data and methodological approach

3.1 Data and variables

The analyses are based on data from the Norwegian GGS (~15 000 respondents). To ensure that union histories and fertility is fully observed throughout the stages of the life course

where most childbearing takes place, the study sample is limited to men and women who were at least 40 years old at the time of the interview (i.e. birth cohorts 1927-1966). After further restricting the sample to individuals being born in Norway (excluding immigrants), I am left with a study sample of 8 493 observations.[4]

[Figure 1 about here]

The measure of childlessness is based on data on completed fertility at the time of the interview from Norwegian administrative registers (Bjørshol, Høstmark & Lagerstrøm 2010). For men and women born in 1966, completed fertility is measured at (the relatively low) age 40. This is unlikely to affect the results for women: Official statistics reveal that women who are childless at age 40 very rarely enter motherhood before age 45 (Appendix, Table A1). For men, the proportion childless decreases with between 1 and 3 percentage points from age 40 to age 50, and the proportion entering parenthood after age 40 increase over cohort. As such, the gender differences in the youngest cohorts should be interpreted with caution.

Figure 1 displays the proportion childless by cohort for men and women in the study sample. Among men as well as women, there is a tendency of a curvilinear pattern in the proportion childless: Childlessness is relatively high in the oldest cohorts, lowest in the cohorts born during the Second World War, and then increases again in the younger cohorts. While the increase in childlessness in the younger cohorts is mirrored in official statistics (Appendix, Table A1), the very oldest cohorts in the sample are not covered in this source. Other studies

[4] Missing data on union histories is imputed as follows: If the starting time for the first union is missing, it is imputed as the cohort average age of first union entry. If information of union entry n+1 is missing, it is set to the year union n was dissolved. Similarly, the dissolution time for union n, if missing, is set to the year when union n was entered. One observation is deleted, as the union history was impossible to reconstruct using these assumptions.

from other Western countries have found a relatively high level of childlessness in the inter-war cohorts (Rowland 2007), and there is also indicative evidence that childlessness was higher among Norwegian women in these cohorts (Noack 2010:39, Rowland 2007:1314). However, estimates based on historical data indicate that the oldest cohorts have higher total fertility than any other cohorts included in the sample (Brunborg 1985:39). As such, high childlessness in these cohorts seems counterintuitive, and explanations linked to selective non-response or left truncation cannot be excluded.[5]

[Figure 2 about here]

The explanatory variable of interest is based on self-reported retrospective union histories. For each age from 18 to 40 years, I record whether the respondent reports to be living with a partner. As I am interested in transitions in and out of partnerships, rather than transitions between union *types* with the same partner, I do not distinguish between cohabiting unions and marriages. Based on self-reported union histories, I construct 23 union state variables for each individual, showing the union status and order for each age from 18 to 40. The *values* of the 23 age-specific variables are defined as single without union experience (0), in first union (1), in second union (2), in third union (3), in fourth union (4) and in fifth or higher order union (5). These 23 variables are then combined into one *sequence variable*. The notion of a sequence variable is illustrated in Figure 2, showing descriptive statistics of ten of the sequence variables in the data set. Sequence variable 1 (lowest horizontal band) shows that the respondent reported not to be living with a partner from age 18 to age 27, enters a first

[5] Among women, the high level of childlessness in the oldest cohorts could also potentially be an artefact of selective non-response: Highly educated women, who have a particularly elevated level of childlessness in the older cohorts (Andersson, Knudsen, Neyer, Teschner, Rønsen, Lappegård & Vikat 2009), are overrepresented in the GGS (Bjørshol et al 2010). I plan to include available information on educational attainment and explore this question further. The U-shaped cohort pattern in male childlessness could, however, not be explained along similar lines.

union at age 28, and remains in this union until age 40. This sequence variable has two *states* (single and in first union). (Note that the *values* of the original age-specific variables constitute the *states* of the sequence variable.) The value of this sequence variable is "000000000011111111111111". In addition to information of which states occur, the value of the sequence variable shows the *order* and *duration* of the states observed.

3.2 Methods

The procedure used consists of several steps. First, data are organized into clusters using sequence analysis. The pairwise distance between all pairs of sequences is quantified using the Dynamic Hamming matching algorithm (Lesnard 2010),[6] an algorithm chosen due to its capability to capture similarity in timing between sequences.[7] To ensure that the results are not driven by the cost-setting schemes, all clusterings are also done using Optimal Matching with empirically based transition costs.[8] Reassuringly, the results are largely similar across cost-setting schemes. A similar taxonomy also emerged when clustering was done separately for men and women.

After pairwise distances are calculated, groups of similar union histories are identified using hierarchical clustering with the AGNES algorithm (Kaufman & Rousseeuw 2005), an algorithm recommended for clustering of sequence variables (see e.g. Gabadinho et al 2011).

[6] The distance between two sequences is the cheapest way of transforming one sequence into the other. This transformation is done by way of substitutions. Take the sequences A={ACB} and B={ABC}. A is transformed into B by swopping (substituting) the two last states. Each such substitution is assigned a cost inversely proportional to how common this transition is in the data set. For instance, while the transition from being single to a first union is common and thus has a low cost, the transition into a fourth union is rare, and a substitution between these two states will therefore be costly.

[7] For the same reason, all substitution costs are calculated separately by age.

[8] In Optimal Matching, indel operations are also allowed. Indel implies deleting one state from sequence A and insert a new (freely chosen) state *(indel)*. If sequence A={ABC} and B={ABB} one deletes C in the third position and inserts B in the third position, so that A=B={ABB}. I have tested specifications where the cost of indels is set to both 0.4 and 0.5 times the highest substitution cost.

The AGNES algorithm starts by grouping all data into one cluster. It then precedes stepwise, dividing one cluster in each step, choosing the solution that minimizes within-cluster variation. All analyses were performed in R, using TraMineR (Gabadinho et al 2011) for specific sequence analysis algorithms.

The number of clusters where chosen using a combination of the within-between ratio and theoretical validation (Aisenbrey & Fasang 2010). The within-between ratio decreased quite steeply up to a five-cluster solution, after which the decrease continued at a slower pace. This finding was similar across several cost-setting schemes (results available upon request). However, when the fifth cluster was split into two, a distinction between union histories consisting of one "trial union" and one long second union, and union histories characterized by a more generally high level of complexity, emerged. As these two types of union histories may have very different implications for the propensity to enter parenthood, a six-cluster solution was kept. Further division of clusters neither had a strong impact on the within-between ratio nor revealed patterns of theoretical interest in data.

The final step is to estimate logistic regression models of childlessness using cluster membership and cohort as independent variables. These models allow me to quantify the level of childlessness in various cohorts for men and women and test hypotheses on the importance of cohort for these levels. The explanatory variables of interest are a set of dummy variables for cluster membership. Birth cohort is grouped into 5-year categories, with the exception of the oldest cohorts (1927-1934), who were grouped together to obtain sufficient statistical power.

3.3 Validity

Sequence analysis is a data mining technique, and does not belong to the family of stochastic methods. Though this has the advantage of not invoking any assumptions of the underlying data generating process, it comes at the cost of not providing any quantitative measures of statistical generalizability. In other words, one cannot quantify the probability of Type I error, and may risk giving meaningful interpretation to patterns stemming from sample variability. However, as the probability that patterns in the sample deviates strongly from patterns in the population decreases with sample size, the relatively large sample size strengthens the probability that the results are not generated by chance.

[Figure 3 about here]

4. Results and discussion

This section presents descriptive and multivariate results. I start by a description of union histories typical for each cluster, followed by a description of the proportion childless within each cluster. I then turn to multivariate models to assess the link between cluster membership and childlessness, as well as the change in this link over time. Finally, I asses compositional effects by describing how membership in clusters with high childlessness changes over cohort.

4.1 Description of clusters

Descriptive statistics of union histories for each cluster are shown in Figure 3, while Table 1 show the proportion of men and women belonging to each cluster. A total of three clusters with different "standard" biographies emerged. The common denominator for these union patterns is that everyone enters a union at some point during their life course, and almost all

remain in the first union at age 40. In total, 70 per cent of men as well as women belong to one of these clusters. Between these clusters, membership is determined by time of union entry: Individuals who enter a first union before age 22 are classified into the cluster Early Standard, individuals who enter their first union after age 27 belong to the Late Standard cluster, while those entering unions between these ages fall into the Standard cluster.

[Table 1 about here]

In two clusters, all individuals experience a union dissolution at some point in the life course. In the cluster Trial Union, all individuals have entered a first union at age 25, and almost all first unions are dissolved before age 30. Individuals quite quickly enter into a second union, which in about 90 per cent of the cases is still intact at age 40. As shown in Table 1, 5,7 percent of men and 7,5 per cent of women belong to this cluster. Compared to the cluster Trial Union, individuals in the Serial Monogamy cluster enter their first union later, and spend more time as single between unions. A non-negligible proportion of individuals in this cluster experience more than three unions. Serial Monogamy is a relatively large cluster – comprising of 12 per cent of men and 15 per cent of women. Finally, the cluster Unpartnered is dominated by individuals with no union experience up to age 40. 10 per cent of men and 7 per cent of women are classified into this cluster.

4.2 Childlessness by cluster: Descriptive results

The proportion childless by cluster, calculated separately for men and women, is displayed Figure 4. The cluster Unpartnered stands out with very high childlessness – amounting to 71 per cent among women and 59 per cent among men. Women are slightly more likely to have a child in spite never having lived with a partner than are men. Having several partners is also

associated with an elevated probability of remaining childless: About 1 in 4 of the men and 1 in 5 of the women in the cluster Serial Monogamy are childless at the time of the interview.

[Figure 4 about here]

The clusters Early Standard and Standard stand out with the very lowest childlessness among men as well as women (Figure 4). In the Late Standard cluster, the proportion childless is higher, particularly among women. This could reflect the fact that men and women in this cluster enter unions later because they have a weaker preference for childbearing – or that they are not able to have a child because they enter unions late and therefore encounter subfecundity problems. Membership in the cluster Trial Union is associated with a very low probability to remain childless – illustrating that union dissolution is not necessarily linked to childlessness.

4.3 Childlessness by cluster: Multivariate results

To test whether the linkages between cluster membership and the probability to remain childless are statistically significant, I estimate logistic regression models taking the probability to remain childless as the dependent variable (Table 2). To allow for full interactions by sex, models are estimated separately for men and women. The mid column displays results from tests of the statistical significance of differences by sex, conducted in a joint model with full interactions by sex (available upon request). Estimating the joint model stepwise reveals that while men are more likely than women to remain childless in a simple model (including cohort dummies only), the sex difference is fully explained by union history (inclusion of dummies for cluster membership).

[Table 2 about here]

As indicated by the descriptive statistics, individuals belonging to the cluster Unpartnered are by far more likely to remain childless than individuals in the cluster Standard (reference category). The finding confirms to expectations from previous studies, and is likely explained by the selection of individuals with strong childbearing desires into unions, as well as the fact that living with a partner facilitates childbearing. The correlation is significantly stronger among men than among women.

Of the two clusters characterised by frequent union dissolutions, only Serial Monogamy correlates strongly – and significantly – with the probability to remain childless. Compared to those classified in the Standard cluster, the odds for remaining childless is almost 5 times higher for men and more than 3 times higher for women who belong to the Serial Monogamy cluster. Estimates for men and women are significantly different at the 5 per cent level. Most members of the cluster Trial Union have experienced union dissolution, but the average childlessness in this cluster does is not differ significantly from the Standard cluster. The difference in proportion childless between the Trial Union and Serial Monogamy clusters indicate that the link between union stability and fertility depends on how the union dissolution is situated in the life course: While an early union dissolution followed by quick repartnering does not increase the probability of remaining childless, a series of union dissolutions does.

Additionally, individuals in the Trial union cluster spend most of their fertile years living with a partner, while members of the Serial Monogamy cluster spend a considerable amount of time living alone between unions. Thus, the higher childlessness in the Serial Monogamy

cluster is in line with the finding that the probability to remain childless increases with time spent as single (Keizer et al 2008). The differences between the clusters could also be attributed to different selection mechanisms between the clusters: Individuals who experience a series of union dissolutions are likely to be a select group, potentially displaying below-average childbearing desires (and thus a relatively low cost of union dissolution). Individuals in the Trial Union cluster need not be particularly select with respect to preferences for family formation: A first union may turn out to be unstable due to sheer bad luck in the searching process.

The proportion childless in the Late Standard cluster is also significantly higher than in the Standard cluster. Late Standard is a stronger predictor of childlessness among women than among men. Though statistically insignificant, the gender difference confirms to expectations, as female fecundity decreases more strongly with age than does male fecundity. It is noteworthy that while membership in the Late Standard cluster is a stronger predictor of childlessness than is Serial Monogamy for women, the opposite is true for men. Though these differences in estimates are not statistically significant, the observed sex differences confirm to expectations.

Early Standard is the only cluster displaying a significantly lower proportion childless individuals than does the Standard cluster. The differences in childlessness between the three standard clusters thus confirm to the timing differences between these clusters: The probability to remain childless decreases with age at union entry. While entering a union early is likely to facilitate the realisation of desired fertility, selection mechanisms may also be at work, as individuals may enter unions early *due to* positive attitudes towards childbearing.

[Table 3 about here]

Change over cohorts

To investigate whether the correlation between cluster membership and probability to remain childless changes significantly over time, I add interaction terms between cohort and cluster membership to Model 1a and b. Regression results are displayed in Table 3 (Model 2a and b). Compared to men born 1940-1944 (reference category), membership in the Unpartnered cluster is a stronger predictor of childlessness for men in the younger cohorts: Interactions terms between membership in the Unpartnered cluster and belonging to one of the younger cohorts are consistently above one, and statistically significant with one exception. No similar trend emerges for women.

The interaction estimates also show a tendency for the cluster Serial Monogamy to be an increasingly important predictor of childlessness, for men as well as women. However, these interaction terms are never statistically significant from one, and the zero hypothesis of no difference over cohort cannot be refuted. There is a tendency for the Late Standard cluster to be a weaker predictor of childlessness over time for women, though the estimates (with one exception) are far from reaching statistical significance. The clusters with the lowest proportion childless – Trial Union and Early Standard – display no significant change over time compared to the Standard cluster.

[Figure 5a and b about here]

Based on the estimates in Model 2, I calculate the predicted probability of remaining childless by cluster and cohort, shown in Figure 5a (men) and 5b (women). The predicted probabilities

illustrate that while the proportion remaining childless is increasing markedly within the Unpartnered cluster, and more modestly within the Serial Monogamy cluster, the proportion remaining childless is relatively constant within each of the other clusters. This indicates that increase in childlessness among men is partly driven by an increase in childlessness among men who have never lived with a partner.

4.4 Compositional effects: Changes in cluster membership over cohorts

The previous section showed that, with the exception of the increase in childlessness among unpartnered men, the proportion childless within each cluster has been relatively stable across cohort. However, as partnership dynamics change, some union patterns may be increasingly common, while others may become less widespread. Such cohort changes in partnership dynamics could in turn change the pathways to childlessness. To assess whether membership in the three clusters with a high proportion childless changes with cohort, I estimate three binomial logistic regression models, taking the membership in the clusters Unpartnered, Serial Monogamy and Late Standard as the dependent variables, and cohort dummies as the only explanatory variables. Regressions are estimated separately for men and women, and results are displayed in Table 4 (Model 3a-c).

[Table 4 about here]

The odds of being classified into the Serial Monogamy cluster increases steeply over cohort, for men as well as women. Among men, the predicted probability of being classified into this cluster increases from 0.04 in the oldest cohorts to 0.22 in the youngest cohorts. As such, serial monogamy has emerged as a standard type of experience that is shared by a fairly large share of the population. As previously shown (Figure 5a and b), the proportion childless

within this cluster has not decreased over cohort. Thus, as an increasing number of individuals experience serial monogamy, living with several partners in the main childbearing years has become an increasingly important pathway to childlessness.

Compared to women born 1940-1944, younger women have slightly lower odds of belonging to the Unpartnered cluster – but the difference is significant only for the youngest cohort. No similar decrease is observed among men. In the youngest cohort, the predicted probability of belonging to the Unpartnered cluster is 0.09 among men and 0.05 among women, a difference is consistent with the marked sex difference in childlessness in the younger cohorts. Among men as well as women, the odds of belonging to the Unpartnered cluster is significantly higher in the oldest cohort than in the reference group. This finding resonates well with the high proportion childless found in the oldest cohort (Figure 1). Finally, the odds of belonging to the Late Standard cluster decreases over cohort for men – but not for women.

4.5 Study limitations

Two important caveats should be noted. The first regards data quality: As the research question requires data on cohabitation, union histories by necessity must be self-reported (rather than constructed based on data from administrative registers). Using self-reported union histories invokes the familiar problems of recall error. Recall error is generally found to lead to under-reporting of life events (Lin, Ensel, & Lai 1997), and such underreporting is found be more severe among individuals of relatively old age at the time of the interview (Kreyenfeld, Hornung, Kubisch & Jaschinski 2010). As such, one risks underestimating the complexity of union histories in the older cohorts. In addition, studying change over time based on data collected at one time point implies that data are left truncated. Childless individuals have higher mortality rates than peers who have started a family (see e.g. Grundy

& Kravdal 2008), and may thus be underrepresented in the sample. Reassuringly, the comparison with official statistics shown in the Appendix shows no such indication of underrepresentation.

The second caveat regards the methodological approach. Sequence analysis allows for considering the life course as a whole. This necessarily comes at the price of not being able to study the impact of each union formation and -dissolution event separately. However, as shown in Section 2, there is already a rich literature addressing the impact of union entry and dissolution on fertility behaviour in general and the transition to parenthood in particular. Still, studies that provide more holistic descriptions of the (typical) life courses that emerge from these transitions have so far been scarce. As such, studies based on sequence analysis neatly complement previous studies of separate parity transitions.

5. Conclusion

The contribution of this study is threefold. First, I take a holistic approach to union histories, showing how typical union histories are correlated with the probability to remain childless. This approach reveals that the correlation between union dissolution and childlessness depends on how the event is situated in the life course: While an early union dissolution followed by repartnering does not increase the probability to remain childless, serial monogamy does. The results also confirm the conventional finding that remaining unpartnered is linked to a strongly elevated probability of remaining childless.

Second, I find that that the interrelationship between union histories and childlessness varies between men and women. In line with previous studies, I find that the level of childlessness is

higher among men than among women. The higher level of childlessness among men is fully explained by differences in union histories between men and women. Further exploration of differences by sex reveals that being unpartnered or serial monogamous is a stronger predictor of childlessness for men than for women. The implications of changing partnership dynamics for childlessness thus seem to be larger for men than for women.

Finally, no previous study has described how the link between full union histories and childlessness changes as the second demographic transition unfolds. While having no union experience remains a strong predictor of childlessness throughout the period of study, serial monogamy emerges as an additional pathway to childlessness as the second demographic transition unfolds. Partnership dynamics linked to relatively high levels of childlessness – particularly for men – thus seems to be deeply rooted in the second demographic transition. Thus, the prospects for reducing levels of male childlessness may be poor. Furthermore, in contexts where the second demographic transition has not yet fully taken effect, the level of childlessness – particularly for men – may be expected to increase in the future.

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Tables

Table 1: Distribution of men and women by cluster.

	MEN		WOMEN	
	Freq.	Per cent	Freq.	Per cent
Early Standard	738	17,7	1568	36,3
Standard	1720	41,2	1212	28,1
Late Standard	530	12,7	249	5,8
Unpartnered	413	9,9	304	7
Trial Union	238	5,7	323	7,5
Serial Monogamy	539	12,9	659	15,3
Sum	4178		4315	

Table 2: Model 1: Logistic regression of the probability to remain childless on birth cohort and cluster membership. Separate models for men and women.

	MEN					WOMEN			
	O.R.		C.I. Upper	C.I. Lower	Diff.	O. R.		C.I. Upper	C.I. Lower
Intercept	0,07	***	0,05	0,1		0,08	***	0,06	0,11
Birth cohort									
1927-1934	0,91		0,6	1,39		1,05		0,69	1,59
1935-1939	0,64	.	0,4	1,01		0,97		0,62	1,51
(ref=1940-1944)	1		.	.		1		.	.
1945-1949	0,63	*	0,42	0,94		0,84		0,56	1,26
1950-1954	1,23		0,85	1,79		1		0,67	1,47
1955-1959	1		0,69	1,47		0,8		0,54	1,2
1960-1966	1,09		0,76	1,56		1,05		70,73	1,51
Cluster									
(ref=Standard)									
Serial Monogamy	4,84	***	3,65	6,42	*	3,17	***	2,34	4,28
Early standard	0,47	**	0,3	0,74		0,58	**	0,41	0,81
Trial union	0,98		0,57	1,71		1,17		0,74	1,87
Late standard	2,57	***	1,89	3,5		3,56	***	2,44	5,2
Unpartnered	37,6	***	28,1	50,31	**	19	***	13,83	26,11
X^2(df.)			981 (11)	***				582,9(11)	***
AIC			2698,7					2667,7	
N			4 178					4 315	

*Note: Estimates are presented as odds ratios. Stars denote conventional significance levels: *** < 0.001, **<0.01, *<0.05, . <0.1. The mid column displays the results of tests of the statistical significance of sex differences (conducted in a joint model with full interactions by sex).*

Table 3: Model 2: Logistic regression of the probability to remain childless on birth cohort, cluster membership, and interactions between the two variables. Separate models for men and women.

	MEN			WOMEN		
	O.R.	Lower C.L.	Upper C.L.		Lower C.L.	Upper C.L.
Intercept	0,08 ***	0,05	0,12	0,07 ***	0,04	0,13
Birth cohort						
1927-1934	1,26	0,67	2,37	1,38	0,64	2,98
1935-1939	0,68	0,32	1,46	1,58	0,7	3,56
1940-1944	1	.	.	1	.	.
1945-1949	0,38 *	0,16	0,88	0,75	0,3	1,85
1950-1954	1,22	0,64	2,32	1,14	0,49	2,65
1955-1959	0,79	0,37	1,65	0,71	0,27	1,87
1960-1966	0,78	0,4	1,54	0,88	0,38	2,05
Cluster						
(ref= Standard)						
Serial Monogamy	4,4 **	1,82	10,64	2,11	0,81	5,53
Early standard	0,71	0,26	1,94	0,57	0,23	1,46
Trial Union	0,98	0,12	7,85	3	0,75	12,03
Late standard	2,78 **	1,33	5,8	7,87 ***	2,84	21,85
Mainly unpartnered	21,66 ***	10,21	45,96	22,4 ***	9,21	54,49
Interaction terms						
Serial Monogamy *						
1927-1934	0,31	0,05	1,81	1,44	0,35	5,89
1935-1939	1,15	0,22	6,09	0,55	0,11	2,8
(ref=1940-1944)	1	.	.	1	.	.
1945-1949	1,65	0,46	5,93	1,96	0,53	7,19
1950-1954	1,1	0,37	3,25	1,69	0,5	5,65
1955-1959	1,28	0,41	4	2,22	0,6	8,14
1960-1966	1,47	0,51	4,28	1,87	0,58	6,06
Early Standard *						
1927-1934	0,45	0,05	4,34	1,28	0,37	4,47
1935-1939	0,85	0,14	5,31	0,91	0,25	3,3
(ref=1940-1944)	1	.	.	1	.	.
1945-1949	0,6	0,09	3,83	1,2	0,32	4,52
1950-1954	0,57	0,14	2,37	0,7	0,19	2,52
1955-1959	0,73	0,16	3,4	1,56	0,4	6,07
1960-1966	0,79	0,17	3,55	1,1	0,32	3,82
Trial Union *						
1927-1934	(a)	.	.	(a)	.	.
1935-1939	(a)	.	.	(a)	.	.
(ref=1940-1944)	1	.	.	1	.	.
1945-1949	5,72	0,5	65,65	0,65	0,09	4,54
1950-1954	0,49	0,03	9,08	0,36	0,06	2,21
1955-1959	0,94	0,08	10,93	0,35	0,05	2,27
1960-1966	1,19	0,12	11,59	0,54	0,11	2,72

Late Standard *								
1927-1934	0,79		0,29	2,16	0,52		0,13	1,97
1935-1939	0,6		0,16	2,23	0,19	*	0,04	0,9
(ref=1940-1944)	1		.	.	1		.	.
1945-1949	1,32		0,37	4,76	0,64		0,15	2,71
1950-1954	0,7		0,23	2,09	0,31		0,07	1,43
1955-1959	1,19		0,38	3,71	0,43		0,1	1,94
1960-1966	1,08		0,38	3,09	0,51		0,13	2,02
Unpartnered *								
1927-1934	0,66		0,24	1,82	0,41		0,13	1,27
1935-1939	1,43		0,46	4,41	0,48		0,14	1,59
(ref=1940-1944)	1		.	.	1		.	.
1945-1949	3,42	*	1,07	10,94	1,05		0,29	3,82
1950-1954	1,77		0,62	5,05	0,97		0,28	3,45
1955-1959	2,74	.	0,87	8,61	1,03		0,27	3,9
1960-1966	3,52	*	1,19	10,42	2,31		0,67	8,02
X^2(df.)			1010,3(41)***				616,1 (41)***	
AIC			2729,3				2 694,6	
N			4 178				4 315	

*Note: Estimates are presented as odds ratios. Confidence limits give 95 per cent confidence intervals. Stars denote conventional significance levels: *** < 0.001, **<0.01, *<0.05, . <0.1. (a) indicates that the parameter could not be estimated due to quasi-complete separation of data points.*

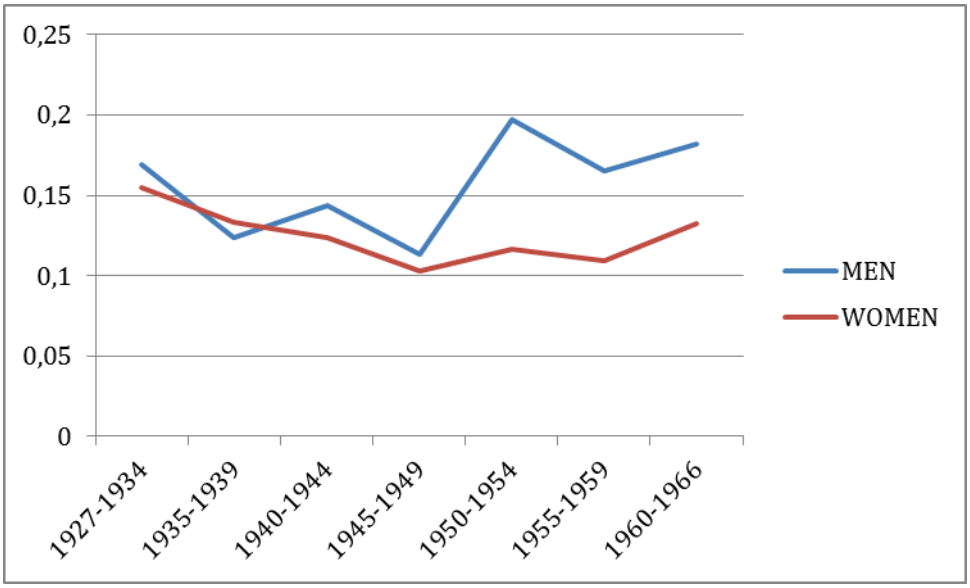
Table 4: Model 3: Logistics regression of the probability to belong to the clusters Unpartnered (Model 3a), Serial Monogamy (Model 3b), and Late Standard (Model 3c) on cohort dummies. Separate models for men and women.

	A) Unpartnered				B) Serial Monogamy				C) Late Standard			
MEN	O.R.	C.I. (O.R.)			O.R.	C.I. (O.R.)			O.R.	C.I. (O.R.)		
Intercept	0,09	[0,07;	0,13]	***	0,07	[0,05;	0,10]	***	0,17	[0,13;	0,21]	***
1927-1934	1,6	[1,23;	2,41]	*	0,57	[0,31;	1,03]	.	1,6	[1,15;	2,22]	**
1935-1939	1,42	[1,24;	2,18]		0,51	[0,27;	0,96]	*	1,03	[0,72;	1,49]	
(ref=1940-1944)	1	.	1,00]		1	.	.		1	.	.	
1945-1949	1,08	[1,23;	1,61]		1,77	[1,16;	2,70]	**	0,71	[0,50;	0,99]	*
1950-1954	1,37	[1,22;	2,03]		2,72	[1,82;	4,09]	***	0,69	[0,48;	0,98]	*
1955-1959	1,06	[1,23;	1,59]		3,28	[2,21;	4,88]	***	0,69	[0,48;	0,98]	*
1960-1966	1,02	[1,22;	1,50]		4,01	[2,74;	5,86]	***	0,75	[0,54;	1,03]	.
X^2(df.)		10,9(6)	.			186,2(6)	***			39,9	***	
N		4 178				4 178				4 178		
WOMEN												
Intercept	0,08	[1,18;	0,11]	***	0,14	[0,10;	0,18]	***	0,05	[0,03;	0,08]	***
1927-1934	1,79	[1,24;	2,74]	**	0,43	[0,27;	0,69]	***	1,55	[0,92;	2,64]	
1935-1939	1,43	[1,26;	2,26]		0,52	[0,32;	0,83]	**	1,47	[0,84;	2,57]	
1940-1944	1	.	.		1	.	.		1	.	.	
(ref=1945-1949)	0,74	[1,27;	1,19]		1,13	[0,80;	1,61]		1,26	[0,75;	2,12]	
1950-1954	0,68	[1,27;	1,08]		1,52	[1,09;	2,12]	*	0,9	[0,52;	1,54]	
1955-1959	0,74	[1,26;	1,17]		1,77	[1,27;	2,46]	***	1,48	[0,90;	2,44]	
1960-1966	0,68	[1,25;	1,04]	.	2,14	[1,57;	2,91]	***	0,96	[0,58;	1,58]	
X^2(df.)		38,8(6)	***			124,2 (6)	***			10,9(6)	.	
N		4 315				4 315				4 315		

*Note: Estimates are presented as odds ratios. Confidence limits give 95 per cent confidence intervals. Stars denote conventional significance levels: *** < 0.001, **<0.01, *<0.05, . <0.1.*

Figures

Figure 1: Proportion childless by grouped birth cohorts (GGS data). Predicted probabilities from logistic regression of the probability to remain childless on cohort dummies. Separate models for men and women.



Note: The measure is based on data on completed fertility from administrative registers, measured at the time of the interview.

Figure 2: Index plot of 10 sequence variables. Each sequence variable describes the union status over 23 years.

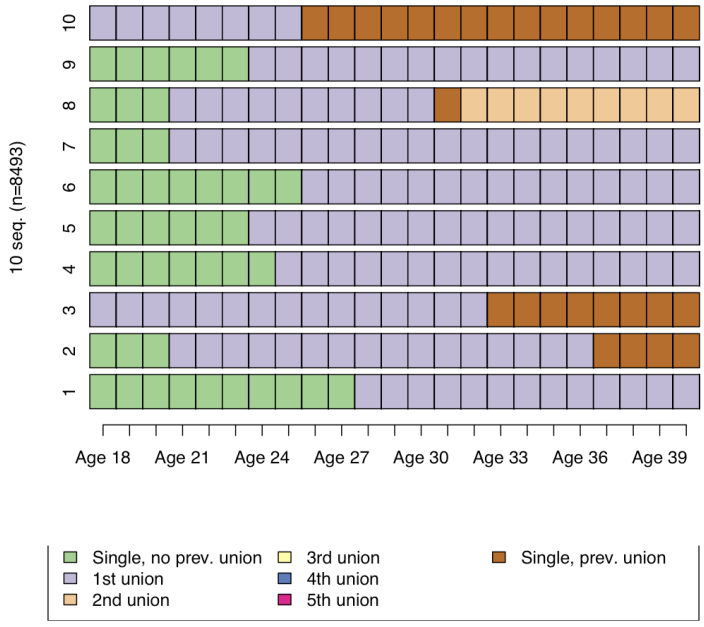


Figure 3: Descriptive statistics for the chosen 6-cluster solution. Men and women, all cohorts.

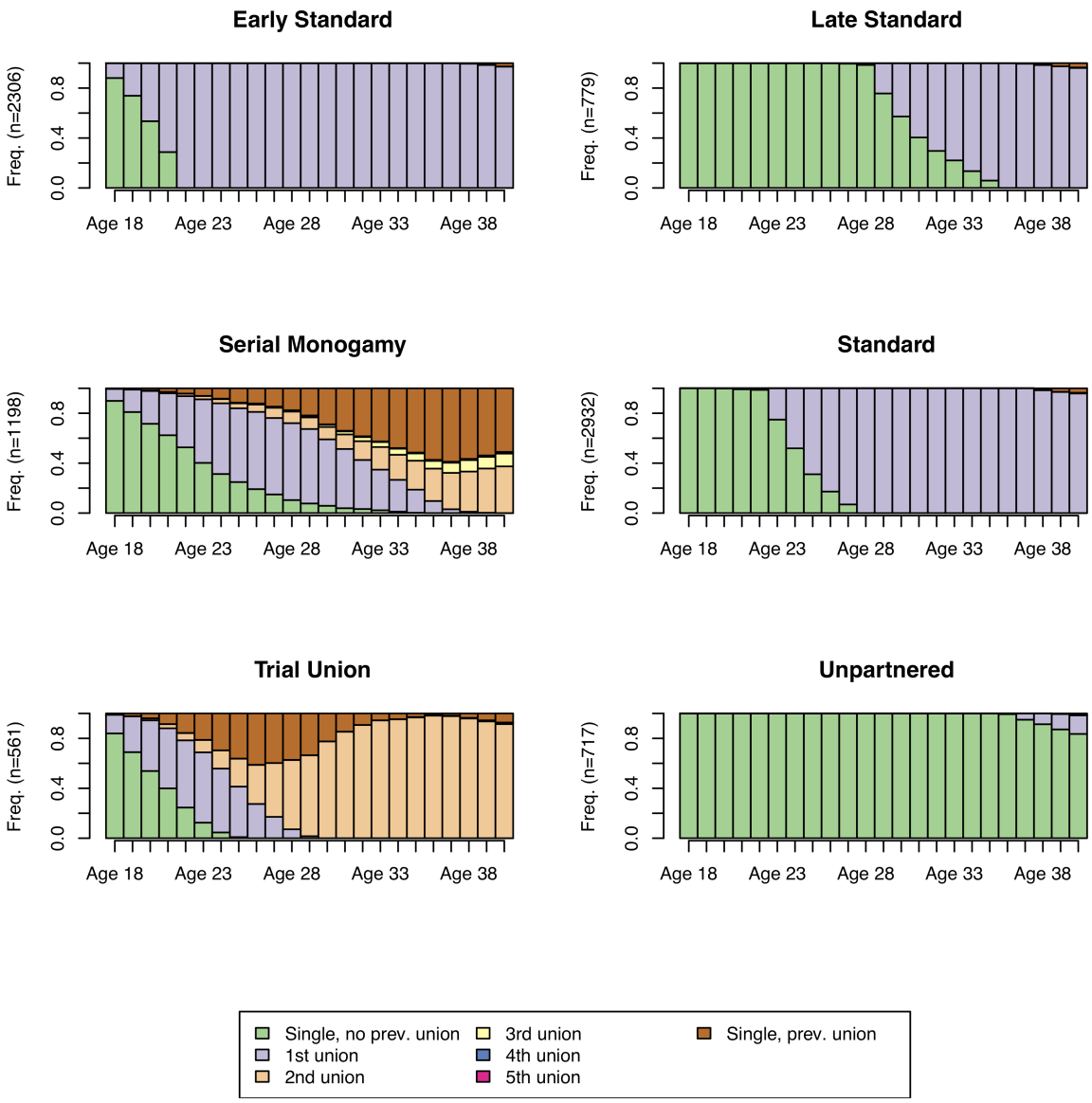


Figure 4: Proportion childless by cluster membership. Separate calculations for men and women. N=4 178 men and 4 178 women.

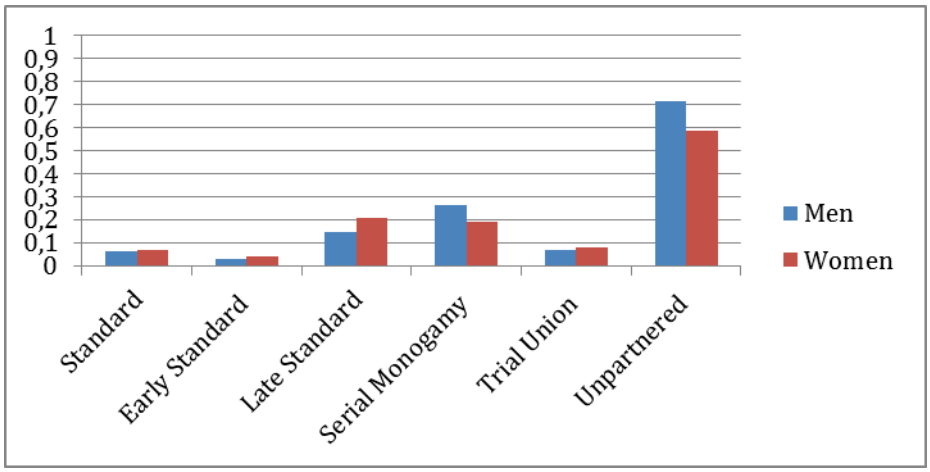
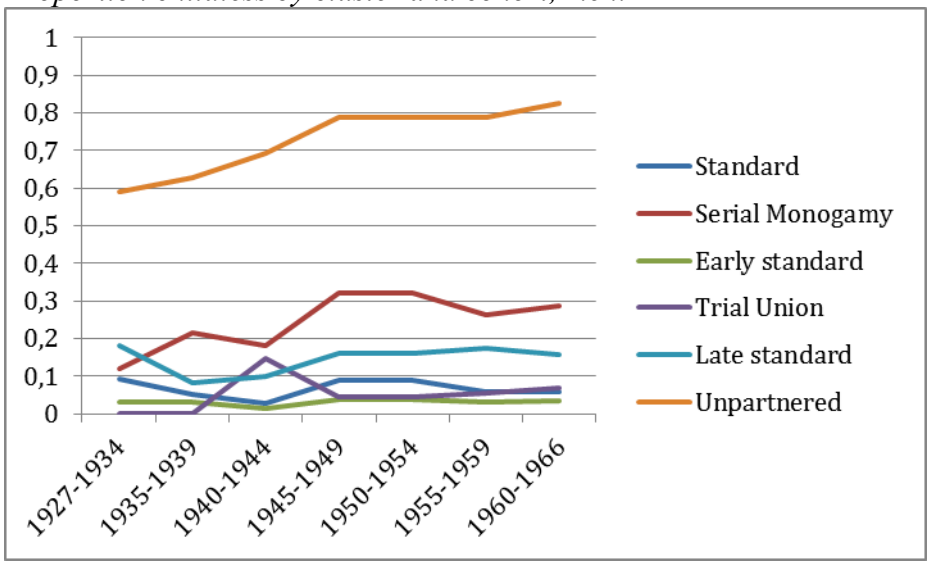
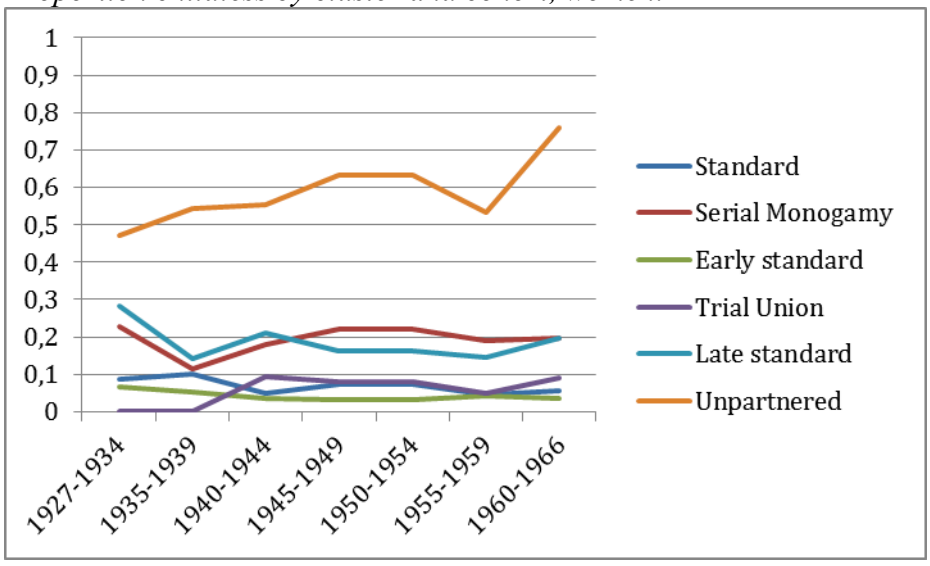


Figure 5a: Proportion childless by cluster and cohort, men.



Note: The figure shows predicted probabilities based on the estimates in Model 2a (Table 3).

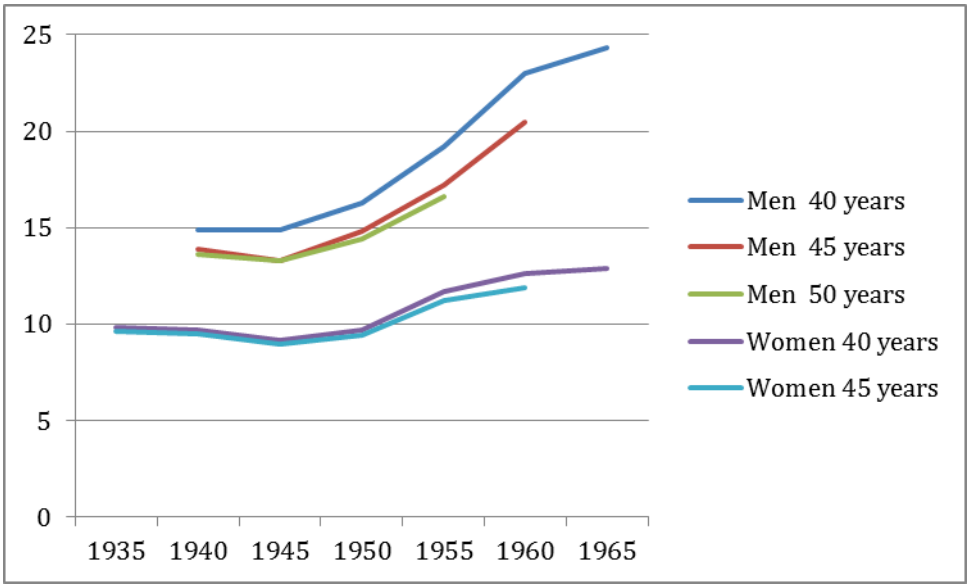
Figure 5b: Proportion childless by cluster and cohort, women.



Note: The figure shows predicted probabilities based on the estimates in Model 2a (Table 3).

Appendix

Figure A1: Proportion childless for selected birth cohorts based on completed fertility at age 40, 45 and 50.



Note: Data from Statistics Norway, www.ssb.no/Statbank, Table 07870. To ensure comparability with the GGS data, I use official statistics on completed fertility measured in 2008.