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Union Histories of Dissolution: What Can They Say About Childlessness?

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Abstract This study investigates how the association between union dissolution and childlessness depends on life course context. Data on union histories and fertility are taken from the Norwegian GGS. To observe union histories up to age 45, I include men and women born 1927–1962. I further condition on having experienced at least one union dissolution before age 45, giving a study sample of 883 men and 1110 women. To capture the life course context of union dissolutions, I group union histories similar in timing, occurrence and ordering of events using sequence analysis. Eight well-clustered groups of union histories are distinguished. Four consist of life courses dominated by a long first or second union and display low levels of childlessness. The highest proportion childlessness is found among individuals who entered a first union late and dissolved it quickly. Groups characterised by long spells alone after a dissolution or many short unions also displayed a high proportion of childlessness. In contrast to findings from the USA, neither union trajectories nor their link with childlessness varies by educational attainment.

Keywords Childlessness · Sequence analysis · Union dissolution · Second demographic transition

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1 Introduction

The increase in childlessness has gained considerable attention from demographers (Tanturri et al. 2015). Similarly, a large demographic literature concerns the dissolution of unions [see Lyngstad and Jalovaara (2010) for an overview]. Nevertheless, our understanding of the link between the two phenomena remains limited. Its nature is less than obvious: while dissolving a union can hinder childbearing (Keizer et al. 2008), it could also lead to repartnering followed by an extra birth (Thomson et al. 2012). The age at which the first union is formed, the duration until its dissolution, and perhaps also its type probably matter for the relationship between union dissolution and childlessness. This points towards a less explored research question: Does the life course context of a union dissolution matter for its relationship with childlessness?

With union dissolution and repartnering on the rise, serial co-residence—the experience of at least two co-residential unions—has become increasingly common [see Cohen and Manning (2010) (US), Dommermuth and Wiik (2014) (Norway)]. In the USA and the UK, serial co-residence is consistently linked to lower education (Bukodi 2012; Edin and Kefalas 2011; Lichter and Qian 2008) and is part of a "two-tier family system"—where family complexity is concentrated among the poor and lower educated [Furstenberg (2014) see also McLanahan (2004)]. With less income inequality (Cingano 2014), lower payoffs to education (Reisel 2013), and a more extensive welfare state (Esping-Andersen 2013) the life chances of young people vary less by educational attainment in Norway than in the USA. Potentially, this could lead to a weaker or altogether different educational gradient in family complexity (Thomson et al. 2014). Dommermuth and Wiik (2014) find that Norwegians with basic education are *least* likely to have lived with more than two partners at age 35, and Lappegård and Rønsen (2013) find that Norwegian men both in the lower and upper parts of the educational distribution are more likely to father children with more than one partner. However, there are also several indications of higher family complexity among the lower educated in Norway, found for women's multipartner fertility (Thomson et al. 2014), marriage (Kravdal and Rindfuss 2008), and divorce (Lyngstad 2004). These mixed results indicate that the educational gradient in family complexity in Norway must be assessed empirically for each of its many components.

To further evaluate the external validity of the US patterns of family complexity, quantitative techniques that give holistic descriptions of union trajectories are required. Sequence analysis (SA) allows for considering multiple aspects of union histories simultaneously—timing, ordering, and union type. SA is a family of quantitative techniques that allow researchers to put "the "course" back in the life course" (Aisenbrey and Fasang 2010), incorporated into social sciences through a tradition of narrative positivism (Abbott 1992). Paraphrasing, I aim to retain the *history* in union histories though the application of sequence analysis. The methodological approach bears resemblance to Mynarska et al's (2015) study of work histories, union histories and childlessness among Polish and Italian women. However, Mynarska et al. (2015) neither divert explicit attention to union

dissolution and how this event is situated in the life course, nor do they assess educational patterns and compare patterns across. In all these aspects, the current study is novel.

Norway is a substantively interesting example as a forerunner of the Second Demographic Transition (Lesthaeghe 2010). Union dissolution is relatively common, and cohabitation is a socially accepted and even normatively prescribed part of the process of family formation (Syltevik 2010; Wiik 2009). Data of union histories of men and women born in cohorts 1927–1962 are drawn from the Norwegian Gender and Generations Survey (GGS). The sample is restricted to individuals who experienced at least one union dissolution before age 45 (*N* study sample = 883 men and 1110 women). The union histories are constructed based on retrospectively reported information on union status for ages 18–45. The relatively large sample size of the Norwegian GGS facilitates detailed descriptions of the subgroup who have experienced a union dissolution before age 45.

The aim of this paper is twofold. First, I give a detailed description of the typical life courses that include at least one union dissolution. The "at-will" nature of co-residential relationships and hence their frequent dissolution is at the core to our understanding of late modern or "pure" relationships (Giddens 1993; Lesthaeghe 2010). But do individuals who dissolve relationships really display fully heterogeneous and "individualised" union histories, or do we rather see that new regularities and patterns emerge as norms change? Furthermore, I explore whether the strong educational gradient in serial co-residence found in the USA (Lichter and Qian 2008) is mirrored in the Norwegian context.

Second, after grouping similar union histories, I explore which types of union histories are linked to a higher probability of remaining childless. While Jokela et al. (2010) have found that serial co-residence correlates with higher fertility among men only in the USA, the relationship between union trajectories and childlessness has been surprisingly unexplored. Doing this, I move beyond the finding that on average union dissolution is linked to childlessness and explore *under which circumstances* union dissolutions are linked to a higher probability to remain childless. I further investigate whether the link between union history and childlessness depends on educational attainment. This part of the analysis again relates to a large literature in the USA, where serial co-residence is linked to low socioeconomic status and early childbearing among women. By assessing whether the nexus of early childbearing and very high family complexity among the lower educated generalises to the Nordic context, this study extends our understanding of how context shapes the social stratification of family complexity.

2 Theoretical Framework and Empirical Background

2.1 The Surge in Union Dissolutions and New Patterns in Union Histories

As union dissolution rates surge, new patterns in union histories emerge. The emergence of serial cohabitation—experiencing at least two spells of unmarried co-residence—has attracted considerable attention in the USA and UK. In these

contexts, serial cohabitation is strongly linked to lower education and economic marginalisation (Bukodi 2012; Lichter and Qian 2008), a pattern probably driven by individuals with lower educational attainment both having a lower threshold for entering unions (Sassler and Miller 2011), and a higher risk of union dissolution (Lyngstad and Jalovaara 2010). By counting the number of union spells, regardless of union type, Dommermuth and Wiik (2014) document the rise of serial co-residence in Norway. In contrast to findings from the USA and the UK, they find that among individuals with union experience, serial co-residence is positively related to educational attainment. This pattern is in line with the expectations from the Second Demographic Transition theory, where highly educated "forerunners" are the first to take to new family forms (Lesthaeghe 2010).

A union dissolution can be followed by very different life course trajectories: it could mark the start of a complex union history (Lichter and Qian 2008), since an early union dissolution could have a destabilising effect on subsequent life course events, and people who experience union dissolutions early may be a select group (Poortman and Lyngstad 2007). However, as union dissolution becomes more common, individuals who experience a short spell of "co-residential dating" (Heuveline and Timberlake 2004) are likely to be a less select group and need no longer have a higher dissolution risk if they repartner.

Despite the large scholarly attention that has been given to changes in patterns of union formation and dissolution, few attempts have been made to give detailed, holistic descriptions of the patterns of union histories that emerge from the increase in union dissolutions. The first research question of this paper fills this gap in the literature by describing the patterns of union histories that involve at least one union dissolution in the main childbearing years. For this research question, it is crucial to employ a quantitative method that can simultaneously take into account the time of first union entry, union type, number of unions entered, and time spent as single between unions.

2.2 Complex Union Trajectories and Childlessness

Individuals who have dissolved a co-residential union are more likely to remain childless (Keizer et al. 2008). Previous studies point to several mechanisms that could drive this association. Union dissolutions increase childlessness by hindering realisation of fertility intentions (Hayford 2009; Liefbroer 2009). Disagreement over childbearing plans may lead to postponed or forgone births (Thomson 1997), as well as tension and union dissolution. Furthermore, to the extent that common children stabilise unions, childless couples may be more likely to break up as they lack this "protective effect" (Andersson 1997; Lillard and Waite 1993; Hart et al. 2017). As having and raising children remain among the core functions of unions, individuals with weak childbearing desires may be more likely to leave their partner, other things being equal. Thomson et al. (2012) show that the effect of dissolving a union on fertility outcomes can be alleviated by quick repartnering. Union trajectories following a dissolution are likely to be influenced by childbearing desires: individuals gain more from quick repartnering if they have not yet reached their

intended family size. Finally, Thomson et al. (2012) show that union dissolution has a lesser impact on fertility in scenarios where family formation is postponed.

Union type may in itself matter for the link between dissolution and childlessness. Particularly, Heuveline and Timberlake (2004) suggest that (childless) cohabitation is sometimes understood as co-residential dating. Similarly, focus groups consisting of young Norwegian couples of fecund age understood the decision to get married as intrinsically linked to the intention of having children (Lappegård and Noack 2015). As processes towards marriage and entering parenthood seem interlinked (Perelli-Harris et al. 2012), it can be expected that those ever married more often will be parents at age 45, even if they eventually divorce.

Previous studies indicate that the life course context of the dissolution matters for its link with childlessness. Hence, the second research question expands upon previous research by exploring the link between types or groups of union histories including a union dissolution before age 45. Based on theory and previous research, it is expected that individuals who have ever been married are more likely to become parents. Furthermore, union trajectories that display several features linked to childlessness—such as late union entry and quick dissolution—are expected to be particularly strong predictors of childlessness.

2.3 Educational Attainment in the Norwegian Context

In the USA, both very complex union histories and their combination with childbearing are by far the most widespread among the parents with lower education (Furstenberg 2014). An interplay of socioeconomic and demographic factors seems to set off a process of cumulative disadvantage. Facing a precarious job market, the lower educated are less likely to attain the living standard that is culturally associated with married life, leading many to postpone or forego marriage (Edin and Kefalas 2011). Beyond affecting union type, such economic stressors are likely to put strain on any co-residential relationship. Limited educational and economic opportunities seem to lower the threshold of early childbearing (Edin and Kefalas 2011), and unplanned pregnancies at a young age are associated with "shotgun cohabitation", and subsequent union instability (Guzzo and Hayford 2012). With a weaker position in the partner market, single mothers will often face the choice between a partner of "lesser quality" and remaining single (Qian et al. 2005; Graefe and Lichter 2007). Bzostek et al. (2012) find that mothers with fewer economic resources (net of an array of controls, including mother's education, health and attitudes) repartner quicker—indicating that economic necessity is among the drivers of (quick) repartnering.

Many of the factors thought to cause the US dividend in family complexity operate with less force in the Norwegian context. As higher education is free in Norway, not obtaining a college degree will to a lesser extent be a direct consequence of lack of economic resources. The economic opportunities of young people without college education are vastly better in Norway than in the USA, due to both lower earnings differentials by educational attainment (Reisel 2013) and lower overall income inequality (Cingano 2014). A more comprehensive welfare

state cushions against economic consequences of spells of unemployment or economic inactivity (Esping-Andersen 2013) and reduces the economic vulnerability of single mothers (Kjeldstad 1998; Tjøtta and Vaage 2008). Furthermore, while the USA shows evidence of education-specific family practices, with non-marital childbearing in unstable relationship being the standard in some lower educated groups (Edin and Kefalas 2011), practices regarding the order of family formation events seem to be more consistent across educational groups in Norway (Ellingsæter and Pedersen 2013; Lappegård and Noack 2015).

In contrast to perspectives that link family complexity to marginalisation, the theory of the Second Demographic Transition (Lesthaeghe 2010) proposes a value shift towards autonomy and self-realisation as the root cause of increased family complexity. The highly educated are forerunners in this process of value change, and the first to develop a taste for "pure relationships" (Giddens 1993), easily dissolved when no longer emotionally and intellectually fulfilling. This leads to the expectation that the most complex union trajectories will be found among the highly educated. With early emergence of modern cohabitation and non-marital childrearing, the Nordic countries have been termed forerunners of the Second Demographic Transition (Lesthaeghe 2010), suggesting a pattern of more complex union histories among the highly educated in Norway than in the USA. In earlier contributions, Lesthaeghe and Surkyn (1988) suggest the forerunners of value change prefer not only "at-will" relationships but also a child-free life. As fertility recuperated in "post-materialist" countries, Lesthaeghe (2010) suggested that also those holding "post-materialist" values will have children if institutions facilitate the combination of paid work and childrearing. However, an intention to have children and still pursue completely "pure" and at-will relationships, leading to very complex family constellations, seems at odds with ideals both for stability of parous couples (Liefbroer and Billari 2010) and of intensive parenting found to have a strong foothold particularly among highly educated parents [see Stefansen (2008) for Norway, Lareau (2000) for the USA]. Seeing these studies in conjunction leads to an expectation that conditional on a complex union history, the highly educated are more likely to remain childless.

Empirical evidence on the educational stratification of complex families in Norway is mixed. Some studies indicate that Norway stands out with a forerunner pattern, with complex union trajectories (also) among the highly educated (Dommermuth and Wiik 2014; Lappegård and Rønsen 2013), while others show that childbearing in cohabiting unions is more common among the lower educated also in Norway (Perelli-Harris et al. 2010) and multipartner fertility (Thomson et al. 2014). Hence, educational gradients of different aspects of family complexity in Norway must simply be evaluated empirically.

The perspectives above give contrasting expectations of the educational gradient of union complexity. The perspectives emphasising a "pattern of disadvantage" suggest that the lower educated will display higher complexity, while the Second Demographic Transition suggest the highest complexity among the highly educated. Despite their different models of explanation, both perspectives give an expectation whereby conditional on a complex union history, the lower educated will be more likely to have children. As stratification by educational attainment in general is less

sharp in Norway than in the USA, the concentration of the combination of childbearing and complex union histories among the lower educated may also be less marked in the Norwegian context.

3 Data and Methods

3.1 Data and Operationalisation

The analysis is based on data from the Norwegian Generations and Gender Survey ($\sim$ 15,000 respondents) (Bjørshol et al. 2010; Vikat et al. 2007). To ensure that union histories and fertility are 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 45 years old at the time of the interview (i.e. the birth cohorts 1927–1962). After further limiting the sample to individuals born in Norway (i.e. excluding immigrants), I am left with a study sample of 3862 men and 3956 women.[1] Retaining only individuals who have experienced at least union dissolution before age 45 gives a final study sample of 883 men and 1110 women.

I construct variables describing union histories (Sect. 3.1.1) and the transition to parenthood (Sect. 3.1.2). For comparability across cohorts, all measures of union and fertility behaviour are censored at age 45. I also include information on highest educational attainment at the time of the interview, based on information from administrative registers.

3.1.1 Variables Describing Union Histories

Information on (co-residential) union histories is constructed based on retrospective self-reporting of union histories in 2007–2008.

Union status is updated monthly and recorded from the month the respondents turn 18 to the month the respondents turn 45. For each of these 324 months, I construct a variable that contains information on whether or not the respondent lives with a partner, and, if yes, the order and type of this union. This gives a total of 11 values, as shown in Table 1. These 324 variables are then combined into one sequence variable (cf. Sect. 3.2.1). The values of the monthly variable shown in Table 1 then constitute the state alphabet of the sequence variable. Importantly, as fertility behaviour is the dependent variable in a regression where sequence/cluster membership is the predictor (Model 2), information on fertility behaviour is *not* included in the sequence variables.

After grouping union histories that are similar using sequence and cluster analysis (see Sect. 3.2.1), I give a detailed description of the patterns that emerge. For this purpose, I construct four variables. *Number of unions* is a continuous variable giving the total number of unions the respondents have entered into from

[1] For a total of 105 unions in this sample, the previous union was reported as dissolved before the next union was entered into. For these unions, the time of union dissolution was set to two months before entry into the next union.

Table 1 State alphabet for sequence variable for union histories

	1st union	2nd union	3rd union	4th union	5th union
In union					
Cohabiting, never married	1	2	3	4	5
Married, direct or after cohabitation	11	12	13	14	–
Not in union					
No union experience	0				
Union experience	99				

No cases of 5th- or higher-order unions that involved marriage were observed

age 18 up to turning 45, including current union (if any). *Number of union dissolutions* gives the total number of unions the respondent has dissolved before age 45. *Years as single with union experience* gives the sum of (completed) years the respondent has spent living alone after the dissolution of a union. The variable does not distinguish between number of previous unions. The means of these variables are shown separately by cluster membership in Table 2.

Finally, as one selected aspect of socioeconomic position, I include a set of three dummy variables for the respondent's highest completed educational attainment, *High school*, higher education of *Lower degree*, and higher education of *Higher degree*. Compulsory (basic) education is the omitted reference category. An indicator for missing educational information is included, but not reported. While interesting patterns in childlessness have emerged using a more fine-grained classification employing register data (Lappegård and Rønsen 2005), the sample size limits the possibilities for more detailed investigations.[2]

3.1.2 Measures of the Transition to Parenthood

Respondents in the Norwegian GGS were presented with a list of birth dates of any children ever born and linked to them in the administrative registers, and allowed to supplement and correct this information (Bjørshol et al. 2010). With register data as a starting point, the fertility measure is less susceptible to recall error than the union histories. Based on the birth date of the first-born child, I define respondents as childless if they have not had their first child at age 45, and otherwise as parents.

For individuals defined as parents, I utilise the birth date of the first-born child, as well as union histories (see below) to construct a categorical variable describing the union context of the transition to parenthood. This variable is used to describe how the union context of the transition to parenthood, if it occurs, varies by cluster (see Sect. 4.3). The variable takes the values *Before 1st union* if the first child is born before the first union is entered, *In first union* for respondents who have a first child in or after the month they enter a first union, but before the first union is dissolved,

[2] While it could also be of great substantive interest to also look at work or earnings histories, these are not available in data for the full sample.

Table 2 Characteristics of union histories by cluster

	2nd Cohab.	1st Cohab.	Complex	Postponed	1st Marriage	2nd Marriage	Long pause	Alone after
Men								
Number of unions	2.09	1.53	2.75	1.16	1.50	2.12	1.69	1.31
	[2.05; 2.13]	[1.45; 1.61]	[2.61; 2.88]	[1.09; 1.22]	[1.41; 1.60]	[2.00; 2.25]	[1.57; 1.81]	[1.16; 1.45]
Age first union entry	23.15	22.65	21.34	30.83	22.67	24.40	22.90	20.64
	[22.64; 23.66]	[22.22; 23.08]	[20.75; 21.92]	[30.04; 31.61]	[22.21; 23.13]	[22.99; 25.81]	[22.23; 23.56]	[18.94; 22.35]
Number of union dissolutions	1.20	1.08	2.20	1.01	1.03	1.15	1.10	1.13
	[1.14; 1.25]	[1.04; 1.11]	[2.11; 2.30]	[0.99; 1.03]	[1.00; 1.06]	[1.00; 1.30]	[1.03; 1.18]	[1.02; 1.23]
Years as single with union experience	3.20	3.33	8.69	6.93	2.45	3.12	7.57	17.10
	[2.85; 3.55]	[2.89; 3.76]	[7.49; 9.88]	[6.16; 7.70]	[2.05; 2.85]	[2.30; 3.95]	[6.59; 8.54]	[16.23; 17.98]
Childless	0.11	0.08	0.23	0.48	0.06	0.08	0.09	0.33
	[0.07; 0.15]	[0.04; 0.12]	[0.14; 0.32]	[0.39; 0.57]	[0.02; 0.10]	[−0.01; 0.16]	[0.02; 0.16]	[0.19; 0.48]
Women								
Number of unions	2.05	1.49	2.76	1.18	1.32	2.06	1.52	1.37
	[2.02; 2.08]	[1.41; 1.57]	[2.62; 2.90]	[1.09; 1.27]	[1.26; 1.39]	[1.99; 2.12]	[1.44; 1.60]	[1.24; 1.50]
Age first union entry	20.84	21.16	20.15	30.28	20.18	21.55	21.33	20.30
	[20.41; 21.26]	[20.72; 21.61]	[19.66; 20.64]	[29.34; 31.21]	[19.83; 20.53]	[20.54; 22.55]	[20.84; 21.81]	[19.67; 20.93]
Number of union dissolutions	1.17	1.11	2.27	1.01	1.01	1.19	1.10	1.05
	[1.12; 1.22]	[1.06; 1.16]	[2.17; 2.37]	[0.99; 1.04]	[1.00; 1.03]	[1.07; 1.31]	[1.05; 1.15]	[0.99; 1.11]
Years as single with union experience	3.50	4.27	9.84	8.03	3.33	3.75	9.83	17.87
	[3.09; 3.90]	[3.75; 4.78]	[8.86; 10.82]	[7.01; 9.04]	[2.92; 3.75]	[2.81; 4.70]	[8.99; 10.67]	[17.09; 18.64]
Childless	0.10	0.07	0.23	0.38	0.06	0.08	0.10	0.20
	[0.07; 0.14]	[0.04; 0.11]	[0.15; 0.31]	[0.26; 0.49]	[0.03; 0.10]	[0.00; 0.15]	[0.05; 0.14]	[0.10; 0.30]

Means calculated separately for men (upper panel) and women (lower panel). 95% CI in brackets

and *After first union* for respondents who dissolve their first union before they have a first child. I also calculate mean age at the transition to parenthood conditional on being a parent at age 45. The distribution of respondents on the values of these variables is shown separately by cluster in Table 5.

3.2 Methods

3.2.1 Finding Patterns in Union Histories: Sequence Analysis

To answer the first research question, identifying patterns in union histories involving at least one dissolution before age 45, data were organised into clusters using sequence analysis. The main results in this paper are estimated using spell-sensitive Optimal Matching (OMspell) (Studer and Ritschard 2016), as implemented in the TraMineR package for R (Gabadinho et al. 2011), version 2.0-6. The OMspell algorithm emphasises duration of spells (Studer and Ritschard 2016, p. 508), which fits the research question at hand: durations of spells as single or partnered are known to matter for childlessness (Keizer et al. 2008; Thomson et al. 2012), while the order of the states is largely given [one can neither move backwards (union 2 → union 1), nor skip a step (union 2 → union 4)].

The distance or dissimilarity between each pair of trajectories was defined as the minimum cost of transforming one sequence into the other. OMspell considers each spell of states (for instance a first union lasting for 23 months) as a distinct state. Costs for transforming one trajectory into another comprise two elements: (1) the cost of compressing or extending spells of the same state and (2) the cost of transforming one state into another. Two operations can be used for such transformations: one state can be *substituted* for another, or one state can be deleted and another inserted ("indel"). To detect similarity between trajectories that differ in timing, it is cheaper to compress/extend states than to entirely replace them (Studer and Ritschard 2016, p. 494). Costs of transformations were given by empirical state-specific substitution costs[3] and an indel set to 1.

After pairwise distances were calculated, groups of similar union histories were identified using hierarchical clustering with the agglomerative nesting (AGNES) algorithm (Kaufman and Rousseeuw 2005), an algorithm recommended for clustering of sequence variables (Gabadinho et al. 2011).[4] All analyses were performed in *R*, using TraMineR for specific sequence analysis algorithms (Gabadinho et al. 2011).

An eight-cluster solution was chosen using a combination of the within–between ratio, average silhouette widths and theoretical validation (Aisenbrey and Fasang 2010), shown in Sect. 4.4. Average silhouette widths capture the average similarity of each observation to the cluster in which it is located, relative to its similarity to

[3] i.e. the distance between two states is inversely proportional to the frequency of transition between these two states (Lesnard 2010, p. 401).

[4] In general, AGNES algorithms start with *N* clusters, merging clusters stepwise until it reaches one cluster with *N* observations (Kaufman and Rousseeuw 2005, p. 199). For calculation of dissimilarity between clusters, the Ward method is applied, as suggested for sequence analysis (Gabadinho et al. 2011).

the nearest-neighbour cluster, ranging from − 1 to 1, where higher values indicate better-defined clusters (Rousseeuw 1987). Within–between ratios quantify the variation within clusters relative to the variation between clusters. This ranges from 0 to 1, where lower values indicate a better cluster solution (Aisenbrey and Fasang 2010).

The robustness of the results to cost-setting scheme was checked by comparing the results to eight-cluster solutions obtained by "standard" or second-generation Optimal Matching (OM), also with empirically estimated transition costs (Studer and Ritschard 2016). In the robustness checks (results available upon request), indel costs are set to 1 (OM) and 0.4 times (OM04) the maximum transition cost, which amounts to 0.8 with the estimated transition matrix. Lower costs of indels mean they will be used more often and shift emphasis from timing of events to whether states occur (Aisenbrey and Fasang 2010, p. 426). Finally, I also estimate distances using the dynamic Hamming distance (DHD) matching algorithm (Lesnard 2010). The DHD algorithm does not use "indels" and estimates transition costs separately for each position in the sequence variable, giving a strong emphasis on timing at the cost of a potential for overfitting (Studer and Ritschard 2016). To the extent that respondents remember the occurrence of events more precisely than their timing, the emphasis on timing will add some noise from recall error.

The first research question is answered by a detailed description of the groups that emerged from the sequence analysis and subsequent clustering. Sequence index plots ordered by the time respondents left the initial state (single without union experience) are shown in Fig. 1. Sequence index plots give a descriptive overview of all unions in the sample, while retaining the order of the states (Fasang and Liao 2014; Piccarreta and Lior 2010). Table 2 describes characteristics of union histories, as well as educational attainment, by cluster using simple means calculations.

3.2.2 The Relationship Between Union Histories and Childlessness: Regression Analysis

The second research question regards the relationship between union history and the probability of remaining childless, and whether this link varies with educational attainment. I address this question by estimating linear probability models (LPMs) taking the probability of being childless at age 45 as the dependent variable. Using LPM for dichotomous outcomes ensures comparability across models (Mood 2010; Wooldridge 2010). Heteroscedacity is handled by way of robust standard errors. As there is marked cohort change in childlessness and in the predictors of interest (union history and educational attainment), controls for birth cohorts are included as a set of dummy variables.[5] The LPM is built stepwise, starting with dummy variables for cluster membership only (1a), adding cohort dummies (1b) and a set of dummies for educational attainment (1c), and interaction terms between the education dummies and cluster membership (1d). I also estimate a model including

[5] Birth cohorts are grouped into 5-year categories with two exceptions: the oldest cohorts (1927–1934) are grouped together for statistical power, and the youngest cohort (1960–1962) has a narrower range. A quadratic specification of birth cohort did not improve the efficiency of the model, but failed to capture the strong nonlinearities in the cohort trend, and a dummy specification was hence preferred.

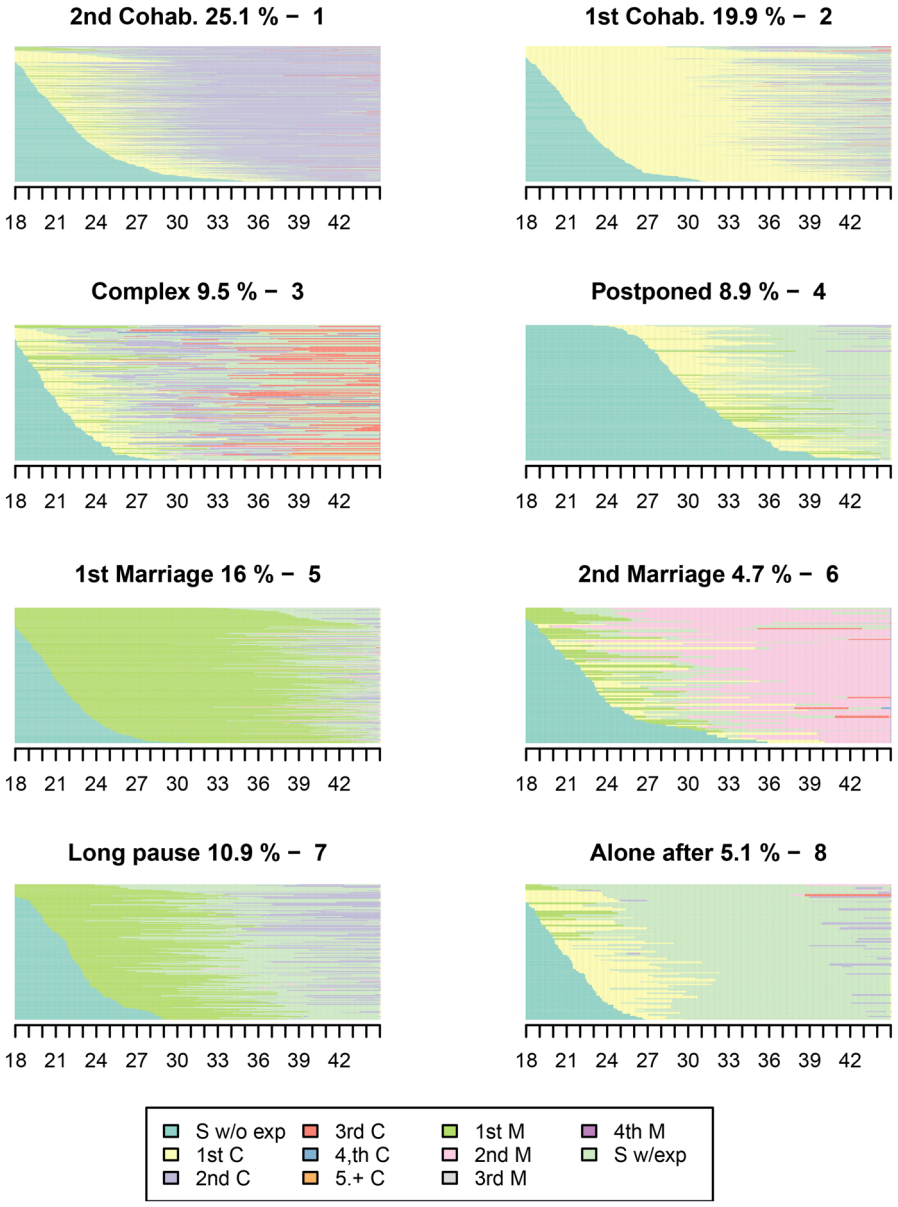

Fig. 1 Sequence index plot by cluster. Eight-cluster solution obtained by OMspell. Results calculated and displayed for men and women jointly. The *x*-axis shows age in years. The *y*-axis shows proportions in each state in the current month

the interaction between cluster and cohort (1e) (Appendix Table 6).[6] To cast additional light on the link between union history and childbearing, I also describe how the union context of childbearing varies with cluster using simple mean calculations (Table 5).

All regression models and mean calculations were done separately by sex to allow for heterogeneous patterns. Estimations were done in *R*.

4 Results

4.1 Patterns of Union Histories: Results from Sequence Analysis

To answer the first research question, describing patterns in union trajectories involving at least one dissolution, this section describes the groups of union histories that emerged from the sequence analysis. I present results for an eight-cluster solution. Based on the patterns in union histories, the clusters are named: *1st Marriage*, *1st Cohabitation*, *2nd Marriage*, *2nd Cohabitation*, *Long pause*, *Postponed*, *Complex*, and *Alone after*. The distribution by state within each cluster for each month is displayed visually in as sequence index plots in Fig. 1. Figure 1 also shows the per cent of the *weighted* sample grouped into this cluster.[7] Furthermore, Table 2 shows various characteristics of union histories by cluster (variable descriptions in Sect. 3.1.1). As everyone in the sample has experienced union dissolution, clusters differ with respect to the number and timing of unions entered into and dissolved, as well as their type (marriages vs. cohabitation).

In four of the clusters, trajectories are dominated by one union. These clusters are characterised and named by the order and type of this dominating union. Union histories dominated by a long first union are grouped into the clusters *1st Marriage* (sometimes preceded by cohabitation) and *1st Cohabitation* (never transformed into marriage). Union type distinguishes the clusters, which are relatively even in size (16 and 20% of respondents, respectively). The average number of unions is approximately 1.5 (Table 2); about half of the respondents in these clusters enter a second union. If entered, second unions are rarely dissolved, particularly when the first union is a marriage (as shown by a mean number of union dissolutions just above one, Table 2). Two clusters are dominated by a long second union, again distinguished by type: *2nd Marriage* and *2nd Cohabitation*. Second unions are predominantly grouped in the cohabitation cluster (25%) rather than the marriage cluster (5%). The large majority of second unions are intact at censoring at age 45, and individuals spend little time as single between unions. Hence, these trajectories are characterised by long and (statistically) stable unions.

Trajectories *not* dominated by one long union are grouped into four clusters. The *Complex* cluster harbours trajectories with several co-residential unions—around

[6] Model 1d omits the interaction between educational attainment and cluster for statistical power and is hence built stepwise from Model 1b.

[7] Weights for region of residence, centrality, sex, and educational attainment are included to correct for selective non-response (Bjørshol et al. 2010).

2.75 across sex. Individuals enter a first union relatively early (age 21 for men and 20 for women), but spend a substantial amount of time as single between unions (9 and 10 years on average for men and women, respectively). Individuals in cluster *Postponed* enter a first union late (on average after age 30), dissolve this union relatively quickly, and rarely repartner (1.16 (1.18) unions entered on average for men (women)), spending on average 7 (8) years for men (women) as single with union experience. The cluster *Long pause* displays a comparable spell as single with union experience, but here men and women enter their first union in their early 20s, and most eventually repartner [1.7 (1.5) unions entered on average for men (women)]. Finally, the longest average spell as single with union experience by far is found in the small cluster *Alone after*. After entering their first union in their early 20s, men (women) on average spend 17 (18) years as single with union experience. Ten per cent of the respondents are grouped into *Complex* and *Postponed*, respectively, while *Alone after* comprises 5% of the weighted sample.

Arguably, the most striking pattern that emerges from this inspection is that individuals who experience union dissolutions have life courses characterised by long unions in the childbearing years. In total, about two-thirds of the trajectories are grouped into clusters dominated by one long union (*1st Marriage*, *1st Cohabitation*, *2nd Marriage* and *2nd Cohabitation*. Ten per cent of the trajectories belong to the cluster *Complex*, the only cluster displaying prototypical "fluid" or "post-modern" union trajectories. That leaves less than a quarter of the sample with trajectories characterised by long spells living alone: before and after a union (*Postponed*), between two unions (*Long pause*) and after a short, early first union (*Alone after*). Hence, what springs to mind when inspecting these union trajectories is not a completely individualised "choice biography"—but rather regularity, and new temporal organisations of living without a partner.

The distribution of union histories by cohort is shown in Appendix Fig. 2. Note that as union dissolution rates increase over cohort, the study sample becomes less select. We see that the decrease in union trajectories characterised by a long marriage is paralleled by an increase in trajectories dominated by a long cohabiting union. There is also a shift from trajectories characterised by fewer unions (*Long pause*) to more frequent repartnering (*Complex*). The proportion trajectories classified as *Postponed* is lowest in the mid-cohorts, known for their early family formation.

The first research question also addresses whether the union trajectories involving a dissolution vary with educational attainment. Table 3 shows the predicted proportion by educational attainment for each cluster. Because both union trajectories and educational attainment change profoundly over cohort, proportions are predicted from a LPM regression including cohort dummies as control variables (hence, proportions need not total 1 within each category). Educational attainment is obtained from administrative registers at the time of the interview (i.e. when the respondent was 45 or older). Consequently, the estimated proportions reflect how education and union history have developed jointly over the life course rather than the impact of union history on educational attainment.

The results show little systematic and no significant variation across educational attainment with respect to union trajectory. Importantly, this result emerges in a

Table 3 Educational level by cluster membership

	Basic educ.	High school	Lower degree	Higher degree
2nd Cohab.	0.16	0.46	0.10	0.29
	[0.10; 0.21]	[0.39; 0.52]	[0.06; 0.13]	[0.23; 0.34]
1st Cohab.	0.23	0.44	0.07	0.26
	[0.17; 0.28]	[0.37; 0.51]	[0.04; 0.11]	[0.20; 0.32]
Complex	0.21	0.46	0.06	0.26
	[0.14; 0.28]	[0.38; 0.55]	[0.01; 0.10]	[0.19; 0.34]
Postponed	0.15	0.44	0.12	0.28
	[0.08; 0.22]	[0.36; 0.53]	[0.08; 0.17]	[0.21; 0.36]
1st Marriage	0.18	0.48	0.07	0.27
	[0.12; 0.25]	[0.40; 0.56]	[0.03; 0.11]	[0.20; 0.34]
2nd Marriage	0.20	0.42	0.10	0.26
	[0.10; 0.30]	[0.31; 0.54]	[0.04; 0.16]	[0.16; 0.36]
Long pause	0.21	0.46	0.09	0.25
	[0.14; 0.28]	[0.37; 0.54]	[0.04; 0.13]	[0.17; 0.32]
Alone after	0.20	0.41	0.05	0.33
	[0.11; 0.29]	[0.30; 0.52]	[− 0.00; 0.11]	[0.23; 0.42]

Predictions from LPM regression of cluster membership and cohort dummies on dummies for belonging to each educational category. Cohort is set to 1950–1954 for prediction. 95% CI for predictions in brackets

sample that is conditioned on union dissolution, where individuals with lower educational attainment are overrepresented. The absence of an educational gradient in union complexity still stands in contrast to findings from the USA and the UK, where serial co-residence in particular is consistently linked to lower socioeconomic status (Bukodi 2012; Lichter and Qian 2008).

4.2 Union History and the Transition to Parenthood: Regression Results

This section presents results for the second research question: How does the probability of childlessness vary with the life course context of union dissolution? Importantly, no information on fertility histories is used in the construction of union trajectories (and hence the clusters). Any association between cluster membership and the probability to remain childless could be due to union histories and the transition to parenthood influencing each other mutually, or both life course trajectories being influenced by some underlying preferences.

Table 4 shows the results from a linear probability model (LPM) where the probability of being childless at age 45 is the outcome. In Model 1a, dummies for cluster membership are the only variables included. The intercept shows that the predicted probability of remaining childless is 0.06 across sex in the reference category (*1st Marriage*). For the clusters *1st Cohabitation*, *2nd Cohabitation*, and

Table 4 Model 1: The association between union history (as captured by cluster) and the probability to remain childless

	Men	Women	Men	Women	Men	Women	Men	Women
Intercept	**0.06****	**0.06*****	**0.12****	**0.08****	**0.13***	**0.07***	0.05	0.08·
	(0.02)	(0.02)	(0.04)	(0.03)	(0.05)	(0.03)	(0.04)	(0.04)
Cluster membership (ref: 1st Marriage)								
2nd Cohab.	0.05·	0.04	0.04	0.05·	0.04	0.04	0.12·	0.00
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.06)	(0.05)
1st Cohab.	0.02	0.01	0.00	0.02	− 0.00	0.02	0.09·	0.00
	(0.03)	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)	(0.05)	(0.05)
Complex	**0.17****	**0.17*****	**0.14****	**0.18*****	**0.14****	**0.17*****	**0.20***	**0.22***
	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.09)	(0.10)
Postponed	**0.42*****	**0.31*****	**0.40*****	**0.32*****	**0.40*****	**0.30*****	**0.48*****	**0.37***
	(0.05)	(0.06)	(0.05)	(0.06)	(0.05)	(0.06)	(0.10)	(0.17)
2nd Marriage	0.01	0.01	0.01	0.01	0.00	0.01	0.08	− **0.07***
	(0.05)	(0.04)	(0.05)	(0.04)	(0.05)	(0.04)	(0.08)	(0.04)
Long pause	0.03	0.03	0.03	0.03	0.03	0.02	0.20·	− 0.02
	(0.04)	(0.03)	(0.04)	(0.03)	(0.04)	(0.03)	(0.11)	(0.05)
Alone after	**0.27*****	**0.14***	**0.26****	**0.15****	**0.26****	**0.14***	0.22	0.16
	(0.08)	(0.05)	(0.08)	(0.06)	(0.08)	(0.05)	(0.14)	(0.12)
Educ. att. (ref: Basic)								
High school					− 0.02	− 0.01	**0.09***	− 0.03
					(0.03)	(0.02)	(0.04)	(0.04)
HL					0.01	0.03	0.00	0.01
					(0.04)	(0.03)	(0.02)	(0.06)
HH					− 0.05	**0.20****	0.12	0.18
					(0.04)	(0.07)	(0.08)	(0.24)
High school ×								
2nd Cohab.							− **0.16***	0.06
							(0.07)	(0.06)
1st Cohab.							− 0.09	0.03
							(0.07)	(0.06)
Complex							− 0.15	− 0.07
							(0.11)	(0.12)
Postponed							− 0.01	− 0.06
							(0.13)	(0.19)
2nd Marriage							− 0.12	0.02
							(0.11)	(0.04)
Long pause							− 0.22·	0.07
							(0.12)	(0.07)
Alone after							0.00	− 0.05
							(0.18)	(0.14)
HL ×								
2nd Cohab.							0.11	0.03
							(0.08)	(0.07)

Table 4 continued

	Men	Women	Men	Women	Men	Women	Men	Women
1st Cohab.							− 0.06	0.00
							(0.07)	(0.07)
Complex							0.16	− 0.06
							(0.17)	(0.14)
Postponed							− 0.14	− 0.04
							(0.14)	(0.21)
2nd Marriage							0.06	0.21·
							(0.18)	(0.12)
Long pause							− 0.22·	0.03
							(0.11)	(0.09)
Alone after							0.27	− 0.00
							(0.23)	(0.15)
HH ×								
2nd Cohab.							− 0.20·	0.00
							(0.11)	(0.26)
1st Cohab.							− **0.24***	0.04
							(0.10)	(0.29)
Complex							0.06	0.21
							(0.25)	(0.37)
Postponed							− 0.30	− 0.27
							(0.18)	(0.35)
2nd Marriage							− 0.21·	0.17
							(0.12)	(0.37)
Long pause							− 0.17	0.09
							(0.19)	(0.28)
Alone after							0.12	0.10
							(0.38)	(0.43)
R^2	0.14	0.06	0.15	0.07	0.15	0.09	0.19	0.10
Adj. R^2	0.13	0.06	0.13	0.06	0.13	0.07	0.15	0.06
Num. obs.	883	1110	883	1110	883	1110	883	1110
RMSE	0.35	0.32	0.34	0.32	0.35	0.32	0.34	0.32

LPM estimates. Estimations done separately by sex. Robust standard errors in parentheses

Bold indicate $p < 0.05$

$^{***}p<0.001$; $^{**}p<0.01$; $^{*}p<0.05$; $^{\cdot}p<0.1$

2nd Marriage, the coefficients are not statistically different from zero, across sex. Hence, we cannot conclude that whether a first or second union dominates the life course, or the type of this dominating union matters for the probability to remain childless. The coefficient for *Long pause* is also statistically insignificant across sex.

For both men and women, the highest proportion childless is found in the cluster *Postponed*. Compared to the *1st Marriage* cluster, the probability of remaining childless is 42 percentage points higher among men, and 31 percentage points

higher among women ($p < 0.001$). Being in the cluster *Alone after* is also associated with an increase in the probability to remain childless, estimated at 27 percentage points ($p < 0.01$) among men and 14 percentage points ($p < 0.05$) among women. Compared to the reference group, belonging to the cluster *Complex* gives a statistically significant increase in the probability of remaining childless with 17 percentage points across sex. Tests of interaction terms in joint models show that the effects do not differ significantly by sex (results available upon request).

To check whether the relationship between union history and cluster is confounded by changes in both union histories and childlessness over birth cohort, a set of dummies for birth cohort are included in Model 1b (Table 4). The point estimates for union history remain remarkably similar when cohort is held constant and typically decrease by 1 to a maximum of 3 percentage points. The results of the statistical tests are unchanged by the inclusion of cohort controls.

As a reference point for the magnitude of the effects, consider the proportion remaining childless at age 45 was 0.14 (0.10) for Norwegian men (women) born 1940, a value increased to 0.20 (0.12) in the 1960 cohort (www.ssb.no). For individuals whose trajectory is dominated by one long union, the predicted probability of remaining childless ranges from 0.06 (*1st Marriage*) to 0.11 (0.10) for men (women) in cluster *2nd Cohabitation*, both well below the cohort averages.[8] In the cluster *Postponed*, on the other hand, the predicted probability of remaining childless is 0.48 for men and 0.37 for women. The cluster *Complex* has a predicted probability of 0.23 across sex, while the predicted probability of remaining childless is 0.33 for men and 0.20 for women in the cluster *Alone after*. For all these clusters, the probability of remaining childless are far above the sex-specific probabilities of remaining childless in the included cohorts. In other words, the co-emergence of new union trajectories and increased childlessness seems to be linked to some particular types of trajectories, namely very complex union histories, and union histories with long spells as single. In particular, the *combination* of late family formation and union dissolution found in the *Postponed* cluster is linked to high childlessness.

The cohorts included in this study faced very different norms and practices regarding union formation and parenthood as young adults, and the association between union history and the transition to parenthood as such may vary by cohort. In Model 1e (Appendix Table 6), I explore this by adding an interaction between cohort and cluster to Model 1b. For men and women born 1945 and later, the link between union trajectory and childlessness has been stable. For the earliest cohorts (born 1927–1944), there is a (non-consistent) tendency for differences in childlessness between union trajectories to be smaller (i.e. negative and statistically significant interaction estimates). Potentially, the more uniform family behaviour of the earlier period could give rise to lower between-cluster variability in these cohorts.

[8] Predictions are made based on estimates in Model 1a. The predicted probability for cluster k is defined as $pp_k = \hat{\beta}_0 + \hat{\beta}_k$.

4.2.1 Union History, Childlessness and Educational Attainment

The second research question also concerns whether the link between union history and the probability to remain childless depends on educational attainment. The model distinguishes between basic education (reference category), high school degree, completed higher education, lower degree, and completed higher education of higher degree. Results are shown in Model 1d (Table 4). For completeness, I also show a model which includes dummies for educational attainment, but omits its interaction with cluster membership (Model 1c, Table 4). Net of union history and birth cohort, having completed a higher education of higher degrees increases the probability of remaining childless among women ($p < 0.01$) but not among men (Model 1c).

Turning to the interaction between educational attainment and union history (Model 1d), the overall impression is that the link between union history and childlessness does not vary with educational attainment. Among men, interactions between the cluster *2nd Cohabitation* and high school education and the cluster *1st Cohabitation* and higher education (higher degree) are both negative and statistically significant at the 0.05 level. While the interactions are not statistically significant in the female sample, tests of three-way interaction terms in a joint model (available upon request) show that the effect does not differ significantly by sex. This gives some indication that union type matters most for the transition to parenthood for men with basic education in our sample. However, as the number of significant interaction estimates is close to the number of false positives one could expect given the number of tests and chosen significance level in the model, this finding should be interpreted with some caution, and treated as indicative only.

4.3 Union History and the Context of Parenthood

In this final results section, I explore the union context of childbearing for the subsample which did become parents, aiming to deepen the understanding of how union histories shape the transition to parenthood. I distinguish between three union contexts: before first union, in first union, and after first union. Results for all clusters are shown in Table 5.

Unsurprisingly, the clusters dominated by a long first union—*1st Marriage* and *1st Cohabitation*—we find the lion's share of childbearing in this first union. The proportion of first births in the first union revolves around 0.9 in these clusters, across sex. The proportion of children born after the first union in these clusters is overall small. In other words, the relatively low childlessness in these clusters is clearly due to childbearing in the first, long union. Also in the cluster *Long pause*, the vast majority of childbearing (0.84 for men and 0.86 for women) takes place in the first union. The low overall childlessness in this group leads to the speculation that the child born in the first union may slow down repartnering and contribute to the "long pause" in co-residence.

The clusters characterised by a long second union—*2nd Marriage* and *2nd Cohabitation*—display a more diverse pattern of childbearing, which also varies more markedly by sex and union type. In these clusters, between 0.38 (*2nd*

Table 5 The union context of and age at childbearing

	2nd Cohab.	1st Cohab.	Complex	Postponed	1st Marriage	2nd Marriage	Long pause	Alone after
Men								
Before 1st uion	0.08	0.06	0.03	0.17	0.09	0.11	0.13	0.15
	[0.04; 0.12]	[0.02; 0.09]	[−0.01; 0.07]	[0.07; 0.26]	[0.04; 0.15]	[0.01; 0.21]	[0.05; 0.22]	[0.01; 0.30]
In 1st union	0.46	0.92	0.47	0.77	0.91	0.38	0.84	0.77
	[0.40; 0.53]	[0.88; 0.96]	[0.35; 0.59]	[0.66; 0.87]	[0.85; 0.96]	[0.22; 0.54]	[0.74; 0.93]	[0.60; 0.93]
After 1st union	0.46	0.02	0.50	0.07	0.00	0.51	0.03	0.08
	[0.39; 0.52]	[0.00; 0.05]	[0.38; 0.62]	[0.00; 0.13]	[0.00; 0.00]	[0.35; 0.68]	[−0.01; 0.08]	[−0.03; 0.18]
Age at 1st birth	27.94	26.08	27.73	31.83	24.61	28.97	25.26	23.69
	[27.15; 28.73]	[25.49; 26.67]	[26.06; 29.41]	[30.51; 33.15]	[23.93; 25.29]	[26.70; 31.24]	[24.26; 26.27]	[21.69; 25.69]
N	213	169	64	60	108	37	61	26
Women								
Before 1st uion	0.13	0.16	0.08	0.42	0.06	0.06	0.11	0.17
	[0.09; 0.17]	[0.11; 0.21]	[0.02; 0.14]	[0.28; 0.57]	[0.02; 0.09]	[−0.01; 0.13]	[0.05; 0.16]	[0.06; 0.27]
In 1st union	0.45	0.83	0.47	0.51	0.94	0.63	0.86	0.69
	[0.39; 0.52]	[0.78; 0.88]	[0.36; 0.58]	[0.36; 0.66]	[0.90; 0.97]	[0.50; 0.77]	[0.80; 0.92]	[0.55; 0.82]
After 1st union	0.42	0.02	0.45	0.07	0.01	0.31	0.04	0.15
	[0.35; 0.48]	[−0.00; 0.03]	[0.34; 0.57]	[−0.01; 0.14]	[−0.00; 0.02]	[0.18; 0.44]	[0.01; 0.07]	[0.04; 0.25]
Age at 1st birth	25.06	23.60	25.13	28.53	21.97	24.41	23.20	22.98
	[24.30; 25.83]	[23.00; 24.20]	[23.75; 26.51]	[27.00; 30.07]	[21.47; 22.47]	[22.74; 26.08]	[22.50; 23.91]	[21.67; 24.28]
N	231	198	77	45	194	49	132	48

Means and 95% CI. Separate estimates for men and women. The sample consists of men and women who had a first child before age 45. Due to rounding, proportions may not total 1

Marriage, men) and 0.63 (*2nd Marriage*, women) of first births take place in the first union. Close to half of the births occur after the first union is dissolved. Knowing that these individuals have long second unions, it seems that repartnering is key to a relatively low proportion of childlessness in these clusters. Similarly, 0.47 of first births in the cluster *Complex* occurs after the first union is dissolved, indicating that repartnering is also important here. Furthermore, the proportion in the cluster *Complex* having a first child before a first union is born is low (0.03 and 0.08 for men and women, respectively). This stands in contrast to previous studies from the USA, which have suggested early (non-union) childbearing as a driver of serial co-residence (Guzzo and Hayford 2012).

4.4 Robustness

The results presented in this paper emerged from a sequence analysis using Optimal Matching between sequences of spells (OMspell) (Studer and Ritschard 2016), with an eight-cluster solution. Appendix Fig. 3 shows the within–between ratio (WB, lower is better) and average silhouette width (ASW, higher is better) for different cluster solutions and matching techniques (see Sect. 3.2.1). For OMspell, the WB ratio falls rapidly towards around eight clusters, at which point the decrease flattens out. The average ASW for OMspell is high and constant (with a small peak at five clusters) up to eight clusters. After eight clusters the ASW declines, indicating that further splitting leads to less well-defined clusters. Together, these measures indicate an eight-cluster solution.

Compared to the eight-cluster solution, a seven-cluster solution using OMspell merges *Complex* and *Alone after* (results available upon request). While individuals in *Alone after* tend to remain unpartnered after the first union is dissolved, the *Complex* is dominated by trajectories of serial co-residence; these differences have obvious implications for fertility behaviour. A nine-cluster solution, on the other hand, is obtained by splitting the cluster *2nd Cohabitation* in two depending on how early the *first* union is entered into (available upon request), a distinction to be of less importance given the research questions at hand. To avoid overfitting and achieve parsimonious results, an eight-cluster solution is preferred.

To assess whether the sequencing algorithm affects the results, I have compared sequence index plots from the main results of the paper (Fig. 1) with similar plots for results from an eight-cluster solution obtained by OM, OM04 and DHD. Sequence Index plots obtained by these alternative algorithms are available upon request. The most striking feature of the comparison is resemblance. Overall, the algorithms matter most for how trajectories not dominated by one or two long unions are categorised. When the standard OM algorithms are used, the *Complex* cluster is larger and includes more trajectories with long second cohabitation. Similarly, a larger *Postponed* cluster emerges and includes more trajectories with earlier first unions, and more higher-order unions (particularly in OM04). The DHD algorithm leads to smaller and more homogenous *Complex* and *Postponed* clusters, comparable to those obtained by OMspell, but makes no distinction in *Long pause* and *Alone after* groups, shown to have quite different fertility patterns. Comparing

ASW and WB ratios across distance algorithms (Fig. 3) shows that unless the number of clusters gets very large (above nine), OMspell consistently has (among the) the lowest WB ratios, and (among the) highest ASW, again supporting the choice of this algorithm. In total, the OMspell algorithm appears to best identify well-defined groups of trajectories.

5 Concluding Discussion

This study adds to the literature on family complexity and childlessness by describing patterns in union histories involving at least one union dissolution, and their relationship with childlessness. Using Norway as a contrasting case, I have explored the external validity of the nexus of complex union histories, low education and early childbearing found in USA.

Using sequence analysis to group together union histories similar in timing, occurrence, and sequencing of events, I have described patterns in union histories (ages 18–44) which involve at least one union dissolution. Two-thirds of the union histories in the sample are grouped into clusters dominated by a long first or second union, distinguished by the type and number of this dominating union (clusters *1st Marriage*, *1st Cohabitation*, *2nd Marriage*, and *2nd Cohabitation*). About a quarter of the sample is classified into groups where union histories are dominated by time spent alone—either before a first union (cluster *Postponed*), between unions (cluster *Long pause*), or after a first union (cluster *Alone after*). Only one cluster, termed *Complex* and capturing one tenth of union histories, captures a stereotypical complex life history, where unions are many and of short duration.

This description nuances the notion that the patterns of union histories that have emerged over the last decades—call them late modern (cf. Giddens 1993) or part of the Second Demographic Transition (Lesthaeghe 2010)—are fully fluid and idiosyncratic. This impression is strengthened by that distinct and well-clustered groups emerged from the sequence analysis. Importantly, this finding emerges in a subsample where everyone has dissolved a union before age 45, and in a country that is among the forerunners in the Second Demographic Transition. The finding of regular patterns in this selected group of "forerunners" is convincing evidence that strong regularities in union patterns, rather than complete fluidity, is an inherent feature of the Second Demographic Transition.

Union trajectories did not differ significantly by educational attainment. Hence, among individuals who dissolve a union before age 45 (where the lower educated will be overrepresented) educational attainment does not have further influence on union complexity up to age 45. Dommermuth and Wiik (2014) found that Norwegians with basic education are *less* likely to have three or more unions, as compared to two unions. As they condition on variables known to influence both educational attainment and union stability (such as parents' education and union dissolution), potentially shifting the educational gradient, different findings are unsurprising. The theory of pattern of disadvantage links family complexity to lower socioeconomic status (Perelli-Harris et al. 2010), while the theory of the Second

Demographic Transition suggests that the highly educated are forerunners in family complexity (Lesthaeghe 2010). The absence of an educational gradient in union complexity in this study could indicate that these two mechanisms cancel each other out.

The second research question concerned the link between union trajectory and childlessness, and whether its nature varied with educational attainment. In groups of union histories dominated by a long union, be it first or second, marriage or cohabitation, between 6 and 11% are childless at age 45, consistently below cohort average. In contrast, near fourth in the cluster *Complex* remained childless, and childlessness was also high in the cluster *Alone after*. In cluster *Postponed* where a first union is formed late and dissolved after a relatively short time nearly a half remain childless; this is the highest proportion by far. Importantly, these results are not to be interpreted as the effect of union history on childlessness: union trajectories and fertility behaviour probably influence each other, and both union trajectories and childlessness are likely to be jointly influenced by tastes and values.

The findings are in line with previous research showing that repeated union dissolutions increase the probability of remaining childless (Keizer et al. 2008) and that union dissolutions have a more profound impact on fertility if repartnering does not occur (Keizer et al. 2008; Thomson et al. 2012). However, while Thomson et al. (2012) find that the negative association between union dissolution and completed fertility weakens when union entry is postponed, the results of this study indicate the opposite. Whether this is due to contextual differences between Norway and Canada or because relationships for first birth and completed fertility go in different directions is an interesting question for future research.

Contrary to expectations, the link between union complexity and childlessness is found to be largely independent of education. Hence, there is no evidence that highly educated forerunners combine a child-free life with a series of shorter unions. Furthermore, there was no evidence of complex union histories being preceded by early or pre-union childbearing, in contrast to the link between early unintended childbearing and subsequent union instability found in the USA (Edin and Kefalas 2011; Guzzo and Hayford 2012). Hence, the US pattern of early childbearing in fragile unions among the lower educated does not seem to have a clear counterpart in the Norwegian context.

There are some indications that marriage is more important for the transition to parenthood for men with basic education than for men with high school or higher education. However, this pattern is not consistent and could be due to statistical chance. From previous studies, we know that the proportion who remain childless among men with basic education is high and increasing (Lappegård et al. 2011). My findings point towards further exploration of whether there is an educational gradient in the importance of marriage for family formation.

Two important caveats should be noted. The first regards data quality: The research question requires data on cohabiting unions with and without children dating back to 1945 for the earliest cohorts. Since this information is not available in Norwegian administrative registers, union histories are self-reported, invoking the familiar problems of recall error, generally leading to under-reporting of life events

(Lin et al. 1997). As under-reporting is most severe among older respondents (Kreyenfeld et al. 2013), one risks underestimating the complexity of union histories in the older cohorts. In addition, studying change over time based on data collected at a single point in time implies that data are left truncated. Childless individuals may be underrepresented in the sample due to higher mortality rates (Grundy and Kravdal 2008). Reassuringly, comparison of the proportion childless in the original sample (i.e. before restricting to those who have dissolved a union before age 45, results available upon request) gives no indication of such underrepresentation.

The second caveat concerns the methodological approach. Sequence analysis enables considering the life course as a whole and hence does not allow the researcher to scrutinise the impact of each union formation and dissolution events separately. However, there is already a rich literature addressing the impact of union entry and dissolution on the transition to parenthood in particular [for overviews see Balbo et al. (2013); Lyngstad and Jalovaara (2010)], while studies which provide holistic descriptions of the (typical) life courses that emerge from these transitions have been scarcer. As such, studies based on sequence analysis neatly complement previous studies of separate parity transitions.

The results of this paper underline that the number of unions, their type and duration, and how these components are combined in the life course, all matter for the link between union dissolution and childlessness. By including groups of union histories that emerged from sequence analysis as predictors in a regression, I have assessed which combinations of characteristics that *actually* tend to appear together matter for childlessness. Sequence analysis hence serves an important complement to a more traditional regression approach, assessing the importance of each characteristic in isolation.

The current study has shown that when it comes to complex union trajectories and childlessness, the "two-tier family system" found in the USA (Furstenberg 2014) does not generalise to the Norwegian context. This fits into a pattern of *weaker* educational stratification of the family life in the Norwegian context, where the lower educated are at disadvantage with respect to some aspects of family formation [e.g. union dissolution (Lyngstad 2004) and male childlessness (Lappegård et al. 2011)], but not others [e.g. male multipartner fertility (Lappegård and Rønsen 2013) and number of partners (Dommermuth and Wiik 2014)]. A two-tier family system sets off a process of cumulative disadvantage: individuals for whom resources are already scarce form family ties that may further increase stress. Children of lower educated parents are on average raised in more complex families, potentially corroborating transmission of disadvantage across generations (McLanahan 2004). A weaker educational stratification of family formation means smaller differences in well-being between the higher and lower educated and that the children of lower educated parents start out at a smaller disadvantage.

For policy makers or researchers aiming to counteract further strengthening of the "two-tier family system" in the USA and elsewhere, a better understanding of the drivers of weaker educational stratification of family life in contexts such as the Norwegian is crucial. A more extensive welfare state and lower earnings

differentials are likely contributing factors. Understanding the relative importance of these factors and exploring other economic or cultural drivers are important tasks for future research.

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Compliance with Ethical Standards

Conflict of interest The author declares no potential conflict of interest.

Appendix

See Figs.2, 3 and Table 6.

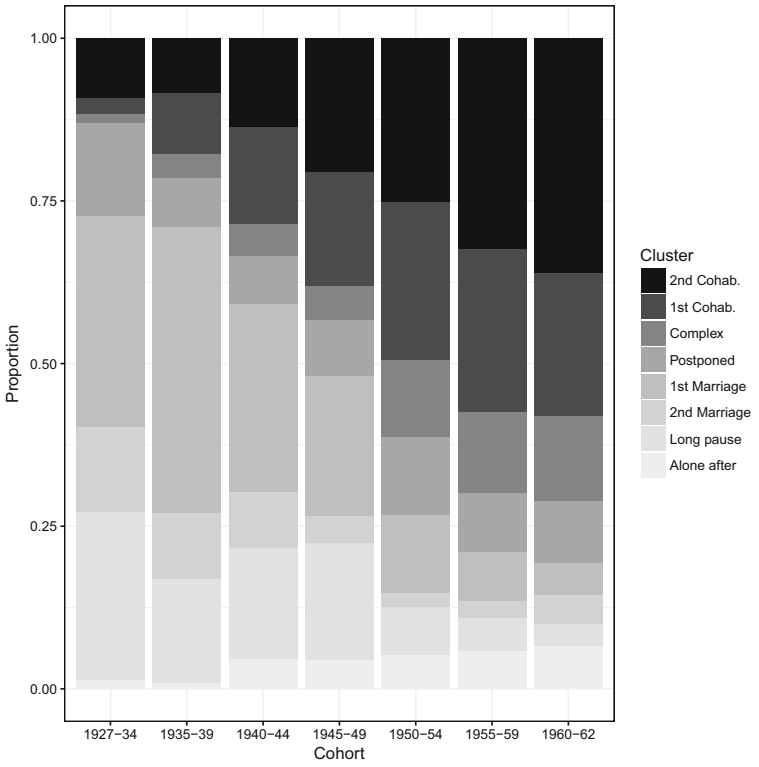

Fig. 2 Distribution on cluster by cohort

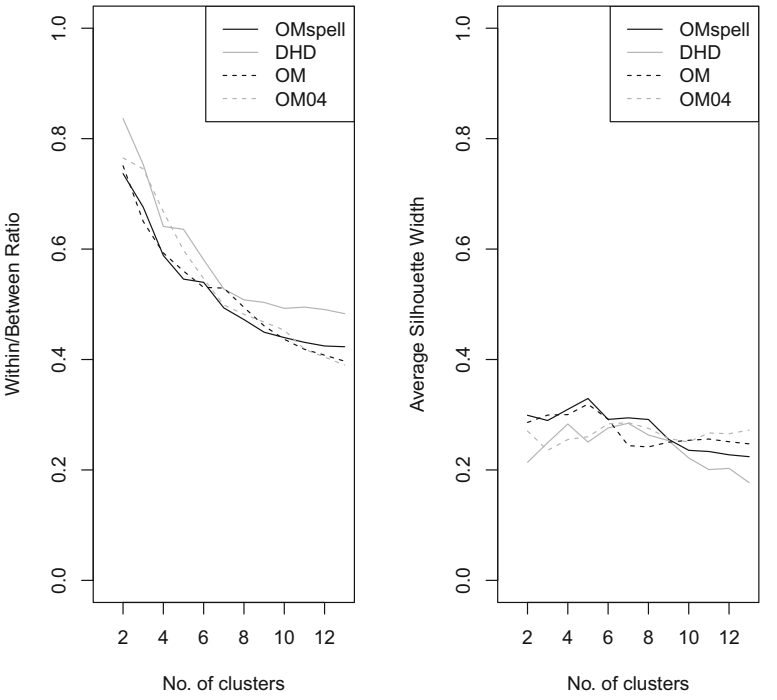

Fig. 3 Within–between ratio (left panel) and average silhouette width (right panel) for different sequencing techniques and cluster solutions

Table 6 Model 1e: The association between union history (as captured by cluster) and the probability to remain childless

	Men	Women	Men	Women
Intercept	0.17 (0.11)	0.04 (0.04)	0.18 (0.12)	0.04 (0.04)
Cluster membership (ref: 1st Marriage)				
2nd Cohab.	0.03 (0.13)	0.10 (0.06)	0.02 (0.13)	0.07 (0.06)
1st Cohab.	− 0.03 (0.12)	0.02 (0.06)	- 0.03 (0.12)	0.03 (0.06)
Complex	0.05 (0.14)	**0.28** (0.12)*	0.05 (0.14)	**0.26** (0.12)*
Postponed	0.24 (0.15)	**0.55** (0.15)***	0.25 (0.15)·	**0.53** (0.15)***
2nd Marriage	− 0.17 (0.11)	− 0.04 (0.04)	- 0.16 (0.11)	- 0.04 (0.04)
Long pause	0.02 (0.16)	0.04 (0.08)	0.01 (0.16)	0.03 (0.09)
Alone after	0.50 (0.30)·	0.18 (0.12)	0.50 (0.30)·	0.16 (0.11)
Birth cohort (ref: 1950–1954)				
1927–1934	− 0.00 (0.16)	0.12 (0.11)	0.01 (0.16)	0.12 (0.11)
1935–1939		0.03 (0.06)	− 0.11 (0.12)	0.03 (0.06)
1940–1944	− 0.06 (0.13)	0.01 (0.05)	− 0.06 (0.13)	0.01 (0.05)
1945–1949	− 0.17 (0.11)	0.02 (0.05)	− 0.17 (0.11)	0.02 (0.05)
1955–1959	− 0.17 (0.11)	0.07 (0.07)	− 0.17 (0.11)	0.06 (0.07)

Table 6 continued

	Men	Women	Men	Women
1960–1962	− 0.17 (0.11)	- 0.04 (0.04)	− 0.16 (0.11)	- 0.04 (0.04)
1927–1934 ×				
2nd Cohab.	0.14 (0.33)	− **0.25** (0.12)*	0.15 (0.33)	− 0.23 (0.12)·
1st Cohab.	− 0.13 (0.17)	− 0.18 (0.12)	− 0.13 (0.17)	− 0.18 (0.12)
Complex		− **0.43** (0.16)**		− **0.40** (0.16)*
Postponed	− 0.03 (0.26)	− 0.37 (0.33)	− 0.04 (0.26)	− 0.35 (0.33)
2nd Marriage	− 0.00 (0.16)	0.05 (0.19)	− 0.02 (0.16)	0.06 (0.19)
Long pause	0.02 (0.27)	0.01 (0.17)	0.01 (0.27)	0.02 (0.17)
Alone after	− **0.67** (0.32)*		− **0.67** (0.34)*	
1935–1939 ×				
2nd Cohab.	− 0.08 (0.14)	0.08 (0.24)	− 0.08 (0.14)	0.12 (0.24)
1st Cohab.	− 0.02 (0.13)	0.24 (0.21)	− 0.02 (0.14)	0.18 (0.21)
Complex	− 0.10 (0.15)	− **0.35** (0.13)**	− 0.09 (0.15)	− **0.33** (0.13)*
Postponed	0.04 (0.25)	− **0.62** (0.16)***	0.02 (0.26)	− **0.59** (0.16)***
2nd Marriage	0.11 (0.12)	0.11 (0.15)	0.10 (0.13)	0.12 (0.15)
Long pause	− 0.07 (0.17)	− 0.11 (0.10)	− 0.06 (0.17)	− 0.09 (0.10)
Alone after	− 0.55 (0.31)·		- 0.56 (0.31)·	
1940–1944 ×				
2nd Cohab.	0.03 (0.18)	− 0.06 (0.11)	0.04 (0.18)	− 0.03 (0.11)
1st Cohab.	− 0.01 (0.16)	0.04 (0.10)	− 0.00 (0.16)	0.03 (0.10)
Complex	0.44 (0.28)	− 0.15 (0.20)	0.45 (0.28)	− 0.18 (0.18)
Postponed	0.20 (0.23)	− 0.39 (0.24)	0.19 (0.23)	− **0.42** (0.21)*
2nd Marriage	0.06 (0.13)	0.07 (0.09)	0.05 (0.14)	0.07 (0.09)
Long pause	− 0.12 (0.18)	0.04 (0.11)	− 0.13 (0.18)	0.02 (0.11)
Alone after	0.06 (0.42)	− 0.22 (0.12)·	0.06 (0.42)	− **0.24** (0.12)*
1945–1949 ×				
2nd Cohab.	0.07 (0.14)	− 0.05 (0.09)	0.07 (0.14)	− 0.03 (0.09)
1st Cohab.	0.06 (0.13)	− 0.00 (0.08)	0.06 (0.13)	− 0.01 (0.08)
Complex	0.09 (0.20)	0.00 (0.18)	0.09 (0.20)	0.02 (0.18)
Postponed	0.15 (0.18)	− 0.17 (0.21)	0.15 (0.18)	− 0.15 (0.20)
2nd Marriage	0.29 (0.16)·	− 0.02 (0.05)	0.29 (0.17)·	− 0.04 (0.05)
Long pause	0.02 (0.17)	− 0.01 (0.10)	0.03 (0.17)	− 0.00 (0.10)
Alone after	− 0.17 (0.34)	0.17 (0.20)	− 0.17 (0.34	0.18 (0.20)
1955–1959 ×				
2nd Cohab.	0.05 (0.14)	− 0.11 (0.09)	0.05 (0.14)	− 0.09 (0.09)
1st Cohab.	0.12 (0.13)	− 0.07 (0.09)	0.12 (0.13)	− 0.07 (0.08)
Complex	0.19 (0.16)	− 0.21 (0.15)	0.19 (0.16)	− 0.20 (0.15)
Postponed	0.35 (0.18)·	− 0.32 (0.19)·	0.34 (0.18)·	− 0.32 (0.19)·
2nd Marriage	0.28 (0.16)·	0.13 (0.20)	0.27 (0.16)·	0.10 (0.16)
Long pause	0.23 (0.23)	− 0.09 (0.12)	0.23 (0.23)	− 0.09 (0.12)
Alone after	− 0.20 (0.34)	− 0.18 (0.15)	− 0.20 (0.34)	− 0.16 (0.14)
1960–1962 ×				

Table 6 continued

	Men	Women	Men	Women
2nd Cohab.	0.09 (0.14)	− 0.01 (0.07)	0.09 (0.14)	0.02 (0.07
1st Cohab.	0.12 (0.14)	0.04 (0.07)	0.11 (0.14)	0.04 (0.07)
Complex	0.13 (0.17)	− 0.04 (0.15)	0.12 (0.17)	− 0.02 (0.15)
Postponed	0.37 (0.19)·	− 0.21 (0.21)	0.35 (0.19)·	− 0.21 (0.21)
2nd Marriage	0.29 (0.16)·	0.04 (0.04)	0.29 (0.16)·	0.03 (0.05)
Long pause	− 0.02 (0.16)	0.09 (0.15)	− 0.01 (0.17)	0.05 (0.13)
Alone after	− 0.25 (0.33)	0.16 (0.20)	− 0.26 (0.33)	0.17 (0.20)
Educ. att. (ref: Basic)				
High school			− 0.02 (0.03)	− 0.02 (0.02)
HL			0.01 (0.04)	0.01 (0.03)
HH			− 0.04 (0.04)	**0.18** (0.07)**
R^2	0.18	0.10	0.18	0.12
Adj. R^2	0.13	0.05	0.12	0.07
Num. obs.	883	1110	883	1110
RMSE	0.35	0.32	0.35	0.32

LPM estimates. Estimations done separately by sex. Robust standard errors in parentheses

Bold indicate $p < 0.05$

$^{***}p<0.001$; $^{**}p<0.01$; $^{*}p<0.05$; $^{\cdot}p<0.1$

References

Abbott, A. (1992). From causes to events: Notes on narrative positivism. *Sociological Methods & Research*, *20*(4), 428–455.

Aisenbrey, S., & Fasang, A. (2010). New life for old ideas: The "second wave" of sequence analysis bringing the "course" back into the life course. *Sociological Methods & Research*, *30*(3), 420–462.

Andersson, G. (1997). The impact of children on divorce risks of Swedish women. *European Journal of Population/Revue Européenne de Démographie*, *13*(2), 109–45.

Balbo, N., Billari, F., & Mills, M. (2013). Fertility in advanced societies: A review of research. *European Journal of Population/Revue Européenne de Démographie*, *29*(1), 1–38.

Bjørshol, E., Høstmark, M., & Lagerstrøm, B. O. (2010). Livsløp , generasjon og kjønn. LOGG 2007 Dokumentasjonsrapport [The life course, generation and gender. LOGG 2007. Documentation report]. Notater 19/2010. Technical report, Statistics Norway.

Bukodi, E. (2012). Serial cohabitation among men in Britain: Does work history matter? *European Journal of Population/Revue Européenne de Démographie*, *28*(4), 441–466.

Bzostek, S. H., McLanahan, S. S., & Carlson, M. J. (2012). Mothers' repartnering after a nonmarital birth. *Social Forces*, *90*(3), 817–841.

Cingano, F. (2014). *Trends in income inequality and its impact on economic growth*. Technical report, OECD social, employment and migration working papers, no. 163, Paris: OECD Publishing.

Cohen, J., & Manning, W. (2010). The relationship context of premarital serial cohabitation. *Social Science Research*, *39*(5), 766–776.

Dommermuth, L., & Wiik, K. A. (2014). First, second or third time around? The number of co-residential relationships among young Norwegians. *Young*, *22*(4), 323–343.

Edin, K., & Kefalas, M. (2011). *Promises I can keep: Why poor women put motherhood before marriage*. Berkeley: University of California Press.

Ellingsæter, A. L., & Pedersen, E. (2013). Economic risk, fertility and the welfare state: Understanding individual rationales. In *The social meaning of children and fertility change in Europe* (pp. 31–47). New York: Routledge.

Esping-Andersen, G. (2013). *The three worlds of welfare capitalism*. Hoboken: Wiley.

Fasang, A. E., & Liao, T. F. (2014). Visualizing sequences in the social sciences: Relative frequency sequence plots. *Sociological Methods & Research*, *43*(4), 643–676.

Furstenberg, F. F. (2014). Fifty years of family change: From consensus to complexity. *The ANNALS of the American Academy of Political and Social Science*, *654*, 12–30.

Gabadinho, A., Ritschard, G., & Studer, M. (2011). Analyzing and visualizing state sequences in R with TraMineR. *Journal of Statistical Software*, *40*(4), 1–37.

Giddens, A. (1993). *The transformation of intimacy: Love, sexuality and eroticism in modern society*. Cambridge: Polity.

Graefe, D. R., & Lichter, D. T. (2007). When unwed mothers marry: The marital and cohabiting partners of midlife women. *Journal of Family Issues*, *28*(5), 595–622.

Grundy, E., & Kravdal, Ø. (2008). Reproductive history and mortality in late middle age among Norwegian men and women. *American Journal of Epidemiology*, *167*(3), 271–9.

Guzzo, K. B., & Hayford, S. R. (2012). Unintended fertility and the stability of coresidential relationships. *Social Science Research*, *41*(5), 1138–1151.

Hart, R. K., Lyngstad, T. H., & Vinberg, E. (2017). Children and union dissolution across four decades: Evidence from Norway. *European Sociological Review*, *33*(2), 317–331.

Hayford, S. R. (2009). The evolution of fertility expectations over the life course. *Demography*, *46*(4), 765–783.

Heuveline, P., & Timberlake, J. M. (2004). The role of cohabitation in family formation: The United States in comparative perspective. *Journal of Marriage and Family*, *66*(5), 1214–1230.

Jokela, M., Rotkirch, A., Rickard, I. J., Pettay, J., & Lummaa, V. (2010). Serial monogamy increases reproductive success in men but not in women. *Behavioral Ecology*, *21*(5), 906–912.

Kaufman, L., & Rousseeuw, P. J. (2005). *Finding groups in data: An introduction to cluster analysis*. Hoboken: Wiley.

Keizer, R., Dykstra, P. A., & Jansen, M. D. (2008). Pathways into childlessness: Evidence of gendered life course dynamics. *Journal of Biosocial Science*, *40*(6), 863–878.

Kjeldstad, R. (1998). *Enslige forsørgere: Forsørgelse og levekår før og etter overgang til en ny livsfase [Lone providers: Providing and living conditions before and after the transition to a new phase of life]*., Social and economic studies Oslo: Statistics Norway.

Kravdal, Ø., & Rindfuss, R. R. (2008). Changing relationships between education and fertility: A study of women and men born 1940 to 1964. *American Sociological Review*, *73*(5), 854–873.

Kreyenfeld, M., Hornung, A., & Kubisch, K. (2013). The German generations and gender survey: Some critical reflections on the validity of fertility histories. *Comparative Population Studies*, *38*, 3–28.

Lappegård, T., & Noack, T. (2015). The link between parenthood and partnership in contemporary norway-findings from focus group research. *Demographic Research*, *32*, 287.

Lappegård, T., & Rønsen, M. (2005). The multifaceted impact of education on entry into motherhood. *European Journal of Population/Revue Européenne de Démographie*, *21*(1), 31–49.

Lappegård, T., & Rønsen, M. (2013). Socioeconomic differences in multipartner fertility among Norwegian men. *Demography*, *50*(3), 1135–1153.

Lappegård, T., Rønsen, M., & Skrede, K. (2011). Fatherhood and fertility. *Fathering: A Journal of Theory, Research, and Practice about Men as Fathers*, *9*(1), 103–120.

Lareau, A. (2000). Social class and the daily lives of children: A study from the United States. *Childhood*, *7*(2), 155–171.

Lesnard, L. (2010). Setting cost in optimal matching to uncover contemporaneous socio-temporal patterns. *Sociological Methods & Research*, *38*(3), 389–419.

Lesthaeghe, R. (2010). The unfolding story of the Second Demographic Transition. *Population and Development Review*, *36*(2), 211–251.

Lesthaeghe, R., & Surkyn, J. (1988). Cultural dynamics and economic theories of fertility change. *Population and Development Review*, *14*(1), 1–45.

Lichter, D. T., & Qian, Z. (2008). Serial cohabitation and the marital life course. *Journal of Marriage and Family*, *70*(4), 861–878.

Liefbroer, A. C. (2009). Changes in family size intentions across young adulthood: A life-course perspective. *European Journal of Population/Revue Européenne de Démographie*, *25*(4), 363–386.
Liefbroer, A. C., & Billari, F. C. (2010). Bringing norms back in: A theoretical and empirical discussion of their importance for understanding demographic behaviour. *Population, Space and Place*, *16*(4), 287–305.
Lillard, L. A., & Waite, L. J. (1993). A joint model of marital childbearing and marital disruption. *Demography*, *30*(4), 653.
Lin, N., Ensel, W. M., & Lai, W. F. G. (1997). Construction and use of the life history calendar: Reliability and validity of recall data. In A. Gotlib & B. Wheaton (Eds.), *Stress and adversity over the life course: Trajectories and turning points* (pp. 249–272). Cambridge: Cambridge University Press.
Lyngstad, T. H. (2004). The impact of parents' and spouses' education of divorce rates in Norway. *Demographic Research*, *10*, 122–142.
Lyngstad, T. H., & Jalovaara, M. (2010). A review of the antecedents of union dissolution. *Demographic Research*, *23*(10), 257–292.
McLanahan, S. (2004). Diverging destinies: How children are faring under the second demographic transition. *Demography*, *41*(4), 607–627.
Mood, C. (2010). Logistic regression: Why we cannot do what we think we can do, and what we can do about it. *European Sociological Review*, *26*(1), 67–82. https://doi.org/10.1093/esr/jcp006.
Mynarska, M., Matysiak, A., Rybinska, A., Tocchioni, V., & Vignoli, D. (2015). Diverse paths to childlessness over the life course. *Advances in Life Course Research*, *25*, 35–48.
Perelli-Harris, B., Sigle-Rushton, W., Kreyenfeld, M., Lappegård, T., Keizer, R., & Berghammer, C. (2010). The educational gradient of childbearing within cohabitation in Europe. *Population and Development Review*, *36*(4), 775–801.
Perelli-Harris, B., Kreyenfeld, M., Sigle-Rushton, W., Keizer, R., Lappegård, T., Jasilioniene, A., et al. (2012). Changes in union status during the transition to parenthood in eleven European countries, 1970s to early 2000s. *Population Studies*, *66*(2), 167–182.
Piccarreta, R., & Lior, O. (2010). Exploring sequences: A graphical tool based on multi-dimensional scaling. *Journal of the Royal Statistical Society: Series A (Statistics in Society)*, *173*(1), 165–184.
Poortman, A. R., & Lyngstad, T. H. (2007). Dissolution risks in first and higher order marital and cohabiting unions. *Social Science Research*, *36*(4), 1431–1446.
Qian, Z., Lichter, D. T., & Mellott, L. M. (2005). Out-of-wedlock childbearing, marital prospects and mate selection. *Social Forces*, *84*(1), 473–491.
Reisel, L. (2013). Is more always better? Early career returns to education in the United States and Norway. *Research in Social Stratification and Mobility*, *31*, 49–68.
Rousseeuw, P. J. (1987). Silhouettes: A graphical aid to the interpretation and validation of cluster analysis. *Journal of Computational and Applied Mathematics*, *20*, 53–65.
Sassler, S., & Miller, A. J. (2011). Class differences in cohabitation processes. *Family Relations*, *60*(2), 163–177.
Stefansen, K. (2008). Et uendelig ansvar. Om foreldreskap i middelklassen [Unlimited responsibilities. Middle class parenting in Norway]. In B. P. Bø & B. C. R. Olsen (Eds.), *Utfordrende foreldreskap - under ulike livsbetingelser og tradisjoner [Challenging parenthood—Under varying life conditions and traditions]* (pp. 27–50). Oslo: Gyldendal Akademisk.
Studer, M., & Ritschard, G. (2016). What matters in differences between life trajectories: A comparative review of sequence dissimilarity measures. *Journal of the Royal Statistical Society: Series A (Statistics in Society)*, *179*(2), 481–511.
Syltevik, L. J. (2010). Sense and sensibility: Cohabitation in 'cohabitation land'. *The Sociological Review*, *58*(3), 444–462.
Tanturri, M. L., Mills, M., Rotkirch, A., Sobotka, T., Takacks, J., Miettinen, A., Faludi, C., Kantsa, V., & Nasiri, D. (2015). *State-of-the-art report: Childlessness in Europe*. Technical report 32, Families and societies working paper series.
Thomson, E. (1997). Couple childbearing desires, intentions, and births. *Demography*, *34*(3), 343–354.
Thomson, E., Winkler-Dworak, M., Spielauer, M., & Prskawetz, A. (2012). Union instability as an engine of fertility? A microsimulation model for France. *Demography*, *49*(1), 175–195.
Thomson, E., Lappegård, T., Carlson, M., Evans, A., & Gray, E. (2014). Childbearing across partnerships in Australia, the United States, Norway, and Sweden. *Demography*, *51*(2), 485–508.
Tjøtta, S., & Vaage, K. (2008). Public transfers and marital dissolution. *Journal of Population Economics*, *21*(2), 419–437.

Vikat, A., Spéder, Z., Beets, G., Billari, F. C., Bühler, C., Désesquelles, A., et al. (2007). Generations and Gender Survey (GGS): Towards a better understanding of relationships and processes in the life course. *Demographic Research*, *17*, 389–440.

Wiik, K. A. (2009). 'You'd Better Wait!'—Socioeconomic background and timing of first marriage versus first cohabitation. *European Sociological Review*, *25*(2), 139–153.

Wooldridge, J. M. (2010). *Econometric Analysis of Cross Section and Panel Data* (2nd ed.). Cambridge: MIT Press.