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Family Trajectories Across Time and Space: Increasing Complexity in Family Life Courses in Europe?[1]

Family life courses are thought to have become more complex in Europe. This study uses SHARELIFE data from 14 European countries to analyze the family life courses of individuals born in 1924–1956 from ages 15 to 50. A new methodological approach, combining complexity metrics developed in sequence analysis with cross-classified multilevel modeling, is used to simultaneously quantify the proportions of variance attributable to birth cohort and country differences. This approach allows the direct comparison of changing levels of family trajectory differentiation across birth cohorts with cross-national variation, which provides a benchmark against which temporal change may be evaluated. The results demonstrate that family trajectories have indeed become more differentiated but that change over time is minor compared with substantial cross-national variation. Further, cross-national differences in family trajectory differentiation correspond with differences in dominant family life course patterns. With regard to debates surrounding the second demographic transition thesis and the comparative life course literature, the results indicate that the degree of change over time tends to be overstated relative to large cross-national differences.

Introduction

Many scholars have claimed that patterns of family formation and living arrangements have undergone great changes in European societies during the twentieth century (for a review, see Buchmann & Kriesi 2011). Young adults leave the parental home, marry, and enter parenthood at later ages (Gauthier 2007; Settersten 2007), and the odds of returning to the parental home as well as never entering marriage or parenthood have increased (Goldscheider 1997; Rowland 2007). Additionally, cohabitation (e.g., Heuveline & Timberlake 2004), divorce (e.g., Schoen & Canudas-Romo 2006), remarriage (e.g., Coleman et al. 2000), and single parenthood (e.g., Heuveline et al. 2003) have become more common. Billari and Liefbroer (2010) spoke of a shift from an early, contracted, and simple to a late, protracted, and complex transition to adulthood. Thomson (2014) emphasized that more complex families are produced through lone childbirth, union dissolution, repartnering and stepfamily childbearing well after the transition to adulthood is complete.

A shift toward more complex family life courses is consistent with the concept of the second demographic transition (SDT). Family demographers have used the SDT (Lesthaeghe & Van de Kaa 1986; Van de Kaa 1987) to account for changes in family behavior through a universal value shift toward postmaterialism within and across societies. However, recent research has displayed stable or growing cross-national differences rather than convergence as suggested by the SDT thesis (Billari & Wilson 2001; Mills & Blossfeld 2005; Corijn & Klijzing 2001; Elzinga & Liefbroer 2007; Fokkema & Liefbroer 2008; Sobotka & Toulemon 2008). Life course sociologists have emphasized institutional variations to account for these cross-national differences, arguing that welfare states shape individual family life courses both directly (Mayer & Müller 1986; Mayer & Schoepflin 1989) and indirectly (Mayer 2004). Although these two perspectives may not be mutually exclusive accounts of family life course variation, they do emphasize very different dimensions of variation: change across time versus differences across countries.

The aim of this study is not only to investigate (1) how family life courses vary across historical time (i.e., birth cohorts), and (2) how family life courses vary across countries, but especially (3) whether family life courses vary more across birth cohorts or across countries.

Despite the wide discussion around cross-temporal and cross-national variation in family formation, the comparative literature has compared family trajectories either across birth cohorts within a single country (Baizan et al. 2002; Bras et al. 2010; Chaloupková 2010;

Robette 2010) or between a small set of countries (Potarca et al. 2013; see Elzinga & Liefbroer 2007 for a notable exception). However, no research has attempted to directly compare change in family formation over historical time with cross-national differences (for notable exceptions in other fields, see Fowler et al. 2016 on ethnoracial diversity; Günther & Harttgen 2016 on realized fertility intentions; Van Winkle & Fasang 2017 on employment trajectories). Research that puts change over time in direct perspective with differences between countries is important because it can provide a benchmark against which change over time can be evaluated. Further, research that directly compares temporal and cross-national variation simultaneously informs two of the most prominent research traditions in comparative family demography and sociology: the ideational account of the SDT and the institutional arguments of comparative life course sociology.

I contribute to the comparative literature by introducing a new methodological approach that enables researchers to directly compare change across birth cohorts with cross-national differences in longitudinal life courses. Specifically, I simultaneously quantify family life course variation across birth cohorts and variation across countries by incorporating a sequence based metric in cross-classified multilevel regressions. This methodological approach enables me to put changing levels of family trajectory complexity across birth cohorts in perspective with cross-national variation. Further, I demonstrate how other researchers can expand on this methodological approach by estimating conditional cross-classified models. This allows me to investigate relationships between individual characteristics and family formation complexity as well as the extent to which individual characteristics account for variation across birth cohorts and countries.

I use sequence analysis to conceptualize family formation holistically, as a long life "process outcome" (Abbott 2005). Abbott conceptualized process outcomes as global results of multiple individual events (such as job spells within careers) as opposed to point-in-time outcomes, which are the results of a process (such as pension amounts). Although many have used sequence analysis to study family processes (e.g., Elzinga & Liefbroer 2007; Fasang & Raab 2014; Raab et al. 2014), the majority of the literature concentrates on events in the early life course as a part of the transition to adulthood. However, changes in family life courses need to be studied as a lifelong process because changes associated with the SDT affect the timing of multiple life course events, their sequencing, and the occurrence of new events in later life, such as divorce and remarriage. Using retrospective data from the Survey of Health, Ageing and Retirement in Europe (Börsch-Supan et al. 2013; Schröder 2011), I am able to

observe family formation until age 50 for men and women born from 1924 to 1956 in 14 European countries.

Theoretical Background

Conceptualizing Complexity in Family Trajectories

How should increasing complexity in family life courses be conceptualized? Concepts surrounding increasing family life course complexity are used ambiguously in the literature (see Brückner & Mayer 2005). *Differentiation* (Mayer 1991) generally refers to variation within individual life courses, and *institutionalization* (Kohli 1997; Mayer & Müller 1986) and *standardization* (Modell & Furstenberg 1976) refer to variation between life courses. Other concepts such as individualization (Beck & Beck-Gernsheim 1994) and pluralization (Brüderl 2004) have been used less systematically. It is essential to develop clearly defined concepts prior to their operationalization to ensure valid measurement of family trajectory complexity.

I conceptualize increasing complexity in family formation as differentiation. Brückner and Mayer (2005) developed a comprehensive categorization of life course variation that occurs either within individual life courses over the lifetime or between individual life courses within a population. They defined differentiation as a process whereby life courses are characterized by an increasing number of distinct life course states. Differentiation further implies increasing unpredictability and uncertainty in individual life courses. Examples of family formation differentiation are when unmarried cohabitation precedes marriage or a first union is followed by divorce and further unions. Contrary to differentiation, *de-differentiation* refers to a process whereby the number of distinct life course stages decreases. Family life courses become de-differentiated if high-parity families are replaced by single-child families.

Family Trajectories Across Time

The SDT thesis is the most prominent account of family life course differentiation. Van de Kaa (Van de Kaa 1987, p.11) postulated the establishment of a new demographic regime following four shifts: from marriage to cohabitation, from child-centric to pair-centric relationships, from precautionary contraception to conception for self-fulfillment, and from uniform to pluralistic families. The change in demographic behavior associated with the SDT,

such as cohabitation and childlessness, is accounted for by a shift from materialism to postmaterialism (van de Kaa 2001). The higher-educated and socioeconomically advantaged act as forerunners of this value shift toward self-actualization and nonconformism as well as the forerunners of more complex family demographic behavior associated with it (Lesthaeghe 1995; Lesthaeghe & Surkyn 1988; Sobotka 2008).

Cohorts born in the mid- to late 1920s just entered courtship age as World War II began. Those cohorts that experienced World War II or its aftermath in Europe held primarily materialist values associated with securing economic and social standing. The family formation patterns of these early industrialist and industrialist cohorts are considered to have been relatively simple, consisting mostly of leaving the parental home early and entering directly into marriage, followed by parenthood (Mayer 2004). Cohorts born in the early and mid-1950s entered courtship age during the 1970s. Stable economic growth and the expansion of welfare state and educational systems facilitated a value shift toward postmaterialism among the early members of this postindustrialist and contraceptive revolution cohort. According to the SDT thesis, this shift toward self-actualization led to postponed marriage and parenthood as well as an increase in cohabitation, childlessness, and divorce. Therefore, I expect that *family trajectories have become more differentiated across birth cohorts* (Hypothesis 1 (H1)).

Family Trajectories Across Countries

Proponents of the SDT have used institutional arguments to account for cross-national variation in family demographic behavior. For example, Lesthaeghe (Lesthaeghe 2010, pp.244–245) argued that the foundations of traditional family formation patterns will weaken first in egalitarian liberal market democracies that respect individual choice despite normative ideals. Comparative life course sociologists focus on institutions and their impact on family formation (see Mayer 2009). At the core lies the proposition that welfare regimes, labor market institutions, and educational systems shape societal life course patterns. Institutions may influence life courses directly by means of age gradation (Mayer & Schoepflin 1989) or indirectly by incentivizing the adherence to dominant life course patterns or enabling individuals to tread new paths (Breen & Buchmann 2002; Buchmann 1989).

Esping-Andersen's (1990) "worlds of welfare capitalism" typology has been widely used as a heuristic to classify and compare European countries (see Arts & Gelissen 2002;

Emmenegger et al. 2015). The extended typology developed by Esping-Andersen (1999) clusters countries based on levels of decommodification (i.e., protection from labor market risks) and defamilization (i.e., public assumption of family care tasks). Although the *social democratic regime* is characterized by universal and generous social protection as well as public child and elderly care, the *liberal regime* provides only limited welfare benefits, and childcare is privately arranged. Unfortunately, common representatives of the liberal welfare state regime type (e.g., the UK and Ireland) did not participate in the survey used in this study (SHARELIFE), or the data was not available when the analyses were performed. Social protection is targeted toward specific groups and is less generous in the *conservative regime* and in the *Mediterranean regime*, but families are especially responsible to compensate residual welfare coverage in the latter. Eastern European countries were considered to constitute an authoritarian welfare state during state socialism. Following their transition to liberal market democracy, scholars have debated whether these countries still compromise a single welfare regime or have shifted to existing models (Aidukaite 2009).

Scandinavian social democratic welfare states were forerunners in the implementation of defamilizing and individualizing family policies, which reduced gender and intergenerational dependencies and allowed greater freedom in family formation (Lohmann & Zagel 2016). In Sweden, paid and job-protected maternity leave was introduced in 1955 and was supplemented by paternal leave in 1974 (DICE 2015).[2] In Denmark, publicly funded childcare for children within one year after birth was introduced as early as 1964 (Garrouste 2010). Further, generous old-age benefits following retirement and unconditional old-age pensions were introduced in Sweden in 1953 and 1913, respectively.[3] These policies allowed cohorts born in the early 1930s to maintain a high labor market attachment after entry into parenthood and when elderly family members were in need of care. High female labor force participation rates coupled with high levels of decommodification safeguard individuals, especially women, from economic downturns (DiPrete et al. 1997) as well as life course risks, such as divorce and single parenthood (DiPrete 2002). Therefore, the social democratic welfare regime reduces the costs and risks of family demographic behavior associated with more complex family life courses, such as cohabitation, nonmarital childbirth, and divorce.

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[2] Maternity leave is defined as a minimum of 14 weeks paid and job-protected leave of absence according to the International Labour Organization (ILO) convention on maternity leave. Paternal leave is defined as a minimum of one week paid and job-protected leave of absence following childbirth or maternity leave for fathers as part of a parental leave scheme.

[3] See ILO Ratifications of Social Security Convention, 1952 (No. 102) (http://www.ilo.org/dyn/normlex/en/f?p=NORMLEXPUB:11300:0::NO::P11300_INSTRUMENT_ID:312247) and the Country Fact Files of HelpAge International (http://www.pension-watch.net/country-fact-file/).

Contrary to welfare systems in Scandinavian countries, the social protection systems and family policies in conservative continental European countries incentivize a male breadwinner–female homemaker division of labor. Many western and central European countries implemented family and child allowances before maternity leave and well before any paternal leave policies (Gauthier & Monna 2004; DICE 2015). For example, Austria introduced family allowances in 1967, paid and job-protected maternity leave in 1974, and paternal leave in 1990. Further, publicly funded childcare in most continental countries is available only for children starting at age 3 (Garrouste 2010). The concentration of family policy on family allowances and maternity leave rather than childcare and paternal leave incentivizes traditional family formation by making women primary care providers and limiting female labor market participation (Gottschall & Bird 2003; Morel 2007). Gendered decommodification and highly familistic policies make family behavior associated with complex family formation, such as divorce and single parenthood, highly costly, especially for women.

In southern Europe, authoritarian regimes (e.g., Mussolini in Italy and Franco in Spain) coupled with the moral teachings of the Greek Orthodox and Roman Catholic churches contributed to the production of a welfare model with the family at its center (Flaquer 2000). For example, maternity leave was introduced in 1976 in Spain and 1984 in Greece (DICE 2015). Without widespread early childcare and paternal leave policies, childcare has to be arranged by the family, usually by women. A late introduction of unconditional old-age benefits additionally burdened families when elderly family members need care. These welfare states are additionally characterized by highly gendered labor market segmentation and very low rates of female labor market participation as well as a context in which families must compensate for low levels of benefits following unemployment or income loss (Ferrera 1996). Consequently, processes that produce family complexity are very risky in the context of Mediterranean welfare states, and reliance on families to secure individual welfare often leads to a dramatic delay in leaving the parental home.

Generally, levels of decommodification and defamilization were high in eastern European countries, comparable with social democratic countries, during the era of state socialism. For example, East Germany introduced maternity leave in 1950, early childcare in 1965, and paternal leave in 1972 (Garrouste 2010; Maul et al. 2009). However, many societies encouraged early marriage and implemented pronatalist policies (Fodor et al. 2002; Kreyenfeld 2004), thereby incentivizing traditional family formation processes. Although the

family trajectories of very young cohorts may be differentiated to a greater extent following the turbulent transition to liberal market democracy, this is not likely the case for cohorts born before the 1970s.

In sum, defamilizing and decommodifying institutions characteristic of social democratic welfare states reduce the risks of complex family formation patterns involving cohabitation, single parenthood, and divorce. Gendered decommodification in conservative welfare states enables men to peruse more complex family patterns similar to social democratic welfare states but incentivizes less complex patterns of early marriage and parenthood for women. Familism in southern Europe and natalism during state socialism in eastern Europe promotes less-complex family patterns consisting of early marriage and parenthood. Therefore, I expect that *family trajectories are most differentiated in social democratic countries (Sweden and Denmark), followed by conservative countries (Austria, West Germany, the Netherlands, France, Switzerland, and Belgium), and least differentiated in southern European countries (Spain, Italy, and Greece) as well as in eastern European countries (the Czech Republic, Poland, and East Germany)* (Hypothesis 2 (H2)).

Comparing Family Trajectories Across Time and Space

Across all countries, family formation differentiation resulting from a shift toward postmaterialism can be conceived as the result of cohort replacement (Ryder 1965). Inglehart (1990) predicted levels of postmaterialism to increase as young cohorts raised in socioeconomically secure contexts gradually replace older cohorts. Similarly, levels of differentiation within countries will gradually rise as younger cohorts with more-complex family trajectories replace older cohorts with relatively simple trajectories. In a world devoid of institutional arrangements that influence family formation differently across countries, levels of family formation differentiation could be expected to increase at similar rates across countries.

However, changes in institutional arrangements that influence family formation have lagged the shift toward postmaterialism in most European countries. Studies have demonstrated that for cohorts born as early as 1946, postmaterialists became increasingly common across continental European countries (Abramson & Inglehart 1986; Inglehart 2008). In certain countries, such as West Germany and the Netherlands, postmaterialism had become predominant among the entire population by the late 1970s and early 1980s. Nevertheless,

paternal leave was not implemented until 1986 in West Germany and 2009 in the Netherlands, and neither country has yet to introduce universal early childcare. Although social democratic institutions in Scandinavian countries enabled postmaterialists to follow alternative family pathways, institutions in continental Europe inhibited complex family formation even as postmaterialism became ever more common. Therefore, I expect that *family trajectory variation across birth cohorts is country-specific* (Hypothesis 3 (H3)), rather than a contemporaneous process across countries.

Social change through cohort replacement is generally a slow process but will be especially slow when institutions impede behavior that would correspond with ideational change. Pronounced increases in family formation differentiation require not only postmaterialist socialization at a relatively early age but also institutional arrangements that correspond to new family formation patterns involving cohabitation, single parenthood, and divorce. In light of the large cross-national differences in family trajectories (Billari 2004; Billari & Wilson 2001; Blossfeld et al. 2005; Corijn & Klijzing 2001; Elzinga & Liefbroer 2007; Sobotka & Toulemon 2008), it is unlikely that variation across birth cohorts will be larger than variation across countries before defamilizing institutions are integrated across European welfare states. I therefore expect that *family trajectory differentiation varies more across countries than across birth cohorts* (Hypothesis 4 (H4)).

Data and Methods

Study Sample and Sequence Definition

I use the third wave of SHARE,[4] SHARELIFE, which consists of retrospectively collected life history data on multiple life domains—such as partnership, family demographics, living arrangements, and employment—for a number of birth cohorts and countries (Börsch-Supan et al. 2013; Schröder 2011). The SHARELIFE population consists of individuals born before

1957 and their partners, and the data set contains information on 26,768 individuals born between 1908 and 1984. Family life course trajectories are operationalized as sequences using the SHARELIFE accommodation, retrospective children, and partner modules. My sample consists of individuals born between 1924 and 1956 in 14 European countries. I exclude individuals born before 1924 because of insufficient sample sizes. All individuals born after 1956 are partners of SHARELIFE respondents that must be excluded from the analysis. Their inclusion leads to grossly underestimated complexity values for cohorts born after 1956 because individuals who never married, or divorced and never repartnered, would not be included in the sample.

I generated four variables containing annual information on four dimensions of family life: (1) whether respondents were living in the parental home, (2) were cohabiting, or (3) were married, and (4) the timing of childbirths and adoptions. I then constructed sequences from age 15 to 50, thereby capturing not only early family formation, such as first marriage and childbirth, but also later family formation events, such as divorce and remarriage. An age range of 35 years is also much longer than in recent research with family trajectories (e.g., Elzinga & Liefbroer 2007; Fasang & Raab 2014).

Sequences are composed of 35 consecutive annual states. The results displayed in this study use a simplified state definition.[5] Each sequence state is (1) in the parental home, (2) single, (3) cohabiting, or (4) married. Further, each state element can be extended by the presence of at least one child: for example, married with at least one child. (See Table 3 in the appendix for a comprehensive overview.) Note that "single" indicates that the respondent was neither in the parental home nor cohabiting; it does not specify the relationship status of the respondent. Full information is available for 22,272 individuals (see Table 4 in the appendix for case sizes by birth cohort and country). I present results using birth cohorts in three-year groups from 1924–1926 to 1954–1956.

Measuring Differentiation as Sequence Complexity

This study aims to describe family life course differentiation across birth cohorts and countries. I use a composite measure developed in sequence analysis that corresponds with the life course concept of differentiation: the sequence complexity index. This index measures

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[5] I performed the analyses with different sequence state definitions to ensure that the results are not dependent on the sequence alphabet. The results are robust to more differentiated sequence state definitions.

variability within sequences as the geometric mean of normalized sequence transitions and normalized longitudinal sequence entropy (Gabadinho et al. 2010; 2011). Formally, the complexity, C, of a sequence, x, is defined as follows:

$$C(x) = 100 * \sqrt{\frac{q(x)}{q_{max}} * \frac{h(x)}{h_{max}}}, \tag{1}$$

where the number of transitions within a sequence, $q(x)$, is divided by the theoretical maximum number of transitions possible, q_{max}; the longitudinal entropy of a sequence, $h(x)$, is divided by the theoretical maximum, h_{max}.

Formally, longitudinal sequence entropy is

$$h(x) = -\sum_i^s \pi_i log\pi_i, \tag{1.1}$$

where π is the proportion of occurrences in a given state, i, of the sequence alphabet, s. Entropy within sequences is maximal when each state occurs an equal number of times, which reflects that the unpredictability of a given state is maximal. Complexity is minimal in sequences composed of a single state and maximal in sequences that contain each state element with equal durations and have the maximum number of transitions. The complexity index provides a more nuanced indicator of life course differentiation compared with just the number of transitions or distinct states because the degree of uncertainty within life courses is incorporated through sequence entropy.

Figure 1: Artificial Example of Family Trajectories and Sequence Complexity

Family Trajectory 1: $C(x) = 46.213$

P	P	S	S	M	M	MC	MC	MC	MC

Family Trajectory 2: $C(x) = 58.648$

P	P	S	S	C	C	M	M	MC	MC

Family Trajectory 3: $C(x) = 51.215$

P	S	C	M	MC	MC	MC	MC	MC	MC
t_1	t_2	t_3	t_4	t_5	t_6	t_7	t_8	t_9	t_{10}

As an example, consider the three artificial family trajectories in Fig. 1. (See the appendix for the calculation of sequence complexity in Fig. 1.) The first sequence, composed of two parental home states (P), two single states (S), two married states (M) followed by four married with children states (MC), has a lower complexity value than sequences 2 and 3.

Sequences 2 and 3 have an additional transition into (or out of) cohabitation, which makes them more complex than Sequence 1. Sequences 2 and 3 differ in regard to the duration spent in distinct states and thus in regard to the degree of predictability displayed by the sequences. Although the second sequence is characterized by frequent transitions, the third sequence shows high stability within the state married with children. Therefore, the complexity of Sequence 3 is lower than that of Sequence 2 because the longitudinal entropy (i.e., the degree of unpredictability) of the third sequence is lower.

Covariates

I introduce individual-level characteristics in the cross-classified models (discussed shortly) that were theorized to be related to family formation complexity: educational attainment, socioeconomic status, and gender. Educational attainment is operationalized using the ISCED 1997 scale recoded as (1) no formal education, (2) preprimary, (3) primary, (4) secondary, and (5) postsecondary education. I use two socioeconomic status indicators that either precede or occur early in individuals' active family formation phase. First, I use the occupation of the main breadwinner when the respondent was age 10 using the reduced ISCO88 scale as a proxy for childhood socioeconomic status. Even though occupation is not equivalent to socioeconomic condition or social class, it is an approximation. Second, whether the respondent's first employment was in the public or private sector serves as a proxy for the stability of employment and amount of benefits available during the early phase of family formation.

Modeling Sequence Complexity

I use a cross-classified random-effects approach to analyze how family trajectories vary across countries and across birth cohorts, and whether they vary more across countries or cohorts. This enables me not only to investigate levels of family trajectory complexity across countries and cohorts but also to decompose the proportion of family trajectory complexity variance attributable to countries and to cohorts. These models represent a special case of multilevel modeling in which the higher-level units cannot be hierarchically ordered (Rabe-Hesketh & Skrondal 2012, pp.433–460; Snijders & Bosker 2012, pp.155–165). Individuals are cross-classified by birth cohort membership and country of residence. Formally, sequence complexity is modeled as follows:

$$y_{ijk} = \beta_0 + \zeta_j + \zeta_k + \zeta_{jk} + \varepsilon_{ijk}, \tag{2}$$

where the sequence complexity, y_{ijk}, is composed of the constant β_0 (i.e., the grand mean); the group-specific error terms, ζ_j, ζ_k, and ζ_{jk}; and the individual error term, ε_{ijk}.[6] The variance attributable to countries and birth cohorts is identified through country- and birth cohort–specific deviations from the grand mean, ζ_j and ζ_k, respectively. The group-specific deviations from the constant are also referred to as random intercepts or effects. Change caused by universal trends that affect cohorts identically across all countries will be captured in the cohort-specific deviations, whereas country-specific differences across all cohorts will be captured by the country-specific deviations. To capture country-specific change across birth cohorts, the additive cross-classified model is extended through an interacted random effect, ζ_{jk}.[7] The relative proportion of complexity variance that is accountable to country- or birth cohort–specific differences are calculated as intraclass correlation coefficients (ICC), ρ:

$$Var(y_{ijk}) = Var(\zeta_j + \zeta_k + \zeta_{jk} + \varepsilon_{ijk}) = \psi_j + \psi_k + \psi_{jk} + \sigma, \tag{2a}$$

$$\rho_{Country} = \frac{\psi_j}{\psi_j + \psi_k + \psi_{jk} + \sigma} \tag{2b}$$

and alternatively

$$\rho_{Cohort} = \frac{\psi_k}{\psi_j + \psi_k + \psi_{jk} + \sigma}, \tag{2c}$$

where σ is the constant variance of the Level 1 residuals; and ψ_j, ψ_k, and ψ_{jk} are the variances of the country-specific, cohort-specific, and interacted random intercepts, respectively, of the parameters in Eq. (2). Equation (2b) calculates the correlation of observations from the same country but different cohorts by dividing the country-specific variance by the total variance. Likewise, Eq. (2c) calculates the correlation of observations from the same cohort but different countries.

Cross-classified random-effects regressions can also be estimated with covariates. In this case, sequence complexity is modeled as follows:

$$y_{ijk} = \beta_0 + \mathbf{X}_{ij}\boldsymbol{\beta} + \zeta_j + \zeta_k + \zeta_{jk} + \varepsilon_{ijk}, \tag{3}$$

where $\mathbf{X}_{ij}\boldsymbol{\beta}$ contains the covariates and their coefficients. Similar to linear multilevel models

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[6] The models are estimated using restricted maximum likelihood estimates (REML) and identity covariance matrices.

[7] Shi et al. (2010) recommended that researchers include random interaction effects because their simulations and empirical tests showed that higher-level random-effects estimates are biased if significant interacted crossed factors are omitted.

with hierarchically nested random effects, the reduction of country-specific and cohort-specific variation by the covariates can be calculated as a pseudo-R^2:

$$R^2{}_{Country} = \frac{\psi_j - \psi_{j,C}}{\psi_j + \psi_k + \psi_{jk} + \sigma} \tag{3.1}$$

and alternatively

$$R^2{}_{Cohort} = \frac{\psi_k - \psi_{k,C}}{\psi_j + \psi_{k} + \psi_{jk} + \sigma}, \tag{3.2}$$

where the variance component of the conditional model is denoted with the subscript C. The standard assumptions for random-effects multilevel modeling apply and are clearly stated and examined in Online Resource 1 (see the upcoming section, Discussion and Conclusion). I conclude that the model parameters are generally consistently and efficiently estimated.

Overview of the Analytical Strategy

My analytical strategy entails four steps.[8] First, I address my first two research questions: how family trajectories vary across birth cohorts, and how they vary across countries. To do this, I estimate unconditional cross-classified random-effects regressions on sequence complexity and investigate the country and birth cohort averages using empirical Bayes predictions of the random effects, ζ_j and ζ_k, and their standard errors (Rabe-Hesketh & Skrondal 2012, pp.109–114). Comparing empirical Bayes predictions of the country- and cohort-specific complexity intercepts is better than comparing ordinary least squares (OLS) estimates because information is weighted by its reliability.[9] Examining the empirical Bayes estimates allows me to test whether levels of family trajectory complexity have increased across birth cohorts (H1) and whether they are highest in Scandinavian countries, followed by continental European countries, and lowest in southern and eastern Europe (H2). I additionally analyze the empirical Bayes predictions of the interacted random intercepts, which indicate the average deviations of countries from the birth cohort random intercepts. If significant deviations exist, I can conclude that family trajectory variation across time is country-specific (H3).

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[8] I use the *TraMineR* (Gabadinho et al. 2011) package to calculate sequence complexities and the *WeightedCluster* (Studer 2013) package to perform cluster analyses on the sequence-based distance matrixes in R, version 3.2.0. The cross-classified regressions are calculated using the mixed command in STATA, version 14.

[9] Country, cohort, and country-cohort balanced panels were generated and analyzed to test the robustness of the empirical Bayes predictions (i.e., predictions without reliability coefficients). The results do not change substantially and lead to the same substantive conclusions.

Second, I address my third and core research question: whether family trajectories vary more across countries or across birth cohorts. I calculate the country and birth cohort intraclass correlation coefficients for both the unconditional and conditional cross-classified models, which enables me to enumerate the proportions of complexity variance attributable to countries and to cohorts. If the intraclass correlation coefficients are higher for countries than cohorts, my expectation that cross-national variation is larger than cross-temporal variation (H4) is validated. As a third step, I then estimate conditional cross-classified models by introducing educational attainment, socioeconomic status, and gender as covariates.

Finally, I use results from cluster analysis to illuminate the qualitative differences between family life courses within countries and birth cohorts that underlie the regression results. In addition, I show that sequence complexity is a valid construct for life course differentiation. Specifically, I analyze complexity distributions within family trajectory clusters and describe how these differ across Europe and across birth cohorts as well as across gender, educational attainment, and socioeconomic status. Combining sequence and cluster analysis is a common method to inductively establish common trajectory patterns or groups (see Aisenbrey & Fasang 2010). I calculate a pairwise sequence distances matrix using optimal matching. This distance matrix is then subjected to a Ward cluster analysis, a hierarchal clustering method that minimizes the residual variance to establish groups with low within-group distance and high between-group distance.

I rely on the average silhouette width (ASW) to determine the optimal number of clusters. The ASW is calculated by computing the silhouette of each observation—that is, how close an observation is to the observations within its own cluster compared with how close it is to the observations in other clusters, then averaging the silhouettes within each cluster, and finally averaging the cluster specific silhouette values. Kaufman and Rousseeuw (1990, p.88) proposed an interpretation of ASW values, where 0.25–0.50 denotes weak structure, 0.51–0.75 indicates a reasonable structure, and 0.76–1.0 is a strong structure indicating clearcut clusters in the data. Cluster solution quality measures displayed in Section 8 in Online Resource 1 indicate that family trajectories are reasonably well structured into family patterns involving marriage as well as parenthood and those following different pathways. The two-cluster solution (ASW = 0.61) reveals variation in family trajectories across countries and across birth cohorts, but it masks important differences because diverse family trajectories are "dumped" together into one cluster. Therefore, I discuss the second-best solution with six clusters (ASW = 0.29) in the following section.

Results

Family Trajectory Differentiation

The unconditional cross-classified random-effects regression results for family trajectory complexity are presented in columns 1 and 2 of Table 1. The first model, column 1, excludes the interacted random effect. The results of the conditional model on sequence complexity are displayed in column 3 of Table 1. I first describe how family trajectories vary across birth cohorts and countries using empirical Bayes predictions of random intercepts from Model 2 (see Table 1, column 2) shown in Fig. 2.

Table 1: Cross-Classified Random Effects Regression on Sequence Complexity

	Unconditional Additive 1	Unconditional Interacted 2	Conditional Interacted 3
Female			–0.570***
			(0.071)
Education (ref. = secondary)			
None			–0.802***
			(0.212)
Preprimary			–0.899***
			(0.106)
Primary			–0.523***
			(0.109)
Postsecondary			1.160***
			(0.103)
Public Sector			0.156
			(0.137)
Occupation of Breadwinner (ref. = agriculture)			
Senior professional			1.301***
			(0.185)
Professional			1.115***
			(0.199)
Technician			1.060***
			(0.184)
Clerk			0.970***
			(0.166)
Service			0.589***
			(0.148)
Craftsman			0.296**
			(0.107)
Industry			0.358*
			(0.176)
Unskilled			0.147
			(0.113)
Armed services			0.592*
			(0.290)
None			0.945**
			(0.289)

		Model 1	Model 2	Model 3
Constant		15.063***	15.068***	15.089***
		(0.521)	(0.491)	(0.429)
Var(Cohort)		0.655***	0.584***	0.330***
		(0.301)	(0.284)	(0.170)
Var(Country)		2.942***	2.561***	1.971***
		(1.161)	(1.029)	(0.798)
Var(Interacted)			0.455***	0.456***
			(0.083)	(0.082)
Var(Residual)		28.764***	28.387***	27.512***
		(0.273)	(0.270)	(0.262)
ρ_{Cohort}		2.02	1.82	1.08
$\rho_{Country}$		9.09	8.00	6.51
R^2_{Cohort}				43.60
$R^2_{Country}$				23.03
R^2_{Total}				5.37
N		22,272	22,272	22,272
R Log-Likelihood		−69,064	−68,989	−68,647

Notes: Unstandardized regression coefficients are displayed. Standard errors are shown in parentheses. Significance of random-effect parameters is determined by likelihood-ratio tests. Data are not weighted.
*p <.05; **p <.01; ***p < .001

Figure 2 shows a clear trend toward increasing trajectory complexity across birth cohorts; however, it is much less pronounced than expected. The estimated sequence complexity for the birth cohorts 1951–1953 and 1954–1956 are, on average, significantly higher than the cohorts 1939–1941 and older. As expected, the family trajectories of birth cohorts born in the early 1950s are more complex than older birth cohorts (H1).

Family trajectories are the least complex in Spain, Poland, and Italy, and they are the most complex in Denmark and Sweden. Family trajectories in East Germany, Belgium, and the Netherlands have average values. With the exception of East Germany and Austria, the empirical Bayes estimates support my expectation that family trajectories are the most complex in Scandinavian social democratic countries, followed by the corporatist continental European countries, with family life courses being the least complex in southern and eastern Europe (H2).

Figure 2: Empirical Bayes Estimates of Mean Sequence Complexity by Cohort and Country
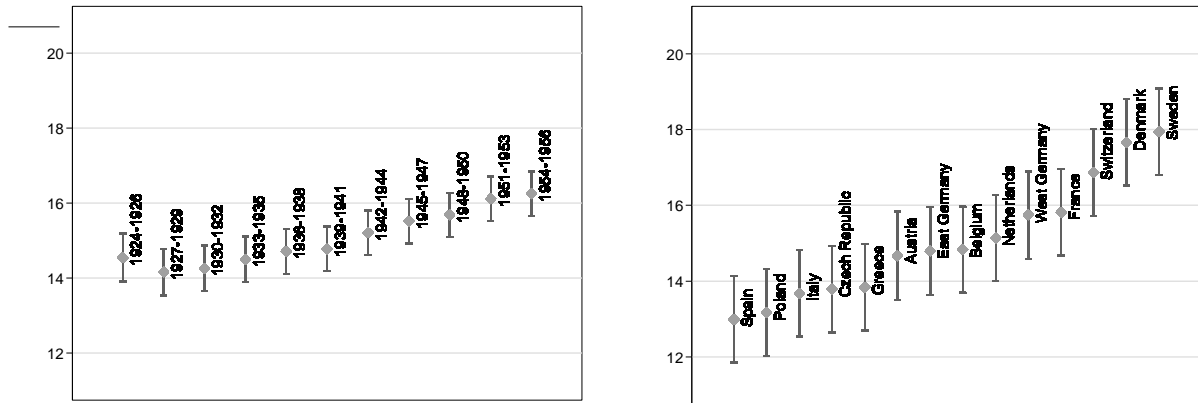
Random intercepts and 95 % confidence intervals are displayed

The significant interacted random effect parameter of column 2 (Table 1) indicates that sequence complexity variation across birth cohorts is not identical in all countries (H3). The country-specific deviations from the birth cohort estimates displayed in Fig. 2 are depicted in Fig. 3. The only statistically significant deviations are found in Switzerland and Sweden for the 1951–1953 cohorts, which have an estimated 1.5 points higher average complexity than the general trend. This indicates that levels of family life course complexity began to increase earlier in Sweden and Switzerland, most likely associated with an early shift toward prolonged family formation involving periods of cohabitation or independent living before marriage in these two countries. All other countries display no significant deviations from the estimated general trend. Despite some country-specific time trends, the results demonstrate an unexpected level of persistent cross-national differences with common trends of increasing complexity.

Figure 3: Empirical Bayes Estimates of Country-Specific Deviations from Mean Birth Cohort Complexity.
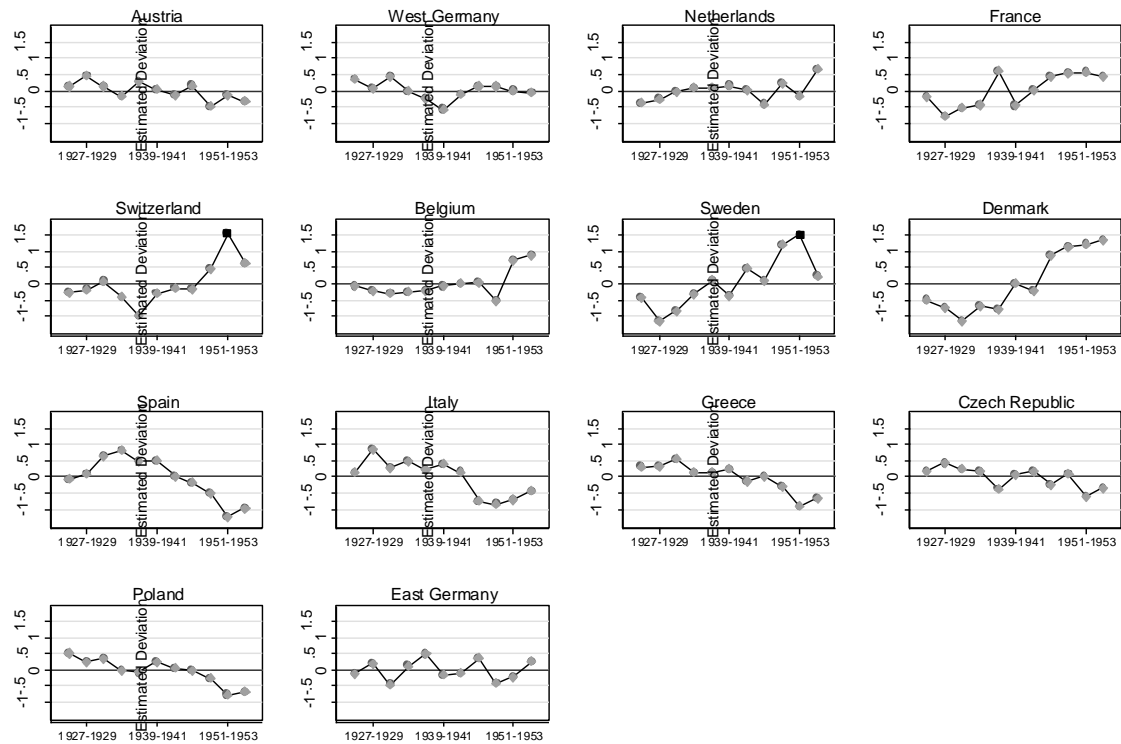
Note: Random intercepts displayed
Black denotes significant deviations; p<0.05

Random intercepts are displayed. Black markers denote significant deviations (p < .05)

I now turn to partitioning the sequence complexity variance between countries and birth cohorts using cross-classified random-effects modeling. As expected, the results demonstrate that the complexity of family trajectories varies more across countries than across birth cohorts (H4). The unconditional average of family trajectory complexity is 15, as indicated by the constant in columns 1 and 2 (see Table 1). The country-specific variation from the average is 2.56 and is thus substantially larger than the birth cohort–specific variation estimate of 0.58, displayed under the random effects of Table 1. An estimated 8 % of the family trajectory variance is attributable to country differences, opposed to a marginal 1.8 % accounted for by birth cohort differences, as shown by the intraclass correlations in column 2.

The associations among educational attainment, socioeconomic status, gender, and sequence complexity are displayed in column 3 of Table 1. The family sequences of women are an average of 0.57 points less complex than those of men. Higher educational attainment is significantly associated with more complex family trajectories. Further, family formation is more complex if the main breadwinner of the respondent's childhood household had an occupation requiring a higher skill level than agricultural labor. However, family formation

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trajectories are also more complex for respondents who had no main breadwinner in their childhood household.[10] The sector of first employment is not significantly associated with sequence complexity. With the exception of the respondent's sector of first employment, these associations are in line with what would be anticipated based on the SDT thesis and institutional arguments of comparative life course sociology.

The conditional intraclass correlations—that is, the proportion of complexity variance attributable to cohort and country differences conditioned on the covariates—also indicate that family trajectories vary considerably more across countries than across birth cohorts when conditioned on the covariates. More than 6.5 % of complexity variation can be attributed to cross-national differences compared with 1 % for differences across birth cohorts. Educational attainment, the occupation of the main breadwinner when the respondent was 10, and gender reduce the country-specific complexity variation by 23 % and the cohort-specific variation by 43.6 %. This indicates that compositional differences account for a considerable amount of complexity variation across countries and cohorts. For example, higher levels of educational attainment in younger cohorts partially account for increasing levels of family formation complexity. These three covariates reduce the total sequence complexity variation by 5.3 %, which is considerable for composite sequence metrics (see Biemann et al. 2011; Van Winkle & Fasang 2017).

Family Trajectory Patterns: Results From Exploratory Cluster Analysis

Family life courses can be categorized as (1) early family formation; (2) parental home, single, or cohabitation trajectories; (3) prolonged family formation; (4) union dissolution trajectories; (5) childless marriages; or (6) delayed family formation (see Fig. 4). The family life courses of these clusters are displayed in Fig. 4 as relative frequency sequence plots, which display 100 representative sequences from each cluster on the left and a box plot of the dissimilarities from the respective sequence on the right (Fasang & Liao 2014).[11]

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[10] This response could mean that there was no main breadwinner or that the main breadwinner had no occupation (e.g., was unemployed).

[11] Relative frequency sequence plots are generated by (1) sorting the sequences, (2) dividing the sorted sample into subgroups, (3) choosing medoid sequences from the subgroups to represent them, (4) plotting the medoid sequences, and (5) plotting dissimilarities from the medoid sequences as boxplots with R^2 and F statistics that evaluate the goodness of fit of the chosen medoid sequences. I sort the sequences using multidimensional scaling and divide the sample into 100 medoid sequences. The dissimilarities are calculated using OM distance. The plots were created with the *seqplot.rf* function developed by Matthias Studer, Anette Fasang, and Tim Liao implemented in the *TraMineRextras* package using R, version 3.2.0.

Figure 4: Relative Frequency Sequence Plots of Family Trajectory Patterns
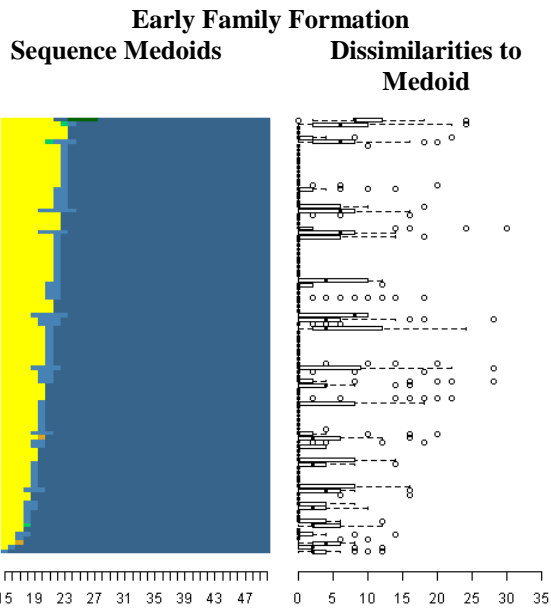
Early Family Formation

Sequence Medoids	Dissimilarities to Medoid

Representation Quality: R^2 = .62 and F = 26.24

Parental Home, Single, and Cohabitation

Sequence Medoids	Dissimilarities to Medoid

Representation Quality: R^2 = .62 and F = 26.24

Prolonged Family Formation

Sequence Medoids	Dissimilarities to Medoid
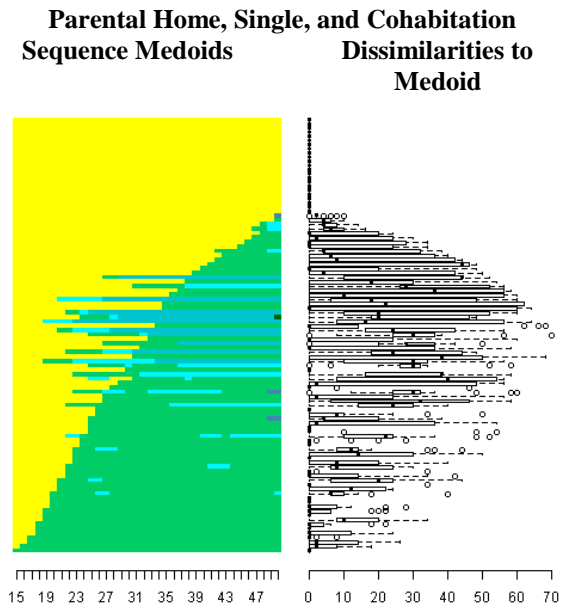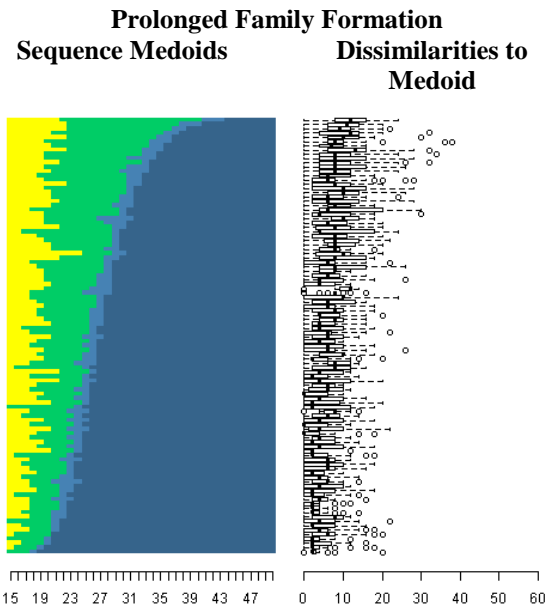
Representation Quality: R^2 = .55 and F = 41.71

Union Dissolution

Sequence Medoids	Dissimilarities to Medoid
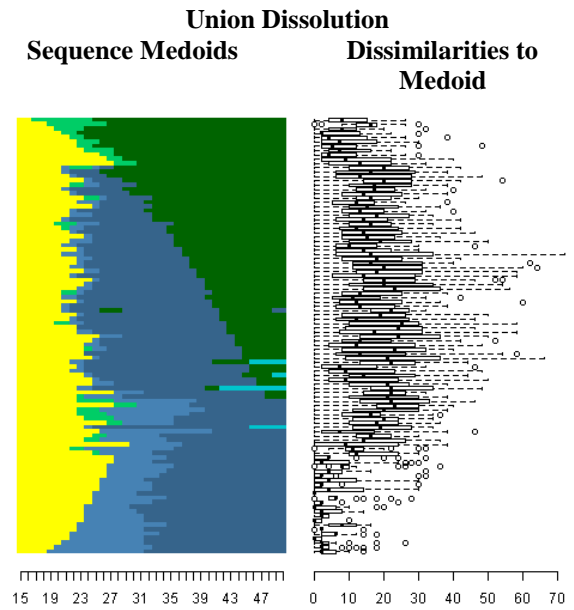
Representation Quality: R^2 = .54 and F = 31.86

Childless Marriage

Sequence Medoids	Dissimilarities to Medoid

Delayed Family Formation

Sequence Medoids	Dissimilarities to Medoid

Representation Quality: R^2 = .66 and F = 29.54   **Representation Quality: R^2 = .84 and F = 495.40**

Legend

🟨 Parental Home	🟦 Cohabiting
🟧 Parental Home, Children	🟦 Cohabiting, Children
🟩 Single	🟦 Married
🟩 Single, Children	🟦 Married, Children
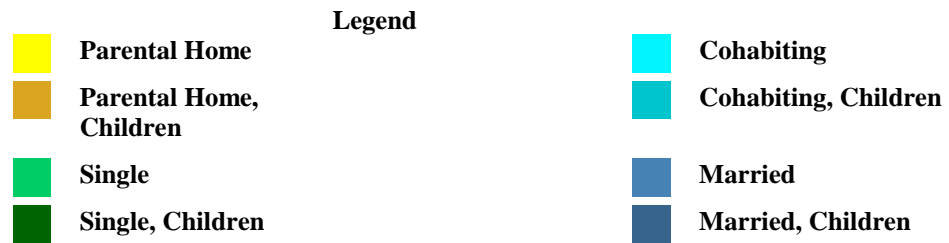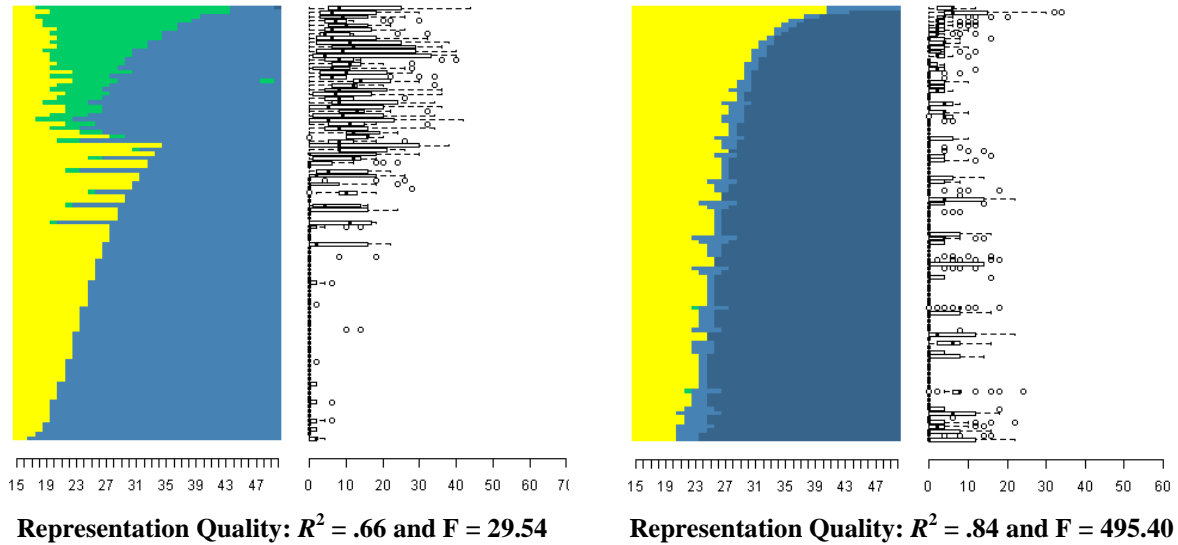
Early and delayed family formation trajectories are characterized by highly coupled transitions out of the parental home into marriage and parenthood by the early to late 20s. Prolonged family formation trajectories are characterized by decoupled transitions in the early life course. A majority lived independently for a period after leaving the parental home before marriage, while some substantially delayed entering parenthood after marriage. Other family trajectories include childless marriages or marriages that dissolved either because of death or because of divorce into independent households or into cohabitation with children. A final cluster includes trajectories that consist of independent living, of cohabitation, or of living in the parental home.

The distribution of sequence complexity within the clusters as well as the cluster sizes are displayed in Table 2. The early and delayed family formation clusters are the largest, each incorporating approximately 30 % of family trajectories. Delayed family trajectories are slightly more complex than early family trajectories because there is less state stability within marriage with children resulting from a longer duration in the parental home. The highest complexity averages are found within the prolonged family formation and union dissolution clusters because trajectories within these clusters include an additional transition into a single state out of the parental home or out of marriage.

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Table 2: Distribution of Sequence Complexity by Family Trajectory Clusters

	Early Family Formation	Parental Home, Single, and Cohabitation	Prolonged Family Formation	Union Dissolution	Childless Marriage	Delayed Family Formation	Total
Complexity	12.51	12.29	19.87	22.40	12.76	14.72	15.51
(SD)	(3.48)	(8.48)	(4.61)	(6.41)	(5.69)	(2.46)	(5.66)
N	6,034	1,473	3,161	2,524	1,381	7,699	22,272
(%)	(28.38)	(5.97)	(14.96)	(11.87)	(6.16)	(32.66)	(100.00)

Notes: Means, percentages, and standard deviations (in parentheses) are displayed. Data are weighted

The prevalence of the different family formation patterns varies across countries in a manner consistent with the regression results. The distribution of family trajectory patterns within countries and cohorts is displayed in Table 5 in the appendix. Levels of differentiation are the highest in Sweden and Denmark because early and delayed family formation trajectories are underrepresented in these countries while prolonged family formation and union dissolution trajectories are overrepresented. Low levels of differentiation in the Czech Republic and Poland are associated with the dominance of early family formation trajectories. Similarly, a dominance of delayed family formation trajectories in Spain, Italy, and Greece account for low levels of differentiation in southern Europe.

Consistent with the regression results, the prevalence of the distinct family trajectory patterns varies little between birth cohorts. Although early family formation trajectories became somewhat more common between 1924–1926 and 1954–1956, delayed family trajectories became considerably less common. Prolonged family formation and childless marriage trajectories remained at a relatively constant level, but the parental home, single, or cohabitation as well as union dissolution patterns became more prevalent. Levels of differentiation for the 1951–1953 and 1954–1956 cohorts are slightly higher because delayed family formation patterns decreased while patterns involving divorce increased. The distribution of family formation patterns across countries and across birth cohorts is in line with the SDT and comparative life course sociology.

The distribution of gender, educational attainment, and socioeconomic status across family trajectory clusters is also consistent with the regression results (see Table 6 in Appendix). Although women are overrepresented in the early family formation cluster, men delay family formation, which corresponds to the finding that women's family life courses are somewhat less complex than men's. The educational gradient in family trajectory complexity is likely attributable to individuals with primary education following early and delayed patterns of

family formation while individuals with postsecondary education commonly form independent households before marrying. This pattern can also be observed among individuals whose main breadwinner during childhood was in the professional occupational classes rather than in the agricultural sector.

Sensitivity Analyses

I conduct multiple sensitivity analyses to test the robustness of my results. The first set of robustness checks addresses the question whether complexity would vary more across cohorts relative to countries if I would observe younger cohorts born after 1956. Unfortunately, no other suitable data sets exist that would allow me to analyze the family formation trajectories of men and women aged 15–50 for cohorts born after 1956.[12] I nonetheless replicate my analyses using the Harmonized Histories data from the Generations and Gender Programme (Europe 2005; Perelli-Harris et al. 2010) with trajectories of individuals aged 15–35 for cohorts born between 1939–1971 from 13 European countries. I find that differences across cohort are still small compared with cross-national differences and in some cases are even smaller than in the analysis presented earlier (see Section 4 in Online Resource 1 for more details). The results solidify my conclusion that the increase in family trajectory complexity is still minor even if the cohort range is extended beyond 1956. Further, the analyses demonstrating even smaller cross-temporal variation using shorter trajectories underline the importance of using long family life courses when analyzing change partially due to events in later life (e.g., divorce and remarriage).

The second set of sensitivity analyses pertain to the dependent variable—sequence complexity—and its influence on the results. First, I conduct separate analyses on entropy, the number of transitions as well as logarithmic complexity and its components. The results are substantively similar and lead to the same conclusions (see Section 1 in Online Resource 1). Second, I perform robustness checks on complexity weighted by durations in specific sequence states. Although the results are quite similar to those presented earlier, cross-national differences are inflated when complexity is weighted to give more importance to

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[12] Although the Generations and Gender Programme has extremely rich life history data on a number of countries, using them would only extend the cohort range past 1956 for Poland, Belgium, and Sweden for long life trajectories. An alternative data source would be the 2006 European Social Survey used by Hofäcker and Chaloupková (2014) to analyze family formation trajectories across 23 European countries for those aged 18–35; however, these data would not expand the cohort range of individuals observed until age 50. Moreover, the 2006 European Social Survey did not collect information on the timing of divorce, which is necessary when analyzing family life courses until age 50.

durations of being single without children, and gender differences become larger when weighted by durations spent in the parental home with children or single with children (see Section 2 in Online Resource 1).

A final set of sensitivity analyses examines how model specifications influence the results. I estimated models with yearly, two-year, four-year, and five-year cohorts rather than three-year cohorts used in the analyses earlier. The results are highly robust to different cohort groupings (see Section 3 in Online Resource 1). As another robustness test, I analyze two-level models with country-cohort clusters, which indicate that the intraclass correlation coefficients from the cross-classified models are well estimated (see Section 7 in Online Resource 1). Finally, I conduct sensitivity analyses omitting single countries and cohorts that demonstrate that my results are not driven by a single country or cohort (see Section 5 in Online Resource 1).

Discussion and Conclusion

I set out to ascertain (1) how family trajectories vary over time, (2) how they vary across countries, and (3) whether they vary more across time or across countries. These questions are motivated by two research traditions in the field of comparative family demography and sociology: the ideational account of the SDT (Lesthaeghe & Van de Kaa 1986) and the institutional account of comparative life course sociology (Mayer 1997; 2009). Based on these theoretical perspectives, I hypothesized that family trajectories became more differentiated across cohorts (H1) and that family trajectories within social democratic countries are the most differentiated, followed by corporatist countries, and are the lowest within southern and eastern European countries (H2). Finally, I argued that the speed and extent of change in family formation within countries result from an interaction between the dissemination of postmaterialism and the implementation of defamilizing institutions. It follows that change over time is country-specific (H3) and that cross-national variation is larger than cross-temporal variation (H4). All four hypotheses were supported by the empirical results, although I observed a higher level of contemporaneous change across countries than expected.

The analyses presented have various potential limitations. The SHARELIFE data were collected retrospectively from elderly respondents, posing the problem of recall error. Havari and Mazzonna (2015) compared information collected in the SHARELIFE childhood circumstances module with national registry data and concluded that recall error does not

compromise the validity or usefulness of the data. Further, the life history calendar used in SHARELIFE collected data on an annual rather than monthly basis. Both recall error and the coarseness of annual life history data may cause an underestimation of family life course differentiation, especially in the early cohorts and in countries with high differentiation levels.

Another potential limitation lies within the birth cohorts analyzed as well as the clustering of cohorts and countries. The data lack birth cohorts entering family formation at the dawn of the twentieth century and after the 1980s, which could display considerably higher levels of family trajectory differentiation. Even with the relatively large number of birth cohorts and countries included in this study, the estimated variance components may be biased downward because of small cluster sizes (Bryan & Jenkins 2015). All these limitations, if anything, point to a potential underestimation of the true degree of differentiation in family life courses. Therefore, the analyses can be understood as lower-bound estimates. The finding of a strong influence of institutional path dependency on family life courses suggests that cross-temporal variation will probably not outweigh cross-national differences for decades to come, although this is an empirical question.

One of my main contributions to the literature is the introduction of a novel methodological approach that simultaneously quantifies cross-national and cross-temporal variation in family life courses. This methodological approach is important for three reasons. First, it enables family demographers and sociologists to describe the extent of increasing family formation complexity by using cross-national differences as a point of reference. I demonstrated that the extent of change in family formation is often overstated in light of much more substantial variation across European countries. Second, this approach addresses two theoretical accounts of family life course variation and enables family demographers and sociologists to investigate processes of family formation without neglecting either the temporal or spatial dimension. For example, I demonstrated that educational attainment is associated with family formation complexity and that compositional differences in educational attainment account for both cross-national and cross-temporal variation. Third, my methodological approach is applicable to other areas of research on the temporal and spatial variation of process outcomes, such as democratic consolidation or health histories.

The implications of my results both advance the SDT thesis and substantiate previous research. I bring a long generational perspective into the debate on increasing complexity in family formation by integrating the theoretical perspectives of the SDT and comparative life course sociology with a focus on temporal order. This is important to gain a deeper

understanding of how family formation differentiation engendered by the dissemination of postmaterialism over time can be inhibited by national institutional arrangements that lag this cultural change. For example, although studies have demonstrated that the dissemination of postmaterialism developed similarly in Denmark and the Netherlands (e.g., Inglehart & Abramson 1994), defamilizing institutions (such as maternity and paternal leave as well as early childcare) that facilitate high female labor market participation were introduced much later or not at all in the Netherlands. Although defamilization lowered the risks of complex family formation associated with postmaterialism in Denmark, continued familization and gendered decommodification in the Netherlands further incentivize early marriage and parenthood, especially for women. This process of institutional lag and the suppression of family formation differentiation is likely to continue in continental Europe and also in southern and eastern Europe.

More generally, my study underlines large and relatively stable cross-national differences in levels of family life course differentiation. This supports the notion that "societies change very gradually" (Mayer 2005, p.17) and that path dependency in institutions may be the primary source of gradual change in family life courses. Many of the cross-national differences and changes across cohorts are consistent with the comparative life course literature as well as the SDT thesis. Future research should further investigate how ideational and institutional change jointly unfolds over time to shape family life courses and how these trends may be associated with social inequality.

References

Abbott, A., 2005. Process and Temporality in Sociology: The Idea of Outcome in U.S. Sociology. In G. Steinmetz, ed. *The Politics of Method in the Human Sciences: Positivism and Its Epistemological Others*. Durham, NC: Duke University Press, pp. 393–426.

Abramson, P. & Inglehart, R., 1986. Generational Replacement and Value Change in Six West European Societies. *American Journal of Political Science*, 30(1), pp.1–25.

Aidukaite, J., 2009. Old welfare state theories and new welfare regimes in Eastern Europe: Challenges and implications. *Communist and post-communist studies*, 42(1), pp.23–39.

Aisenbrey, S. & Fasang, A.E., 2010. New Life for Old Ideas: The "Second Wave" of Sequence Analysis Bringing the "Course" Back Into the Life Course. *Sociological Methods & Research*, 38(3), pp.420–462.

Antonova, L. et al., 2014. Migration, family history and pension: the second release of the SHARE Job Episodes Panel. *SHARE Working Paper Series*, pp.1–14.

Arts, W. & Gelissen, J., 2002. Three worlds of welfare capitalism or more? A state-of-the-art report. *Journal of European Social Policy*, 12(2), pp.137–158.

Baizan, P., Michielin, F. & Billari, F., 2002. Political Economy and Life Course Patterns: The Heterogeneity of Occupational, Family and Household Trajectories of Young Spaniards. *Demographic Research*, 6, pp.191–240.

Beck, U. & Beck-Gernsheim, E., 1994. *Riskante Freiheiten–Zur Individualisierung der Lebensformen in der Moderne*, Frankfurt/Main: Suhrkamp.

Biemann, T., Fasang, A.E. & Grunow, D., 2011. Do Economic Globalization and Industry Growth Destabilize Careers? An Analysis of Career Complexity and Career Patterns Over Time. *Organization Studies*, 32(12), pp.1639–1663.

Billari, F., 2004. Becoming and Adult in Europe: A Macro(/Micro)-Demographic Perspective. *Demographic Research*, Special Co, pp.15–44.

Billari, F. & Liefbroer, A., 2010. Towards a new pattern of transition to adulthood? *Advances in Life Course Research*, 15(2–3), pp.59–75. Available at: http://linkinghub.elsevier.com/retrieve/pii/S1040260810000407.

Billari, F. & Wilson, C., 2001. Convergence towards diversity? Cohort dynamics in the

transition to adulthood in contemporary Western Europe. *Max Planck Institute for Demographic Research, Working Paper 39*, pp.1–29. Available at: http://www.demogr.mpg.de/Papers/Working/wp-2001-039.pdf.

Blossfeld, H.-P. et al. eds., 2005. *Globalization, Uncertainty and Youth in Society*, London: Routledge.

Börsch-Supan, A. et al., 2013. Data Resource Profile: the Survey of Health, Ageing and Retirement in Europe (SHARE). *International journal of epidemiology*, 42(4), pp.992–1001.

Börsch-Supan, A., 2017a. Survey of Health, Ageing and Retirement in Europe (SHARE) Wave 1. Release version 6.0.0 SHARE-ERIC. Available at: https://doi.org/10.6103/SHARE.w.1.600.

Börsch-Supan, A., 2017b. Survey of Health, Ageing and Retirement in Europe (SHARE) Wave 2. Release version: 6.0.0. SHARE-ERIC. Available at: https://doi.org/10.6103/SHARE.w2.600.

Börsch-Supan, A., 2017c. Survey of Health, Ageing and Retirement in Europe (SHARE) Wave 3 - SHARELIFE. Release version: 6.0.0. SHARE-ERIC. Available at: https://doi.org/10.6103/SHARE.w3.600.

Bras, H., Liefbroer, A.C. & Elzinga, C.H., 2010. Standardization of pathways to adulthood? An analysis of Dutch cohorts born between 1850 and 1900. *Demography*, 47(4), pp.1013–34.

Breen, R. & Buchmann, M.C., 2002. Instiutional Variation and the Position of Young People: A Comparative Persepctive. *The ANNALS of the American Academy of Political and Social Science*, 580(1), pp.288–305.

Brückner, H. & Mayer, K.U., 2005. The De-Standardization of the Life Course: What It Might Mean and If it Means Anything Whether It Actually Took Place. In R. Macmillan, ed. *The structure of the life course. Standardized? Individualized? Differentiated?*. Amsterdam: Elsevier, pp. 27–54.

Brüderl, J., 2004. Die Pluralisierung partnerschaftlicher Lebensformen in Westdeutschland und Europa. *Aus Politik und Zeitgeschichte*, 19, pp.3–10.

Brugiavini, A. et al., 2013. Working life histories from SHARELIFE: a retrospective panel. *SHARE Working Paper Series 11-2013*, pp.1–13.

Bryan, M.L. & Jenkins, S.P., 2015. Multilevel Modelling of Country Effects: A Cautionary Tale. *European Sociological Review*, 32(1), pp.3–22.

Buchmann, M.C., 1989. *The Script of Life in Modern Society: Entry Into Adulthood in a Changing World*, Chicago: University of Chicago Press.

Buchmann, M.C. & Kriesi, I., 2011. Transition to Adulthood in Europe. *Annual Review of Sociology*, 37, pp.481–503.

Chaloupková, J., 2010. The De-standardization of Early Family Trajectories in the Czech Republic: A Cross-cohort Comparison. *Czech Sociological Review*, 46(3), pp.427–451.

Coleman, M., Ganong, L. & Fine, M., 2000. Reinvestigating remarriage: Another decade of progress. *Journal of Marriage and Family*, 62(4), pp.1288–1307.

Corijn, M. & Klijzing, E. eds., 2001. *Transitions to Adulthood in Europe*, Springer Netherlands.

DICE, D., 2015. *Parental leave entitlements: Historical perspective (around 1870-2014)*, Munich: ifo-Insitute. Available at: https://www.cesifo-group.de/ifoHome/facts/DICE/Social-Policy/Family/Work-Family-Balance/parental-leave-entitlements-historical-perspective.html.

DiPrete, T. et al., 1997. Collectivist versus Individualist Mobility Regimes? Structural Change and Job Mobility in Four Countries. *American Journal of Sociology*, 103(2).

DiPrete, T., 2002. Life Course Risks, Mobility Regimes, and Mobility Consequences: A Comparison of Sweden, Germany, and the United States. *American Journal of Sociology*, 108(2), pp.267–309.

Elzinga, C.H. & Liefbroer, A.C., 2007. De-standardization of Family-Life Trajectories of Young Adults: A Cross-National Comparison Using Sequence Analysis. *European Journal of Population / Revue européenne de Démographie*, 23(3–4), pp.225–250.

Emmenegger, P. et al., 2015. Three Worlds of Welfare Capitalism: The making of a classic. *Journal of European Social Policy*, 25(1), pp.3–13.

Esping-Andersen, G., 1999. *Social Foundations of Postindustrial Economies*, Oxford: Oxford University Press.

Esping-Andersen, G., 1990. *The Three Worlds of Welfare Capitalism*, Princeton, NJ: Princeton University Press.

Europe, U.N.E.C. for, 2005. *Generations & Gender Programme: Survey Instutments*, New York and Geneva.

Fasang, A.E. & Liao, T.F., 2014. Visualizing Sequences in the Social Sciences: Relative Frequency Sequence Plots. *Sociological Methods & Research*, 43(4), pp.643–676.

Fasang, A.E. & Raab, M., 2014. Beyond Transmission: Intergenerational Patterns of Family Formation Among Middle-Class American Families. *Demography*, 51(5), pp.1703–1728.

Ferrera, M., 1996. The "Southern" Model of Welfare in Social Europe. *Journal of European Social Policy*, 6(1), pp.17–37.

Flaquer, L., 2000. Is there a Southern European model of family policy? In A. Pfenning & T. Bahle, eds. *Familes and Family Policies in Europe: Comparative Perspectives*. Frankfurt/Main: Europäischer Verlag der Wissenschaften, pp. 15–33.

Fodor, E. et al., 2002. Family policies and gender in Hungary, Poland, and Romania. *Communist and Post-Communist Studies*, 35(4), pp.475–490.

Fokkema, T. & Liefbroer, A.C., 2008. Trends in living arrangements in Europe: Convergence or divergence? *Demographic Research*, 19, pp.1351–1418.

Fowler, C.S., Lee, B.A. & Matthews, S.A., 2016. The Contributions of Places to Metropolitan Ethnoracial Diversity and Segregation : Decomposing Change Across Space and Time. *Demography*, (53), pp.1955–1977.

Gabadinho, A. et al., 2011. Analyzing and Visualizing State Sequences in R with TraMineR. *Journal of Statistical Software*, 40(4), pp.1–37.

Gabadinho, A. et al., 2010. Indice de complexité pour le tri et la comparaison de séquences catégorielles. *Revue des nouvelles technologies de l'information RNTI E-19*, (September 2015), pp.61–66.

Garrouste, C., 2010. *100 Years of Educational Reforms in Europe: a contextual database*, Luxembourg: Publication Office of the European Union.

Gauthier, A., 2007. Becoming a Young Adult: An International Perspective on the Transitions to Adulthood. *European Journal of Population / Revue européenne de Démographie*, 23(3–4), pp.217–223.

Gauthier, A. & Monna, B., 2004. Family Allowances in Industrialized Countries: Historical Landmarks. *Max-Plank-Insitute for Demographic Research, Comparative Family Policy*

Database. Available at: https://www.demogr.mpg.de/cgi-bin/databases/FamPolDB/index.plx.

Goldscheider, F., 1997. Recent Changes in U.S. Young Adult Living Arrangements in Comparative Perspective. *Journal of Family Issues*, 18(6), pp.708–724.

Gottschall, K. & Bird, K., 2003. Family Leave Policies and Labor Market Segregation in Germany - Reinvention or Reform of the Male Breadwinner Model? *Review of Policy Research*, 20(1), pp.115–134.

Günther, I. & Harttgen, K., 2016. Desired Fertility and Children Born across Time and Space. *Demography*, 53(1), pp.55–83.

Havari, E. & Mazzonna, F., 2015. Can We Trust Older People's Statements on Their Childhood Circumstances? Evidence from SHARELIFE. *European Journal of Population*, 31(3), pp.233–257.

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(December), pp.1214–1230.

Heuveline, P., Timberlake, J.M. & Furstenberg, F.F., 2003. Shifting Childrearing to Single Mothers: Results from 17 Western Countries. *Population and Development Review*, 29(1), pp.47–71.

Hofäcker, D. & Chaloupková, J., 2014. Patterns of Family Life Courses in Europe – between Standardisation and Diversity A Cross-national Comparison of Family Trajectories and Life Course Norms in European Countries. *Comparative Population Studies*, 39(3), pp.559–586.

Inglehart, R., 2008. Changing Values among Western Publics from 1970 to 2006. *Western European Politics*, 31(1–2), pp.130–146.

Inglehart, R., 1990. *Culture shift in advanced industrial society*, Princeton: Princeton University Press.

Inglehart, R. & Abramson, P., 1994. Economic Security and Value Change. *American Political Science Review*, 88(2), pp.336–354.

van de Kaa, D.J., 2001. Postmodern Fertility Preferences: From changing value orientation to new behaviour. *Population and development review*, 27, pp.18–22.

Van de Kaa, D.J., 1987. Europe's Second Demographic Transition. *Population Bulletin*,

42(1).

Kaufman, L. & Rousseeuw, P.J., 1990. *Finding Groups in Data*, Hoboken, NJ, USA: John Wiley & Sons, Inc.

Kohli, M., 1997. Die Institutionalisierung des Lebenslaufs. In *Soziologische Theorie und Empirie*. Wiesbaden: VS Verlag für Sozialwissenschaften, pp. 284–312.

Kreyenfeld, M., 2004. Fertility desicions in the FRG and GDR: An analysis with data from the German fertility and family survey. *Demographic Research*, 10(SUPPL. 3), pp.275–318.

Lesthaeghe, R., 1995. The Second Demographic Transition: An Interpretation. In K. O. Mason & A.-M. Jensen, eds. *Gender and Family Change in Industrialized Countries*. Oxford: Oxford University Press.

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

Lesthaeghe, R. & Van de Kaa, D.J., 1986. Twee demografische transities? In R. Lesthaeghe & D. J. Van de Kaa, eds. *Bevolking: Groei en Krimp*. Deventer: Van Loghum Slaterus, pp. 9–24.

Lesthaeghe, R. & Surkyn, J., 1988. Cultural Dynamics and Economic Theories of Fertility Change. *Population and Development Review*, 14(1), p.1.

Lohmann, H. & Zagel, H., 2016. Family policy in comparative perspective : The concepts and measurement of familization and defamilization. *Journal of European Social Policy*, 26(1), pp.48–65.

Maul, K. et al., 2009. *Female employment and childbearing plans in Germany: preliminary national report for the RECWOWE task "Fertility, female employment and reconciliation policies,"* Nantes.

Mayer, K.U., 2005. Life courses and life chances in a comparative perspective. In S. Svallfors, ed. *Analyzing Inequality: Life Chances and Social Mobility in Comparative Perspective*. Palo Alto, CA: Stanford University Press, pp. 17–55.

Mayer, K.U., 2009. New Directions in Life Course Research. *Annual Review of Sociology*, 35, pp.413–433.

Mayer, K.U., 1997. Notes on a Comparative Political Economy of Life Courses. *Comparative Social Research*, 16, pp.203–226.

Mayer, K.U., 1991. Soziale Ungleichheit und die Differenzierung von Lebensverläufen. In W. Zapf, ed. *Die Modernisierung moderner Gesellschaften*. Frankfurt/Main: Campus Verlag, pp. 667–687.

Mayer, K.U., 2004. Whose Lives? How History, Societies, and Institutions Define and Shape Life Courses. *Research in Human Development*, 1(3), pp.161–187.

Mayer, K.U. & Müller, W., 1986. The state and the structure of the life course. In A. B. Sorensen, F. E. Weinert, & L. R. Sherrod, eds. *Human development and the life course: Multidisciplinary perspectives*. Hillsdale, NJ: Lawrence Erlbaum Associates, pp. 217–245.

Mayer, K.U. & Schoepflin, U., 1989. The State And The Life Course. *Annual Review of Sociology*, 15(1), pp.187–209.

Mills, M. & Blossfeld, H.-P., 2005. Globalization, uncertainty and the early life course. A theoretical framework. In H.-P. Blossfeld et al., eds. *Globalization, Uncertainty and Youth in Society*. New York: Routledge, pp. 1–24.

Modell, J. & Furstenberg, F.F., 1976. Social change and transitions to adulthood in historical perspective. *Journal of Family History*, 1(1), pp.7–32.

Morel, N., 2007. From subsidiarity to "free choice": Child- and elder-care policy reforms in France, Belgium, Germany and the Netherlands. *Social Policy and Administration*, 41(6), pp.618–637.

Orso, C.E. et al., 2016. SHARE Job Episodes Panel. Release version: 5.0.0 SHARE-ERIC.

Perelli-Harris, B., Kreyenfeld, M. & Kubisch, K., 2010. *Harmonized Histories Manual for the Preparation of Comparative Fertility and Union Histories*, Rostock.

Potarca, G., Mills, M. & Lesnard, L., 2013. Family Foundation Trajectories in Romania, the Russian Federation and France: Towards the Second Demographic Transition? *European Journal of Population*, 29, pp.69–101.

Raab, M. et al., 2014. Sibling Similarity in Family Formation. *Demography*, 51(6), pp.2127–2154.

Rabe-Hesketh, S. & Skrondal, A., 2012. *Multilevel Modeling with Stata* Revised., College Station, TX: Stata Press.

Robette, N., 2010. The diversity of pathways to adulthood in France: Evidence from a holistic approach. *Advances in Life Course Research*, 15(2–3), pp.89–96.

Rowland, D.T., 2007. Historical Trends in Childlessness. *Journal of Family Issues*, 28(10), pp.1311–1337.

Ryder, N.B., 1965. The Cohort as a Concept in the Study of Social Change. *American Sociological Review*, 30(6), pp.843–861.

Schoen, R. & Canudas-Romo, V., 2006. Timing Effects on Divorce: 20th Century Experience in the United States. *Journal of Marriage and Family*, 68(3), pp.749–758.

Schröder, M., 2011. *Retrospective data collection in the Survey of Health, Ageing and Retirement in Europe. SHARELIFE methodology*, Mannheim: Mannheim Research Institute for the Economics of Aging (MEA).

Settersten, R., 2007. Passages to Adulthood: Linking Demographic Change and Human Development. *European Journal of Population / Revue européenne de Démographie*, 23(3–4), pp.251–272.

Shi, Y., Leite, W. & Algina, J., 2010. The impact of omitting the interaction between crossed factors in cross-classified random effects modeling. *British Journal of Mathematical and Statistical Psychology*, 63, pp.1–15.

Snijders, T.A.B. & Bosker, R.J., 2012. *Multilevel Analysis: An introduction to basic and advanced multilevel modeling* 2nd ed., Thousand Oaks, CA: Sage Publications.

Sobotka, T., 2008. Overview Chapter 6 : The diverse faces of the Second Demographic Transition in Europe. *Demographic Research*, 19, pp.171–224.

Sobotka, T. & Toulemon, L., 2008. Overview Chapter 4: Changing family and partnership behaviour: Common trends and persistent diversity across Europe. *Demographic Research*, 19, pp.85–138.

Studer, M., 2013. *WeightedCluster Library Manual: A practical guide to creating typologies of trajectories in the social sciences with R*, Lausanne, Switzerland.

Thomson, E., 2014. Family Complexity in Europe. *The ANNALS of the American Academy of Political and Social Science*, 654(1), pp.245–258.

Van Winkle, Z. & Fasang, A., 2017. Complexity in Employment Life Courses in Europe in the Twentieth Century—Large Cross-National Differences but Little Change across Birth Cohorts. *Social Forces*, 96(1), pp.1–30. Available at: https://academic.oup.com/sf/article-lookup/doi/10.1093/sf/sox032.

Appendix

Table A3: List of Sequence State Elements and Average Durations

State Abbreviation	State Definition	Average State Duration (years)
P	In the parental home and without children	8.487
PC	In the parental home with at least one child	0.091
S	Outside the parental home, not cohabitating with an intimate partner, and without children	2.103
SC	Outside the parental home, not cohabitating with an intimate partner, and with at least one child	1.023
C	Cohabitating with an intimate partner without children	0.234
CC	Cohabitating with an intimate partner with at least one child	0.370
M	Married without children	3.337
MC	Married with at least one child	20.354

Table A4: Sample Frequencies Cross-Classified by Country and Birth Cohort

	24–26	27–29	30–32	33–35	36–38	39–41	42–44	45–47	48–50	51–53	54–56	Total
Austria	22	59	49	65	72	119	112	95	87	77	32	789
West Germany	45	57	61	83	132	168	154	113	168	177	95	1,253
Sweden	77	84	106	138	159	197	218	239	193	167	69	1,647
Netherlands	53	70	91	132	141	181	228	281	263	240	183	1,863
Spain	63	100	131	168	126	146	138	157	153	162	152	1,496
Italy	56	77	140	158	209	238	219	232	237	181	170	1,917
France	73	119	135	151	150	174	192	233	276	250	231	1,984
Denmark	75	91	118	122	132	155	207	234	222	217	289	1,862
Greece	70	75	136	174	168	156	193	241	267	321	199	2,000
Switzerland	43	59	77	82	97	93	133	135	124	122	132	1,097
Belgium	102	119	168	183	189	194	237	264	308	294	248	2,306
Czech Republic	47	53	102	111	117	165	202	215	211	188	162	1,573
Poland	43	63	88	79	120	115	122	189	209	222	228	1,478
East Germany	29	38	47	73	95	108	120	126	132	136	103	1,007
Total	798	1,064	1,449	1,719	1,907	2,209	2,475	2,754	2,850	2,754	2,293	22,272

Table A5: Descriptive Statistics on the Study Countries and Birth Cohorts by Cluster Grouping

	Early Family Formation	Parental Home, Single and Cohabitation	Prolonged Family Formation	Union Dissolution	Childless Marriage	Delayed Family Formation
Countries						
Austria	33.84	6.97	15.21	15.08	7.35	21.55
West Germany	27.11	3.87	19.50	9.70	7.15	32.67
Sweden	22.37	7.29	32.33	13.90	5.34	18.77
Netherlands	21.27	5.24	13.22	13.32	8.95	38.00
Spain	22.38	7.65	3.13	4.98	5.78	56.08
Italy	23.99	4.22	6.42	5.83	4.92	54.62
France	27.65	8.01	17.71	15.06	5.82	25.75
Denmark	22.44	6.49	37.07	13.45	6.85	13.71
Greece	17.23	7.53	7.31	6.64	7.80	53.49
Switzerland	17.38	10.11	23.62	13.72	7.60	27.56
Belgium	30.51	5.79	3.72	14.03	6.07	39.89
Czech Republic	48.60	2.63	1.42	10.87	3.96	32.52
Poland	47.25	2.38	7.71	4.79	4.62	33.25
East Germany	22.63	6.18	24.40	6.52	4.61	35.66
Birth Cohorts						
1924-1926	21.99	5.61	16.53	7.81	9.39	38.68
1927-1929	23.33	6.18	14.23	8.15	7.72	40.39
1930-1932	28.99	4.56	13.21	5.57	6.21	41.46
1933-1935	24.65	5.11	13.04	9.23	6.23	41.73
1936-1938	26.30	5.22	16.07	9.41	7.41	35.60
1939-1941	30.15	4.41	17.27	10.70	5.26	32.21
1942-1944	28.84	6.31	15.86	12.30	5.86	30.82
1945-1947	29.15	5.51	14.47	13.03	5.12	32.72
1948-1950	30.94	6.34	14.36	15.27	5.00	28.08
1951-1953	29.12	7.43	15.04	14.21	7.33	26.88
1954-1956	29.63	7.61	14.40	14.86	5.83	27.67
Total	28.38	5.97	14.96	11.87	6.16	32.66

Notes: Row percentages are displayed. Data are weighted.

Table A6: Summary Statistics by Cluster Grouping

	Early Family Formation	Parental Home, Single and Cohabitation	Prolonged Family Formation	Union Dissolution	Childless Marriage	Delayed Family Formation
Gender						
Male	18.17	6.71	15.97	10.92	6.06	42.16
Female	37.90	5.27	14.01	12.75	6.25	23.81
Education						
None	32.30	6.05	5.36	7.16	5.42	43.72
Preprimary	35.48	5.39	10.54	8.73	6.26	33.60
Primary	36.14	5.18	7.97	11.93	6.05	32.73
Secondary	27.48	5.75	16.11	12.93	6.20	31.52
Postsecondary	14.87	7.60	25.35	13.75	6.19	32.25
Sector of First Employment						
Private	29.26	5.85	14.71	11.82	6.10	32.27
Public	19.74	7.17	17.37	12.36	6.77	36.58
Occupation of Breadwinner						
Senior professional	17.65	8.28	26.34	15.06	7.02	25.66
Professional	16.03	8.91	24.82	13.80	7.70	28.73
Technician	25.78	6.40	15.53	15.22	7.60	29.46
Clerk	23.01	6.64	12.66	14.88	6.06	36.76
Service	25.77	5.08	16.12	13.50	7.32	32.21
Agriculture	26.45	6.05	18.69	7.97	5.31	35.53
Craftsman	31.44	5.28	11.48	12.51	6.05	33.24
Industry	33.93	5.38	10.73	12.09	6.57	31.30
Unskilled	34.40	5.65	10.46	12.10	5.73	31.66
Armed services	24.09	6.96	14.38	13.01	8.13	33.43
None	38.51	5.02	10.85	14.90	5.51	25.21
Total	28.38	5.97	14.96	11.87	6.16	32.66

Notes: Row percentages are displayed. Data are weighted.

Calculation of Sequence Complexity for Figure 1

I. Maximum Longitudinal Entropy

Calculation for maximum entropy of a sequence with 10 consecutive states and 8 possible sequence elements. An equal occurrence of each state element implies that each element is observed 1.25 times.

$$h_{max} = -\left[10 * \left(\frac{1.25}{10} log \frac{1.25}{10}\right)\right]$$

$$= 2.079$$

II. Family Trajectory 1: P/2 S/2 M/2 MC/4

$$h(x) = -\left[3 * \left(\frac{2}{10} log \frac{2}{10}\right) + \left(\frac{4}{10} log \frac{4}{10}\right)\right]$$

$$= 1.332$$

$$C(x) = 100 * \sqrt{\frac{3}{9} * \frac{1.332}{2.079}}$$

$$= 46.213$$

III. Family Trajectory 2: P/2 S/2 C/2 M/2 MC/2

$$h(x) = -\left[5 * \left(\frac{2}{10} log \frac{2}{10}\right)\right]$$

$$= 1.609$$

$$C(x) = 100 * \sqrt{\frac{4}{9} * \frac{1.609}{2.079}}$$

$$= 58.648$$

IV. Family Trajectory 3: P/1 S/1 C/1 M/1 MC/6

$$h(x) = -\left[4 * \left(\frac{1}{10} log \frac{1}{10}\right) + \left(\frac{6}{10} log \frac{6}{10}\right)\right]$$

$$= 1.227$$

$$C(x) = 100 * \sqrt{\frac{4}{9} * \frac{1.227}{2.079}}$$

$$= 51.215$$