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Destination as a process: Sibling similarity in early socioeconomic trajectories

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ABSTRACT

This paper proposes a process-oriented life course perspective on intergenerational mobility by comparing the early socioeconomic trajectories of siblings to those of unrelated persons. Based on rich Finnish register data (N = 21,744), the findings show that social origin affects not only final outcomes at given points in the life course but also longitudinal socioeconomic trajectories from ages 17–35 in early adulthood. We contribute to previous literature in three ways. First, we show that there is a pronounced similarity in the early socioeconomic trajectories of siblings. This similarity is stronger for same-sex siblings and stronger for brothers than for sisters. Second, we show that sibling similarity in full trajectories cannot be reduced to similarity in outcomes, i.e., siblings are not only more similar in the final outcomes that they obtain but also in the pathways that lead them to these outcomes. Third, our findings support that sibling similarity follows a U-shaped pattern by social class, i.e., similarity is especially strong in disadvantaged trajectories, weak among middle-class young adults, and increases again within the most advantaged trajectories. We conclude that measures of social mobility that concentrate on final outcomes are at risk of underestimating the association between social origin and destination because social inequalities are formed across the life course, not just at the end of specific life phases.

1. Introduction

Most research on intergenerational mobility and socioeconomic attainment has focused on outcomes observed in early to mid-adulthood, usually the highest level of education or occupational standing by a certain age. This literature has been very informative, providing details on the family background effects on education (Branigan, McCallum, & Freese, 2013; Breen & Jonsson, 2005; Sieben, Huinink, & De Graaf, 2001) and labor market outcomes (Björklund, Eriksson, Jäntti, Raaum, & Österbacka, 2002; Erikson & Goldthorpe, 1992, 2010; Solon, 1992). It has further contributed to our understanding of how the association between family of origin and socioeconomic destination is mediated by education (Blau & Duncan, 1967; Hauser & Mossel, 1985; Torche, 2011).

Relying on "final" outcomes, however, has a notable drawback: it ignores how family background determines longitudinal trajectories of sequentially linked education and employment states leading to these outcomes. Inequality in socioeconomic status attainment, however, can exist in both final outcomes and the processes leading to these outcomes. This paper builds on the life course paradigm and Abbott (2016) in emphasizing the need for "process outcomes" of social inequality. We argue for complementing existing work from a final outcome perspective with life course measures of social inequality. Life course experiences and social inequality therein unfold over entire trajectories and not only at specific ages in the life course. For example, a bachelor's degree can be obtained at age 23 after an uninterrupted highly successful four years of study. Alternatively, a bachelor's degree could be obtained after starting a vocational program, dropping out of another university program, following a series of unpaid internships for a year or two, or by simply taking seven rather than four years until completion. From a broader perspective, how the individuals' specific life stages developed in their continuity might be just as important as the individuals' attainment of a given outcome in only one of many years of life. As a result, the final outcomes perspective is at risk of either underestimating or overestimating the family of origin effects on social inequality across early adult socioeconomic trajectories. Social origin effects would be underestimated if the siblings were not only more similar in the final outcomes they obtain but also in the

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trajectories leading to these outcomes. They would be overestimated if siblings are more similar in final outcomes but experience more heterogeneous trajectories leading to these outcomes than do unrelated persons.

This paper offers a new perspective on intergenerational social mobility with a sibling analysis of origin effects on combined educational and labor market trajectories across early adult life courses. The outcome of interest is conceptualized as a 'process outcome' (Abbott, 2005 2016) and socioeconomic destination is understood as a process rather than a snapshot of attainment at a given point in time. We focus on Finland, a relatively egalitarian welfare state, in which the impact of social origin on socioeconomic attainment is weak compared to that in other countries, such as Germany or the United States (Björklund et al., 2002). Rich, high-quality annual panel data drawn from administrative registers allow us to propose and test a new extension to recent dyadic sequence analysis methods that have studied sibling similarity in family formation (Raab, Fasang, Karhula, & Erola, 2014).

We make three contributions to the literature. First, we extend previous findings from "final" outcome regression analysis by applying dyadic sequence analysis to study sibling similarity in *early socioeconomic trajectories* (ESETs) as a life course measure of social inequality. We first establish that social origin affects ESETs, that is, siblings are indeed significantly more similar in socioeconomic trajectories between the ages of 17 and 35 than are unrelated individuals. Our results underline pronounced gender differences in status attainment trajectories with stronger sibling similarity for same-sex dyads. In line with previous research, well-established family background factors, such as parental education and income, affect sibling similarity in ESETs but can only account for a relatively modest share of total sibling similarity in ESETs.

Second, we assess the added value of the process outcome approach by comparing our results to those of a final outcomes analysis. This allows us to demonstrate that a large share of family of origin effects on early adult socioeconomic attainment remains unobserved in a research design concentrating only on final outcomes. Compared to unrelated dyads, siblings are not only more similar in the final outcomes that they obtain but also in the trajectories leading to these outcomes.

Finally, we show that sibling similarity in ESETs is particularly strong among siblings from the most disadvantaged and most advantaged families. The strongest sibling similarity is found in disadvantaged trajectories involving extended periods of unemployment and periods spent outside of the labor force. These findings can be interpreted as a reinforcement of social inequality through a concentration of more or less successful young adult socioeconomic trajectories in the most and least resourceful families.

2. Family of origin effects on socioeconomic trajectories

Overall, the strongest intergenerational correlations in socioeconomic attainment are observed for education (e.g., Conley & Glauber, 2008; Hauser & Mossel, 1985). Several studies show that the transmission of occupational status and income is in part mediated by education, but they also observe independent effects of parental status on the children's socioeconomic outcomes (Bukodi, Erikson, & Goldthorpe, 2014; Erola, Jalonen, & Lehti, 2016). These include the transmission of occupation-specific skills (e.g., carpentering, fishing, or farming), values and preferences, social networks, and—perhaps the most obvious case—the inheritance of occupation-specific assets, especially in the form of fixed resources such as farming property (Jonsson, Grusky, Di Carlo, & Pollak, 2011).

The mechanisms of intergenerational transmission affect status attainment at various times in the life course, when choices influencing socioeconomic careers are made. This calls for a longitudinal perspective that covers a large span of the life course rather than a single point in time. Already Blau and Duncan (1967) used path models to account for the sequential order of different markers of attainment, i.e., education and occupational status. During recent decades, research has routinely underlined the importance of averaging incomes over a longer period of the life course (permanent income) instead of examining monthly or annual earnings at given time points that tend to fluctuate considerably within short-time periods for some individuals (Björklund & Jäntti, 1997). Several recent studies have followed a more dynamic approach based on panel regression and growth curve models (for an overview and their utility for life course questions, see Brüderl, Kratz, and Bauer, (2018)). Härkönen and Bihagen (2011) used growth curve models on Swedish data to demonstrate that career progress (measured as occupational prestige) proceeds rapidly during the first 5–10 years in the labor market and flattens out at age 30–40. They also show that class origin affects career progress to a lesser extent than educational attainment does. Manzoni, Härkönen, and Mayer, (2014) applied the same method to study career progress using data from the German Life History Study (Mayer, 2008). These and other studies illustrate the crucial role of education as a mediating factor between social origin and career progress, but they also underline the importance of initial labor market status for subsequent career advancement.

This line of research, however, has focused on changes in single indicators of socioeconomic status—educational degree, labor market status or income—over time. We know little about the overall impact of social origin for the entire process of early adulthood status attainment, which covers periods in education, moves into and out of the labor market, and includes mobility between jobs. Further, previous studies have mainly relied on metric indicators of socioeconomic attainment, i.e., income and occupational prestige and have disregarded the categorical nature of many markers of attainment, including education, employment status or different reasons for being out of the labor force.

Several recent studies have applied sequence analysis to describe school-to-work transitions and early employment trajectories (e.g., Brzinsky-Fay, 2007; Lorentzen, Bäckman, Ilmakunnas, & Kauppinen, 2018; Pollock, 2007). While these studies have made important contributions by identifying patterns in early adult life course sequences and relating them to basic sociodemographic characteristics, they have not paid much attention to the importance of family of origin effects. To our knowledge, there are only a few previous studies that have focused on this topic.

Dorsett and Lucchino (2014) focused on the individuals' educational and socioeconomic pathways during the first five years after completing compulsory school (after age 16). They report a strong association between family background and subsequent labor market trajectories in the UK. Aisenbrey and Fasang (2017) identify typologies of joint work and family life courses in Germany and the United States from age 20 until 44 using multichannel sequence analysis. Their findings show that parental background is particularly influential for sorting into the most and least advantaged types of work-family lives and that this influence is even greater in the United States than in Germany. Sirniö, Kauppinen, and Martikainen, (2017) follow a similar strategy to analyze joint labor market and family formation trajectories in Finland and identify links between parental income, education, and family structure with different types of joint work-family-life courses. Haapakorva, Ristikari, and Gissler, (2017) analyzed both parental and offspring labor market sequences, finding a strong association between the parents' and children's disadvantaged trajectories in Finland, even when controlling for other parental background factors. The present study adds to this literature by applying a dyadic sibling design that also accounts for unobserved background effects, in addition to the observed background indicators relied upon in previous studies.

2.1. Theoretical background

Based on theoretical consideration and previous research, we distinguish several factors that link family of origin to ESETs unfolding at different stages of the life course: 1) parental education, 2) parental economic resources, 3) parental unemployment, 4) family structure

during childhood, 5) regional characteristics shared by all members of a household, e.g., local labor market opportunities, and 6) genetic similarity. This list is not exhaustive and was chosen based on the salience of these characteristics in previous literature and on our data's limitations that prevented us from studying other mechanisms, such as parent-child relationship quality and sibling interactions (discussed in the concluding section).

1) Parental educational attainment is one of the main factors connecting social origin to occupational status in mid-life (Blau & Duncan, 1967; Conley & Glauber, 2008; Hauser & Mossel, 1985; Torche, 2011). Middle- and upper-class parents have the necessary human, social and cultural capital to successfully navigate educational institutions, which lower-class parents often lack (Fasang, Mangino, & Brückner, 2014; Lareau, 2001). They are therefore more successful in helping their children reproduce their own educational success.

2.) *Parental economic resources* are closely linked with parental education. However, previous research has repeatedly shown an independent effect of the parents' financial resources—usually measured by earnings—on their children's socioeconomic outcomes net of education (Bukodi et al., 2014; Erola et al., 2016). Ranging from private tutoring to financing a university education, economic resources enable parents to financially support their children's education. Economic deprivation during childhood is a stress factor that can depress children's early attainment and development and set them on an early path of cumulative disadvantage over their life course (Dannefer, 2003; Elder, 1974).

3.) Parental unemployment spells interrupt the parents' careers and reduce family income (Gangl, 2006). Moreover, parental unemployment often is accompanied by other scarring effects that have potentially harmful consequences for their children. In addition to reducing income, parental unemployment lowers the children's schooling ambitions and their social-psychological well-being (Andersen, 2013; Brand & Thomas, 2014).

4.) Concerning *family structure* during childhood, family stress theories (Amato, 2000) emphasize possible detrimental effects of (frequent) changes of family structure during childhood for the children's subsequent educational and occupational attainment. Parental separation not only tends to go along with the lower economic well-being of parents and children but is also a stressful experience that absorbs the mental resources of children and draws their attention from school-related activities (Bernardi & Radl, 2014). Lower educational attainment early in life can accumulate to persistent disadvantage throughout early adulthood. Overall, it has been demonstrated that compared with children who live with their biological parents, children who do not live with their biological parents fare worse on a variety of outcomes (Härkönen, Bernardi, & Boertien, 2017).

5.) Regional characteristics shape *local labor markets* and local educational opportunities. Although they are not necessarily linked to parental resources, local opportunity structures signify a shared non-family environment that can generate sibling similarity. Sibling studies thereby employ a broader definition of social origin not restricted to parental characteristics (Solon, 1992).

6.) Regarding genetic similarity, as crucial components of ESETs, IQ, cognitive ability and education are genetically heritable, but the extent to which genes influence these characteristics vary across countries, suggesting that social policies and institutions also matter (Belsky et al., 2018; Branigan et al., 2013; Conley et al., 2015; Devlin, Daniels, & Roeder, 1997; Haworth et al., 2010). Recent research has emphasized the potential importance of interactions between genetics and environmental factors (Conley et al., 2015; Domingue, Belsky, Conley, Harris, & Boardman, 2015). However, to date, the exact biological mechanisms behind heritability estimates are relatively poorly understood. Recent research conducted by using genome-wide association studies to construct polygenic scores are shedding new light on the importance of specific genes for certain behaviors (e.g., Domingue et al., 2015; Okbay et al., 2016). In our study, genetic influence might account for part of our findings, but we are unable to further disentangle this component beyond a rough twin indicator for the sibling dyads.

Finally, based on previous findings, one can assume that part of the origin effect on ESETs is gender specific. For Finland, this has been shown for earnings and family formation trajectories. Sibling similarities in earnings were considerably stronger among brothers than among sisters (Österbacka, 2001). In terms of family formation trajectories, in contrast, sibling similarity was stronger for sisters (Raab et al., 2014). Based on these findings, on one hand, sibling similarities in the present study could be stronger for brothers because earnings constitute a key element of ESETs. On the other hand, if the ESETs are closely linked to family trajectories, sibling similarity could be more marked for sisters, or these two effects could on average cancel each other out.

3. The Finnish context

Finland represents a social-democratic welfare model that is characterized by an egalitarian social benefit system, a strong tradition of decommodification that enhances gender equality and a free-of-charge educational system that promotes equality of opportunity (Erikson & Goldthorpe, 1992; Esping-Andersen, 1990). Thus, it is highly likely that any intergenerational effects found in the Finnish context are at least as strong as those in liberal and conservative welfare regimes. Accordingly, our findings are likely to be lower-bound estimates of the family background effect on ESETs in affluent democracies. Finland is, therefore, a particularly well-suited case to provide a conservative estimate of family of origin effects on ESETs.

In Finland, approximately 95% of each birth cohort continues to upper secondary education immediately after finishing comprehensive school, and 86% obtain an upper secondary qualification within eight years of leaving comprehensive school (Kilpi-Jakonen, Erola, & Karhula, 2016). Despite the educational expansion and the egalitarian Finnish educational system, access to tertiary education is highly competitive, which is reflected in a relatively low admission rate of only 30% of all applicants each year (Kilpi-Jakonen et al., 2016). This often results in a gap between the exit from secondary education and the continuation to higher education.

Typically, earning a bachelor's degree takes 3–4 years, and a master's degree requires an additional 2–3 years. Those entering university programs have a right to study for a master's degree, and most do so. It follows that the age of entry into the labor market varies considerably with education. Those earning a secondary education vocational degree are, in principle, able to enter the labor market at ages 17–18, those continuing to polytechnics enter the market at approximately age 25, and those attending universities enter their first jobs at approximately age 28. However, the differences in youth unemployment by educational qualification reflect the timing of labor market entrance across educational groups. For instance, in 2001–2002, over 40% of the youth aged 22–30 with only compulsory schooling experienced some periods of unemployment. That figure was 24% for those with a vocational secondary degree and only 10% for those with a general secondary or a higher degree (Sipilä, Kestilä, & Martikainen, 2011).

Overall, in Finland, intergenerational income mobility measured with sibling correlation models is lower than that in the US and on a level with that in other Nordic countries (Björklund et al., 2002). However, social origin still influences earnings and income significantly (Björklund et al., 2002; Österbacka, 2001; Sirniö, Martikainen, & Kauppinen, 2013).

The ESETs also comprise information on unemployment and time spent outside the labor force, which is also related to some family background characteristics (Kallio, Kauppinen, & Erola, 2016; Vauhkonen, Kallio, Kauppinen, & Erola, 2017). Until the recession of the early 1990s, unemployment was relatively rare in Finland. Other periods of being outside the labor force consist mainly of parental leave, mandatory military service, and unemployment in which people have

dropped out of the labor force permanently without applying for any unemployment benefits. Similar to the situation in most affluent societies, Finnish labor force inactivity due to childcare is highly gendered and common in the trajectories of women. In contrast, inactivity due to military service is a distinctive feature of male trajectories. Our age range of 17–35 is appropriate to measure ESETs in Finland, as by this age, Finns have typically reached occupational maturity, entered the labor market and transitioned to parenthood, if they ever have children (Jalovaara & Fasang, 2017).

4. Research questions and research design

Sibling designs are well established in the stratification literature as an efficient method for estimating the impact of social origin on socioeconomic outcomes (Conley & Glauber, 2008; Mazumder, 2008; Solon, 1992). Sequence analysis, on the other hand, is particularly useful to study trajectories of categorical states that indicate status attainment—including spells of education, inactivity, and employment—in a longitudinal fashion. Here, we adopt a research design that combines the advantages of both sibling models and sequence analysis (see Raab et al., 2014 for a similar design in the context of family formation). Our first research question asks the following:

(RQ1) Are early socioeconomic trajectories (ESETs) of siblings more similar compared to those of unrelated persons?

Analogous to sibling models, we use sibling similarity in sequence distances as a measure of the overall effect of social origin (Björklund et al., 2002; Solon, 1992). Note that this broadly encompasses all background shared by siblings, including not only parental characteristics and early childhood family conditions but also shared childhood neighborhoods, peers and genetics. Throughout the paper, we refer to sibling similarity, theoretically interpreting it as the overall social origin effect or *omnibus measure* for the effect of family background, as is customary in the sibling literature (e.g., Björklund et al., 2002; Erola et al., 2016; Karhula, 2015; Solon, 1992).

We first compare the sequence differences in the siblings' trajectories to the sequence differences in the trajectories between randomly assigned unrelated persons, as illustrated in Fig. 1 (Panel A, Random Assignment). For every focal person in our data set, we assign one sibling and one randomly selected unrelated person to generate one sibling dyad and one unrelated dyad, respectively. By definition, siblings share the same social origin, whereas unrelated dyads do not. Accordingly, we can identify the effect of social origin by contrasting the average distance in sibling dyads with the average distance in the unrelated dyads. If the distances between siblings are significantly smaller than the distances between the randomly assigned unrelated persons (and siblings are thereby more similar), this indicates family of origin effects on early career trajectories.

After establishing whether sibling similarity in ESETs exists, we address the possible family background determinants behind the similarities. We match the randomly assigned persons conditionally on observed characteristics discussed in the theory section (Fig. 1, Panel B, Conditional Assignment on Parental Background). In scenario B, the unrelated person shares the same observable family background characteristics with the focal person, making the sibling and unrelated dyads more similar to each other in this scenario than in the random assignment (scenario A, Fig. 1).

Next, we test, whether the final outcomes approach that focuses on education or earnings at a certain age underestimates the full extent of social origin effects. Whether this is the case is an empirical question that might vary in the context of different applications. We therefore estimate how much of the social origin effect, i.e., sibling similarity, we would miss by looking only at selected final outcomes. In other words, we test, whether siblings are only more similar in final outcomes or are also more similar in the trajectories leading to these outcomes.

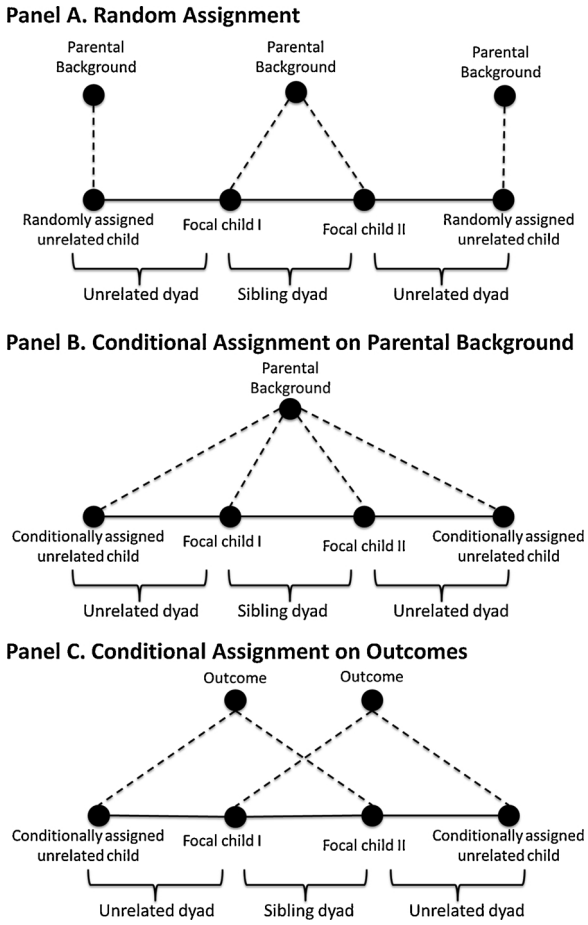

Fig. 1. Assignment of dyads with matching under random assignment (panel A), conditional assignment on family background (panel B), and conditional assignment on outcomes (panel C).

Therefore, our second research question is the following:

(RQ2) How much of the sibling similarity in early adult socioeconomic trajectories would we miss by only looking at outcomes at age 35?

To address this question, we apply a conditional matching design that matches on the combination of outcomes of the two dyad members (Fig. 1, Panel C, Conditional Assignment on Outcomes). We create a sibling dyad and an unrelated dyad with identical outcome constellations, i.e., we ensure that the outcomes of the focal persons' dyad partners are the same both in the sibling dyad and in the unrelated dyad.

Consider two illustrative examples. First, we take a sibling dyad in which the focal person, focal child 1, has a university education and the matched sibling, focal child 2, has a high school degree. Then, we match the focal person, focal child 1, who holds a university degree, with an unrelated person who has a high school degree, equal to focal child 2. We have created two dyads with the identical outcome combination (university education – high school degree). If we still find more similarity in the sibling dyad, that means that siblings have more similar socioeconomic trajectories than do the unrelated persons, even when comparing dyads with identical outcome combinations: siblings are more similar in their trajectories above and beyond a similar outcome combination. Second, consider a scenario in which both siblings obtain a university education. Then, the focal child 1 is matched to an unrelated person with a university education as well. If we still find significant sibling similarity, this means that in addition to reaching the same outcome, i.e., a university degree, siblings are more similar in the

pathways surrounding this outcome. In both cases, the sibling and the unrelated dyad partner are identical, according to the matched outcomes at age 35.

In the conditional assignment on outcomes, we first separately match on education and earnings at age 35 and then for the combination of both. This takes the methodological approach developed in Raab et al. (2014) one step further to directly analyze the added value of the sequential approach. If sibling similarity vanishes after matching on the final education, this would suggest that education fully mediates the effect of social origin on ESETs. After matching on educational outcomes, if siblings are still more similar than are random unrelated persons, this would indicate that social origin affects ESETs (*destination as a process*), even after controlling for education. Because attaining education is itself an essential part of the trajectory, controlling for education will certainly reduce the effect of social origin. Part of this reduction is not mediation but results from educational attainment being part of the trajectory. Given this anticipated reduction in sibling similarity, we consider our assignment strategy a conservative test of the added value of the sequential approach.

In contrast to education, earnings at age 35 is a final outcome of the ESETs. Referring to previous research, we ask whether it is sufficient to study this single outcome measure to fully capture the family of origin effect on ESETs. If we still observe sibling similarity after matching on earnings at age 35, this indicates that siblings are more similar not only in final outcomes but also in the processes leading to these outcomes. The social origin effect on ESETs would then be underestimated by focusing only on final outcomes.

We further analyze how much of the remaining similarity lies solely in the trajectories by simultaneously matching on earnings and education. This remaining similarity would remain concealed in final outcome approaches, even if they consider both educational attainment and earnings. In addition to educational attainment and final earnings, the trajectories also include similarity in terms of the timing, duration, and the sequencing in ESETs, in which siblings may or may not be more similar compared to unrelated persons with similar outcome combinations.

(RQ3) In which ways are siblings' ESETs more similar?

To answer our third research question, we identify clusters of typical ESETs and calculate the probabilities of siblings to belong to the same cluster as compared to the probabilities for unrelated persons. We thereby identify whether siblings cluster in specific substantive profiles of ESETs. If the focal person's sibling is more likely to belong to the same cluster than is a randomly assigned person, the family of origin is likely to play an influential role for this specific profile of ESETs. Note that the relatively higher probabilities of siblings to belong to specific clusters might be systematically related to differences in the homogeneity and average degree of cluster membership for different clusters (Piccarreta & Studer, 2018). Siblings could have an elevated probability to be both in particularly distinct and homogeneous groups, simply because it is more likely to find any effects for such well-defined groups. We tested the sensitivity of our results by calculating the cluster-specific Average Silhouette Widths (ASWs) (Studer, 2013). There was no systematic association between the siblings' probability to be in the same cluster and the cluster-specific ASWs. In our case, we therefore conclude that a higher probability of siblings to be in the same cluster is not purely driven by differential cluster distinctness and homogeneity.

5. Data and methods

5.1. Data

We use the administrative register-based Finnish Growth Environment Panel (FinGEP). The data consist of a 10% random sample of Finnish parents in 1980. All subsequent family members are included in the sample. We use yearly panel data to follow this parent sample's children who were born in 1970–1975 and construct socioeconomic sequences from age 17 to age 35 (years between 1987 and 2010). Only individuals who have at least one sibling are included, which allows us to separate the impact of having any siblings from the specific impact of siblings. Respondents are identified as siblings if they share the same biological mother.

We define ESETs as sequences with seven different states: in education (EDU), unemployed (UNEMP), otherwise outside of the labor force (OUT) and earning income in four categories (I1 to I4). Being in education denotes that an individual is enrolled in full-time education (primary, secondary, or higher education), according to student registers. Being in a state of unemployment denotes that an individual was a registered unemployed job seeker during the last week of the year. Individuals categorized as being outside of the labor force are those individuals with no employment and who are not registered as unemployed or as being in education. Included in this group are individuals on parental leave. The state consists mostly of parents staying home with children, men serving the mandatory military or civilian service (6–12 months), or individuals with no employment who are not applying for unemployment benefits. Unfortunately, the data does not allow us to distinguish these different types of being out of the labor market.

The four earnings groups are based on the earnings quartiles at age 35. Earnings are measured as the sum of the income from paid labor and entrepreneurial income and are based on the information available in the tax registries. When defined in this way, the earnings groups reflect the socioeconomic status of the individuals' labor market position in terms of income relative to that of their peers. Although earnings are an excellent way of measuring socioeconomic status, an interesting possibility would have been to contrast earnings trajectories to those based on occupational classifications. Unfortunately, this is not possible because Statistics Finland only collected the data on occupational status in five-year intervals during our observation period.

We further use information on parental background characteristics: parental education, childhood family income, parental unemployment, family structure during childhood and area of residence at age 17. The yearly registers in Finland started in 1987. Prior to this, the data was available in five-year intervals, from which we use data from 1980 and 1985. Parental education (educational level of the highest-educated parent) is observed at age 15, except for the 1971 cohort, for which it is observed at age 16 because data for 1986 are not available. For education, we use the CASMIN-classification (König, Lüttinger, & Müller, 1988) with the following five categories: basic education, vocational upper secondary degree, general upper secondary or postsecondary non-higher education, bachelor's degree, and master's degree or higher.

Childhood family income is measured in 1980 when the children were between 5 and 10 years old. Incomes are equalized by using the modified OECD scale and divided into quartiles to enable exact matching, as described below. Parental unemployment is measured in 1980 and 1985, when the children were 5–15 years old. A parent is defined as unemployed if he or she experiences more than four months of unemployment in the given year. We measure unemployment experienced by either parent in 1980 or 1985. We do not distinguish between unemployment of mothers and fathers because previous studies on the intergenerational effects of parental unemployment in Finland have shown similar effects for mothers and fathers (Karhula, Lehti, & Erola, 2017). Disrupted childhood family structure is indicated by parental divorce or separation. We consider parents divorced or separated if the mother or father is not living in the same household as the child at age 15. An area indicator based on postal codes distinguishes five regions corresponding roughly to the so-called NUTS-regions: the Helsinki, Southern, Western, Eastern, and Northern Finland regions.

In the dyadic regression analysis, we further control for the age difference between the siblings to capture possible cohort differences.

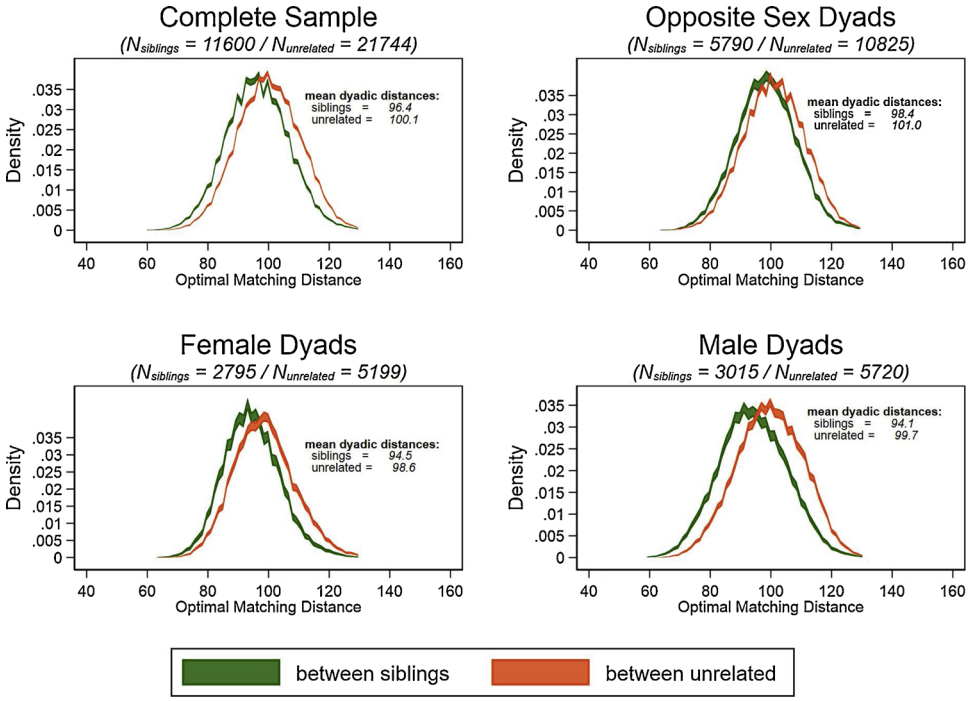

Fig. 2. Distributions of sequence distances for sibling dyads and randomly assigned unrelated dyads: Fixed-bandwidth kernel density with asymptotic confidence intervals.

We distinguish three categories: born in the same year, born from 1 to 3 years apart and born more than 3 years apart. Born in the same year refers to twins and thereby captures the stronger genetic similarity of twins compared to that of siblings; however, unfortunately, we cannot distinguish between monozygotic and dizygotic twins. When examining the added value of the sequential approach, we match on the education and earnings of the children at age 35, as outlined above (research question 3). Education is classified analogously to parental education in five categories. Earnings are defined by the sequences in quartiles at the age of 35.

Our starting sample comprises 24,040 individuals, including only individuals with siblings born in the birth cohorts that are included in our analysis. We exclude individuals with missing data in the sequences (788, 3.3 percent), those with missing information on our matching variables (1,313, 5.5 percent), and those with no siblings left after these exclusions (195, 0.8 percent). This leaves us with 21,744 individuals, a 9.6 percent reduction.

The sample restriction results in a slight bias towards excluding disadvantaged individuals. Additionally, in the matching on family background, we were unable to match 88 children (0.4 percent) with an unrelated person; as a consequence, these children, almost all of whom have unemployed and divorced or separated parents (86 out of the 88), are also excluded from the analyses. As our results show that sibling similarity in disadvantaged trajectories is stronger than that in other trajectories, these limitations might lead to a slight downward bias in our estimates of average sibling similarity.

In addition, we exclude identical dyads appearing multiple times in our analytical sample. This happens when a focal person is matched to a random sibling, and the random sibling, as a focal person, is in turn matched to the original focal person. In the end, our first analytical sample consists of 11,600 sibling dyads and 21,744 randomly selected unrelated dyads, that is, 33,344 dyads in total. In the matching samples, the number of dyads varies slightly due to different numbers of excluded identical dyads.

5.2. Methods

We apply optimal matching—the most common form of sequence analysis in the social sciences—which calculates pairwise distances between all sequences by using two transformation operations, namely, substitution and insertion/deletion of states, to turn one sequence into another. These operations are associated with specific costs, and the distance between two sequences is defined as the sum of the costs for aligning two sequences (for an introduction, see MacIndoe & Abbott, 2004). We use a standard optimal matching algorithm with a constant substitution cost of two and insert/deletion cost of one. Optimal matching distances can be thought of as a “common backbone” or a “common narrative” of the sequences (Elzinga & Studer, 2015). They emphasize the duration spent in different states (Studer & Ritschard, 2016).

We further ran the analysis by using transition-based substitution costs and the dynamic Hamming distance. The results varied slightly, but the findings were very robust, leading to the same substantive interpretation (results with other cost specifications can be found in excel tables in online supplementary material). All distances were standardized to a mean of 100 and a standard deviation of 10. Thus a 10-unit difference corresponds to one standard deviation change in the sequence distances.

The output of the sequence analysis is a pairwise *distance matrix* that contains the sequence distances between all pairwise combinations of related and unrelated individuals. The 21,744 sequences are compared with all other sequences. This yields $(N \times (N - 1)) / 2 = 236{,}389{,}896$ comparisons (i.e., cells in the distance matrix).

Our first research question concerned sequence similarity between sibling dyads compared to the unrelated dyads. To address this question, we extract the distance values for the sibling dyads and the randomly assigned unrelated dyads from the distance matrix. The distribution of the siblings’ distances is then compared to the distance distribution within the unrelated dyads (Fig. 2). We further asked whether observed family background characteristics account for sibling similarities. Using a dyadic regression framework with dyadic distance as the dependent variable, we obtain the estimates of sibling similarity

Table 1
OLS regression predicting dyadic distances.

	OM with constant substitution cost			
	M1. (Random Assignment)	M2. (Conditional Assignment on Family Background)	M3. (Conditional Assignment on Family Background)	
			Main effects	Interaction effects
Sibling indicator (ref. Unrelated dyad)				
Sibling dyad	−3.70*	−2.55*	−1.91*	
	(0.11)	(0.11)	(0.42)	
Gender constellation (ref. = opposite sex)				
Both female			−2.53*	−1.34*
			(0.16)	(0.27)
Both male			−1.89*	−2.37*
			(0.17)	(0.29)
Highest parental education (ref. Both basic education)				
Both vocational upper secondary			−0.55	0.34
			(0.18)	(0.28)
Both general upper secondary or postsecondary non-HE			−1.10*	0.50
			(0.22)	(0.36)
Both bachelor's degree (polytech. + univ.)			−2.41*	1.35
			(0.30)	(0.48)
Both master's degree or higher			−3.08*	0.79
			(0.30)	(0.47)
Household income in childhood (ref. = 1. Quartile (lowest))				
2. Quartile			−0.63	0.07
			(0.19)	(0.31)
3. Quartile			−1.17*	0.09
			(0.20)	(0.32)
4. Quartile (highest)			−1.47*	−0.21
			(0.23)	(0.37)
Parental unemployment			0.56	−0.11
			(0.23)	(0.38)
Experienced parental divorce or separation			0.90*	−0.04
			(0.19)	(0.31)
Area of residence at age 17 (ref. Helsinki region)				
Southern Finland (excl. Helsinki region)			−0.62	0.07
			(0.21)	(0.34)
Western Finland			−0.82*	0.12
			(0.21)	(0.34)
Eastern Finland			−1.15*	−0.03
			(0.24)	(0.39)
Northern Finland			−0.24	0.27
			(0.23)	(0.37)
Age difference (ref. 1 to 3 years)				
Born in same year			0.27	−3.70*
			(0.19)	(0.51)
Over 3 years			0.21	0.06
			(0.18)	(0.29)
Constant	100.05*	98.92*	101.97*	
	(0.07)	(0.07)	(0.25)	
Observations	33,344	33,030	33,030	
Adjusted R-squared	0.03	0.01	0.05	

Robust standard errors in parentheses.
* $p < 0.001$, two-tailed t-test.

with sibling status of the dyad as an independent variable (Table 1, M1). We then matched the unrelated persons to ensure the similarity of observed family background characteristics and extracted the respective distance values from the distance matrix. Parental education, household income in childhood, parental unemployment, parental divorce, and area of residence in childhood were used as matching variables. After matching, the sibling and unrelated dyads were identical regarding these characteristics, and any remaining sibling effect was generated by unobserved factors (Table 1, M2). Subsequently, to analyze the driving factors behind sibling similarity, we ran a fully interacted regression model by sibling status to identify sibling-specific effects, including the full set of covariates. This illustrates both the general family background determinants behind sequence similarity (main coefficients) and family-specific effects (interaction coefficients) (Table 1, M3). Due to our large sample size, we concentrate only on the coefficients that are statistically significant at a p-value of 0.001.

Our second research question asked whether the ESETs with identical final outcomes still show sibling similarity. To answer this question, we examined whether the sibling similarity in ESETs diminishes once we account for the trajectories' outcomes, that is, the highest level of education and earnings at age 35. This was achieved by matching the dyads on outcomes (for details, see the research question and research design section) and by extracting the respective distance values for sibling and unrelated dyads from the resulting distance matrix.

Finally, we identified typical patterns of ESETs by applying cluster analysis to examine in which way siblings' trajectories are more similar. We used an optimized algorithm of the Partitioning Around Medoids (PAM) technique for the clustering (Reynolds, Richards, de la Iglesia, & Rayward-Smith, 2006). Based on substantive meaningfulness and well-established cut-off criteria (e.g., Average Silhouette Width and Point Biserial Correlation), we decided on a seven-cluster solution (Studer, 2013). We then examined whether siblings have a higher probability to sort into the same ESET cluster than do unrelated dyads and whether this is particularly the case for specific clusters. Sequence and cluster analyses were conducted by using the TraMineR (Gabadinho, Ritschard, Mueller, & Studer, 2011) and WeightedCluster (Studer, 2013) packages in R.

6. Results

6.1. Are early socioeconomic trajectories of siblings more similar than those of unrelated persons (RQ 1)?

The findings indicate that the siblings' ESETs are indeed more similar than those of random unrelated dyads. Displayed separately for the complete sample, opposite-sex dyads, female dyads, and male dyads, Fig. 2 shows the distributions of distances for sibling dyads in green and those for the randomly assigned unrelated dyads in orange. The width of the curves reflects 95% asymptotic confidence intervals. The curves mostly do not overlap, indicating that across the entire distance distribution, siblings are significantly more similar than are unrelated dyads.

As expected, significant sibling similarity in ESETs indicates that social origin affects socioeconomic pathways in early adulthood. The total difference in mean distances of siblings and unrelated dyads is 100.1 - 96.4 = 3.7. Equally in line with expectations, smaller distances between same-sex siblings compared to that between opposite-sex siblings indicate that family background affects ESETs in gender-specific ways. Brothers are particularly similar compared to unrelated male dyads (99.7 - 94.1 = 5.6), followed by sisters compared to unrelated female dyads (98.6 - 94.5 = 4.1, see bottom graphs in Fig. 2). This would translate to a Cohen's D of 0.56 and 0.41, usually considered medium effect sizes. Similarity in ESETs is considerably lower, although still significant, for opposite-sex siblings compared to that of their unrelated peers (101.0 - 98.4 = 2.6, upper right panel Fig. 2).

Our findings suggest that either social origin matters more for boys or that brothers have a more pronounced influence on each other's ESETs than do sisters. The greater difference between brothers and unrelated male dyads compared to that between female dyads substantiates previous literature that shows larger family of origin effects

on earnings for men in Finland (Österbacka, 2001). In contrast, for family formation trajectories, the origin effect is stronger for women in Finland (Raab et al., 2014). Additionally, findings in other countries, e.g., the US, do not show gender differences in sibling similarity for socioeconomic outcomes (Conley & Glauber, 2008).

Next, using OLS regressions, we examine (1) to what extent observable parental characteristics can account for sibling similarity and (2) whether these background characteristics in a similar way affect the similarity in ESETs for siblings and unrelated dyads. Table 1 shows two OLS regression models with the dyadic sequence distances as the dependent variable based on two different samples of matched unrelated dyads. Model 1 (Table 1, M1) contrasts sibling dyads with randomly assigned unrelated dyads (Panel A in Fig. 1). Model 2 (Table 1, M2) contrasts sibling dyads and unrelated dyads that were matched conditionally on sharing the same parental education, household income in childhood, parental unemployment, parental divorce/separation, and region of residence at age 17 (Panel B in Fig. 1). A decline in sibling similarity in Model 2 compared to Model 1 indicates that these family background characteristics account for part of the sibling similarity. The average difference between sibling dyads and unrelated dyads decreases from 3.70 in Model 1–2.55 (-1.15) in Model 2, suggesting that the observed family background characteristics account for approximately 31 percent of the initial sibling effect. Therefore, a majority of the sibling effect remains unaccounted for, even though the key importance of our matching variables for socioeconomic attainment is well-documented (Bukodi et al., 2014; Conley & Glauber, 2008; Erola et al., 2016).

Compared to a recent sibling study from Finland, which accounted for over half of the family variance in occupational status at the ages of 25–29 and 30–34 by parental education, occupational class and income (Erola et al., 2016), the present study accounts for a smaller share of the total family effect. Note, however, that the sequence distance analyzed in the present study is a more complex outcome measure that allows for greater overall variation than less complex variables, such as an occupational status index, used in previous research. The effect size for the sibling indicator has to be interpreted in the context of the effect sizes of other covariates that are known to have a strong influence on socioeconomic outcomes. The sibling indicator has one of the largest effect sizes in all model steps, only surpassed by the indicators for higher parental educational degrees, attesting to the substantive relevance of social origin effects (Table 1).

The sibling similarity is notable, but the explanatory power of the model (Adjusted R-squared) is very small compared to that in sibling correlation studies (e.g., Mazumder, 2008; Erola et al., 2016). This is related to the complexity of the sequences. As process outcomes, they are far more complex than simple random variables because they can take very many different expressions in the combination, timing, and sequencing of states. As a result, there is great heterogeneity in these sequences resulting from a multitude of factors. Single indicators, such as sibling status, education or gender tend to capture only a small share of the variation in the trajectories. However, as we note above, in comparison to other important covariates including education and gender, we find one of the largest effects is that for sibling status, attesting to its high substantive relevance.

To determine which specific family background determinants accounted for the similarity in ESETs, we employ an OLS regression model on the sample of conditionally matched unrelated dyads in M3 (Table 1, M3). Model 3 includes sibling status, age difference, and all the matching variables as independent variables (for descriptive statistics on variable distributions in sibling and unrelated dyads see Appendix A). These variables are interacted with the sibling status dummy to assess whether they affect the similarity in ESETs differently for siblings than they do for unrelated dyads. The coefficients for the interaction effects indicate family-specific similarity in ESETs for the respective subgroups. For example, women are more similar in ESETs than are opposite sex dyads (negative main coefficient), and there is still something family-specific that makes sisters even more similar than women are in general (negative interaction coefficient). Indeed, the coefficients for the interaction between gender and sibling status are sizeable: compared to unrelated peers who share similar family background characteristics, brothers are even more similar by 2.37 units and sisters by 1.34 units (Table 1, M3).

In the literature, parental education and household income in childhood are often linked to socioeconomic outcomes (Bukodi et al., 2014; Conley & Glauber, 2008; Erola et al., 2016). Most of this effect is usually attributed to education alone, while income only has a modest direct effect on socioeconomic outcomes (Erola et al., 2016). Our results confirm these previous findings. Model 3 shows a gradual increase in similarity in ESETs with parental education (Table 1, M3). Compared to children whose parents completed comprehensive school or lower education, children of highly educated parents have, on average, 3.08 units more similar ESETs. This effect holds for siblings and unrelated dyads alike, i.e., we do not observe statistically meaningful interaction effects with sibling status. Parental income has a smaller but statistically significant effect on ESETs when parental education is also controlled for. (Table 1, M3). The interaction effects for sibling status and income quartiles are neither statistically significant nor relevant in terms of effect size.

Parental separation and divorce increase the dyadic distances by 0.90 units. This is likely due to a lower joint influence of parents on their children. Compared to living in other regions, living in western or eastern Finland at age 17 is also associated with more similar ESETs, likely reflecting differences in regional job markets and unemployment levels. These effects did not have statistically significant interactions with sibling status.

Similarly, the main effects for age differences were small in size and not statistically significant, indicating no cohort effect for our study period. The interaction effect for siblings born in the same year, however, was sizeable (3.70) and significant. This strong twin effect results from twins' shared genes and the more similar environmental conditions of twins compared to that of unrelated persons or regular siblings. In summary, our findings indicate that social origin influences ESETs through similar factors, as previous literature has demonstrated for final outcomes (Bukodi et al., 2014; Erola et al., 2016; Sirniö et al., 2013).

6.2. How much of the sibling similarity in early adult socioeconomic trajectories would we miss by only looking at the outcomes at age 35? (RQ2)

As shown in Panel C of Fig. 1, we examine the added value of the trajectory approach by matching the sequence outcomes of the unrelated dyad to those of the sibling dyad, thus creating dyad pairs with the same outcome combination. This allows us to assess whether siblings are more similar not only in final outcomes but also in the processes that lead to these outcomes.

Model 1 (Table 2, M1) serves as a reference point and shows that sibling dyads are, on average, significantly more similar than randomly assigned, unrelated dyads by 3.70 units. Matching on education reduces the sibling similarity coefficient by 38.4 percent to -2.28 (Table 2, M4). This demonstrates that the origin effect on ESETs was mediated to a considerable amount by education, corroborating the findings of previous studies (Bukodi et al., 2014; Erola et al., 2016). Given that ESETs comprise the educational attainment process (from age 17 onwards), this strong effect is not very surprising. However, a notable part of the origin effect on ESETs is not associated with education, and 61.6 percent of the social origin effect on ESETs remains after matching on educational attainment.

Model 5 (Table 2, M5) shows how much sibling similarity is reduced after accounting for earnings at the end of the observation period. In this model, the earnings constellation at age 35 is the same for the sibling dyad and the conditionally matched unrelated dyad. Sibling similarity is reduced by 24.6 percent to -2.79. Despite this notable

Table 2
Sibling effect in analytical samples with random assignment and conditional assignment on different outcomes.

	M1 Random Assignment	M4 Conditional Assignment on education (at age 35)	M5 Conditional Assignment on earnings (at age 35)	M6 Conditional Assignment on both Outcomes (at age 35)
Sibling dyad	−3.70*	−2.28*	−2.79*	−1.79*
	(0.11)	(0.11)	(0.11)	(0.10)
Constant	100.05*	98.65*	99.16*	98.15*
	(0.07)	(0.07)	(0.07)	(0.07)
Decrease in sibling effect (%) compared to model M1		38.4	24.6	51.6
Observations	33,344	33,354	33,353	33,355

Robust standard errors in parentheses.
** p < 0.001, two-tailed t-test.

reduction, even a larger share of the origin effect on sibling similarity than that in the case of education remains unexplained. Even after matching on both outcomes, education and earnings (Table 2, M6), approximately half of the sibling similarity remains. Regardless of whether siblings share the same education or earnings, their socio-economic trajectories are more similar to each other than those of unrelated persons with the same constellation of outcomes in terms of the timing, duration, and sequencing of socio-economic events in early adulthood. These findings suggest that analyses focusing on final outcomes are at risk of underestimating the full extent of sibling similarity in early adult lives as they unfold over time. Siblings are not only more similar in final outcomes but also in the processes leading to final outcomes.

6.3. In which way are siblings' ESETs more similar?

Using cluster analysis, we identified seven ESET patterns, which we named "Unemployment", "Dropout/mother", "Low income", "Middle income", "Academic", "Middle high income" and "High achiever". The cluster solution is very robust across different distance measures, including OM with transition cost-based substitution costs and Dynamic Hamming Distances (sensitivity analysis available from the authors).

To illustrate the clustering, Fig. 3 presents relative frequency sequence plots (RF plots) of the clusters (Fasang & Liao, 2014). RF plots extract a set of representative sequences and plot them as sequence index plots. This is necessary because plotting all sequences in the large data set would result in severe overplotting and a visual distortion of the data. The RF plots show the extracted medoid sequences as representative sequences for equal-sized frequency groups (n = 100) of the data (the sequence with the shortest average distance to all other sequences in the group, sequences sorted using multidimensional scaling) (see Fasang & Liao, 2014 for details).

Most trajectories follow a standard route: almost everyone is enrolled in secondary education at age 17, followed by higher education or labor market entry with gradually increasing earnings. Mandatory military service appears almost universally for men around ages 19 and 20. A total of 10.6 percent of the trajectories end up in the "Unemployment" cluster and are characterized by extended unemployment spells. The "Unemployment" and the "Dropout/mother" cluster are clearly more atypical and disadvantaged in terms of lower labor market participation and later earnings. Low- and middle-income clusters consist of fairly typical trajectories with gradually increasing earnings. The "Academic" cluster is characterized by long educational spells with above average incomes at later ages. The "Middle high income" cluster on the other hand has shorter education coupled with median to high incomes later on. The last cluster of "High achievers" consists of trajectories where higher education is achieved quickly and combined with steeply increasing income.

To measure in which way the siblings' trajectories are more similar, we examine differences in the probabilities of siblings and unrelated

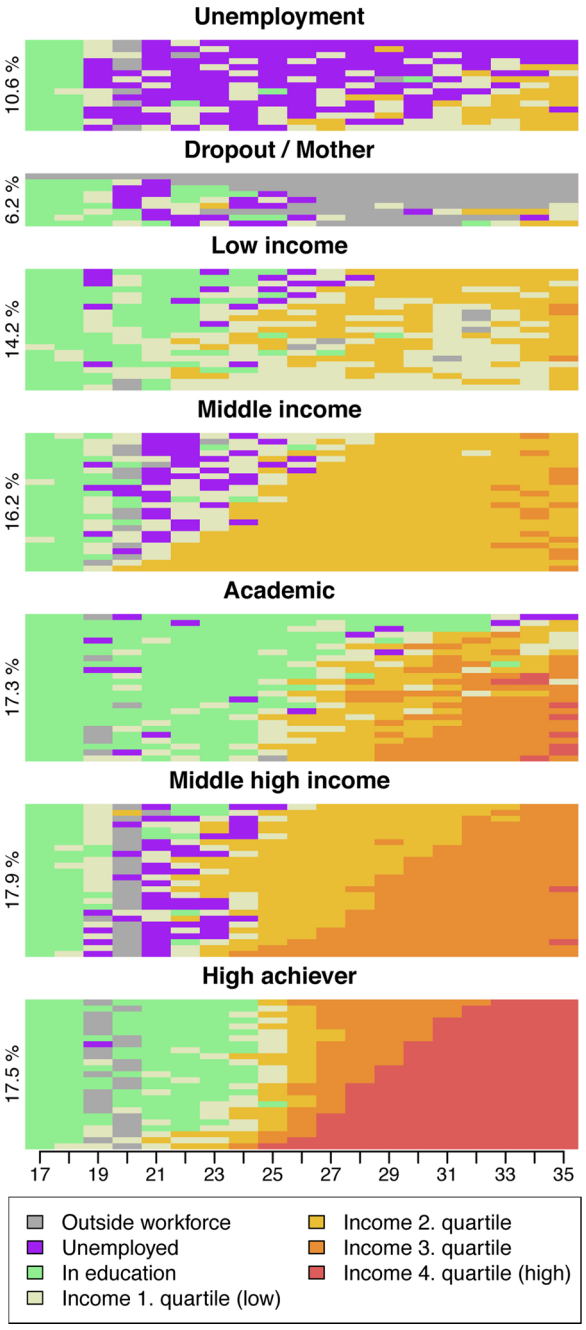

Fig. 3. Relative frequency sequence plot of the seven ESET clusters with sequences sorted by using multidimensional scaling.

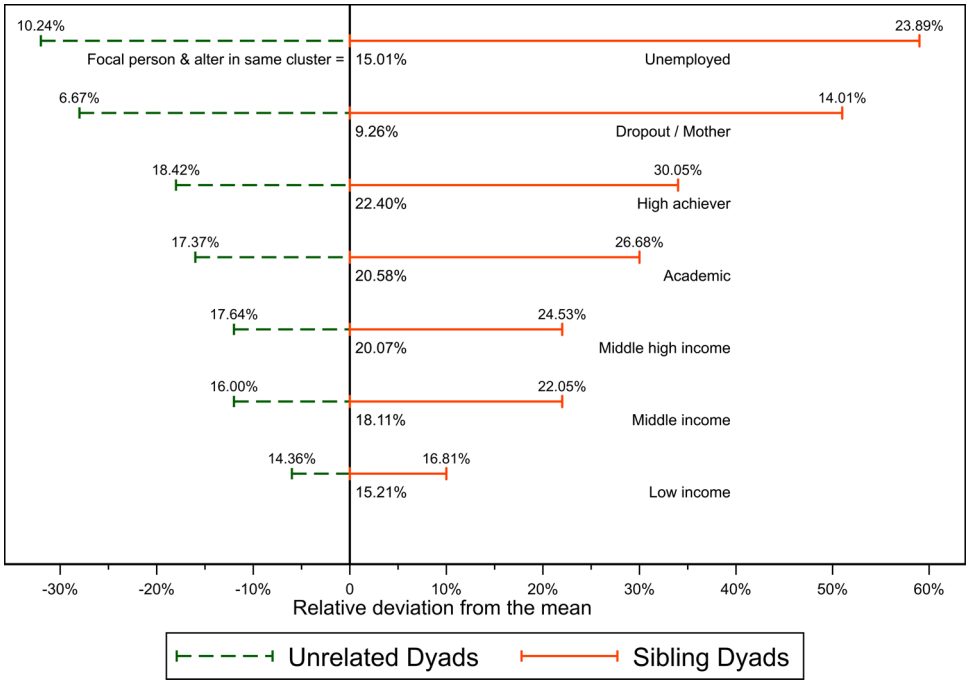

Fig. 4. Focal person and alter in the same cluster: Conditional probabilities and relative deviations from the overall mean.

persons belonging to the same cluster as the focal person (Fig. 4). We can see that compared to random unrelated persons, siblings always have a higher probability of belonging to the same cluster. This sibling effect is most pronounced for the two disadvantaged clusters, "unemployment" or "dropout/mother". This finding was very robust across different distance measures and indicates that this is the case independent of whether we emphasize the timing, duration or sequencing of the events in the calculation of sequence distances. Siblings were also more likely to belong to the same cluster in the case of "High achievers". Overall, these findings indicate that family of origin effects as measured by cluster membership are most pronounced at the extremes of the social structure.

As noted above, these results might be biased if siblings have a higher probability of being in the same group in clusters that have strong average cluster membership and are more homogeneous simply because it is more likely to find any effects for such well-defined groups (Piccarreta & Studer, 2018). In our application, this does not seem to be the case. There is no systematic association between the clusters that have the highest ASWs and the highest probability of both siblings being in the same group. The highest cluster-specific ASWs are found for the "Dropout/mother", "High achiever" and "Middle income" groups, but sibling similarity is not high in the "Middle income" cluster. In contrast, the "Unemployment" and "Academic" clusters have high sibling similarity, but relatively low ASWs. Consequently, the association between ASWs and siblings probability of joint membership is not especially strong, and we believe that the biases if present, are small.

7. Conclusion

In this paper, we bring a longitudinal process-oriented perspective to the long-standing debate on social origin effects on socioeconomic attainment. The empirical analyses were based on high-quality register data and applied a new extension to recently developed methods that combine sequence analysis with a sibling design (Raab et al., 2014). We address three research questions. First, we replicate and extend previous sibling studies by analyzing and showing sibling similarity in a process outcome framework. We establish that compared to randomly selected unrelated persons, siblings are indeed more similar in ESETs and that this similarity is particularly strong for brothers. This gender-specific difference in sibling similarity substantiates previous findings on earnings in Finland (Österbacka, 2001) but differs from some of the findings on socioeconomic status in the US (Conley & Glauber, 2008) and Denmark, where no differences in permanent earnings (Schnitzlein, 2014) and higher correlations in years of education for sisters have been found (Bredtmann & Smith, 2018). Overall, sibling similarity is notable among all sibling constellations in our study. However, the share of variance explained in the dyadic distances of socioeconomic trajectories—which captures differences in the combination, timing, and sequencing of states—is small compared to some other sibling studies that use less complex outcome measures and sibling correlations (e.g., Erola et al., 2016). Because our study is situated in the relatively egalitarian context of Finland, where sibling correlations in earnings are lower compared to that in the US and other countries (Björklund et al., 2002), sibling similarity likely is stronger elsewhere. Accordingly, we consider replications of this study design in other countries a promising approach to assess the impact of macrostructural contexts on social origin effects on ESETs.

Overall, the findings indicate that observed characteristics of the family background—parental education, income during childhood, parental unemployment, parental divorce and separation, and region—account for only 31 percent of sibling similarity. It follows that much of the social origin effects summarized in sibling similarity are related either to mutual sibling influence or family background and shared environment characteristics that remained unobserved in our data. The observed family background effects worked much in the way we expected based on previous literature (e.g., Bukodi et al., 2014; Conley & Glauber, 2008; Erola et al., 2016). Compared to the effects in studies on final outcomes, family background effects in our study accounted for a smaller share of sibling similarity (e.g., Erola et al., 2016; Hauser & Wong, 1989; Sieben & de Graaf, 2003). This indicates that the social origin effect on ESETs is not as strongly related to traditional family background variables. Research on final outcomes might tend to overestimate the importance of these factors for intergenerational inequality. The fact that even when considering key drivers of ESETs, much of sibling similarity remains unaccounted for points to two general issues in the analysis of sibling similarities that might be even more

pronounced in our case than in the studies focusing on final outcomes.

First, although registers provide exceptionally reliable information on social origin, we could not measure everything shared in the siblings' growth environment. The role of extended family could not be controlled for, although this might influence sibling similarity (Jæger, 2012; Mare, 2011, 2014). Furthermore, we could not measure the peer or neighborhood effects with the available data, although these are known to matter for later outcomes (Sampson, Morenoff, & Gannon-Rowley, 2002). Relationship quality and conflict between parents and children is equally not available in the registers but has been shown to matter for the intergenerational transmission of behaviors from parents to children (Fasang & Raab, 2014).

Second, genetically informed research on twins (Heath et al., 1985; Kohler, Rodgers, & Christensen, 1999) argues that high sibling (twin) similarity might arise in open meritocratic societies because the genetically similar abilities of siblings (twins) lead to similar outcomes in an open opportunity structure. From this point of view, sibling similarity simply reflects similar genetically determined abilities and not social origin in terms of parental investment and behavior. Apart from the very sizable twin effect in the regression analysis (see Table 1, M3), our data did not allow for a more thorough empirical test of this hypothesis. As a result, the unexplained sibling similarity might indeed be partly driven by genetic factors. Future research using molecular genetic data is important to shed light on how these factors contribute to the sibling similarity in socioeconomic outcomes.

In a similar vein, we want to highlight another seemingly counter-intuitive feature of sibling similarity: low sibling similarities do not necessarily point to weak social origin effects. This is a well-known methodological and substantive issue that our analysis shares with traditional sibling resemblance models that use single outcome measures such as education or earnings (Conley, 2008). For instance, strategic parental investment clearly must be evaluated as a family of origin effect, although it can decrease sibling similarity if it leads to differential outcomes. Despite these limitations, we follow Conley's conclusion that sibling correlations can be read "as a global effect of family background if we assume a model in which offspring are invested in equally (or at least that any favoritism is randomly distributed) and in which siblings have only a mean-regressive effect on each other. That is, that they tend to cause each other to be more alike than they would in each other's absence" (Conley, 2008: 597). This is most likely the case in the egalitarian context of Finland.

In the present study, we show how the assessment of sibling similarities as a global effect of family background can be advanced by taking a processual perspective (Abbott, 2016). By matching siblings and unrelated dyads on specific outcome constellations in terms of education and income at age 35, we were able to show that a notable share of sibling similarity in trajectories would remain unnoticed when examining only single final outcomes. Social origin matters not only for the final outcomes but also for the timing, duration, and sequencing in ESETs. If this holds true also in other contexts, one implication is that the vast literature on intergenerational transmission analyzing final outcomes provides lower bound estimates of sibling similarity in the sequentially linked process of socioeconomic attainment. In the previous literature, Björklund and Jäntti (2012) note that sibling correlations are a downward biased estimate of social origin effects, as only the shared family background of the siblings is measured. The total origin effect consists of shared and nonshared influences. Our results show that sibling correlations on final outcomes are further downward biased because they do not fully capture social origin effects on the socioeconomic trajectories leading to these outcomes. However, one should keep in mind that sibling comparisons as a measure of the effect of social origin are in another sense upwardly biased, as they measure shared factors not traditionally thought of as family background, such as neighborhood similarities (Solon, Page, & Duncan, 2000).

Here, we only analyzed the trajectories from age 17 to age 35. A natural extension of the current study would be to study longer trajectories. As the outcomes at the end of the trajectory likely more strongly reflect most recent life courses, we can presume that by using longer sequences and later outcomes, the social origin effect on trajectories would be even stronger in addition to the final outcome effects. We could not test this hypothesis due to data limitations but encourage future research to tackle the question.

Sibling similarity was most pronounced for disadvantaged trajectories involving longer spells of unemployment or periods spent outside the labor force for other reasons, followed by the similarity in trajectories with higher education and a steep rise to higher earnings after education. These results demonstrate that the family of origin matters most for the most disadvantaged and advantaged trajectories. In summary, the family of origin matters less for the typical trajectories, but some origins are a clear risk factor for belonging to disadvantaged trajectories, and some origins steer individuals into a very advantageous path of higher education combined with steeply rising earnings. This U-shaped pattern in sibling similarity is in line with research for the US (Torche, 2011), which showed that intergenerational associations in social status are most pronounced among those with low and very high educational attainment. A sensitivity analysis of our results corroborated that this pattern of sibling concentration in specific clusters is not simply a result of more pronounced cluster distinctness and homogeneity at the extremes of the inequality distribution. Accumulation of economic and other forms of disadvantage in the most disadvantaged families might affect all siblings in a family strongly and uniformly. On the other hand, the most advantageous ESETs, the "High achievers", might hardly be attainable without abundant parental resources, such as parental financial support or information on the choice of field and track of study. Another possible interpretation is that resourceful parents are very successful in shielding their children from less advantageous trajectories through economic and social capital.

While differential cluster homogeneity is less of a problem for purely descriptive analyses, the results using clusters as dependent or independent variables could potentially be biased. This did not seem to be a relevant distortion in our study, but it should be kept in mind that sibling similarity might be overstated in the "Dropout/Mother" and "High achiever" and "Middle income" clusters that were the best-defined groups and understated in the "Low income" group that was the least well defined group. More generally, it is crucial for future research to further develop guidelines for the different cluster solutions' "sociological validity" along with their methodological soundness (Piccarreta & Studer, 2018). As there are many possible biases associated with clustering, one of the promising avenues of future research is to develop and implement further advanced clustering methods (e.g., Studer, 2018).

In liberal democracies, processes of status attainment play a crucial role in the perception of inequalities as just or unjust. Psychological research has shown that the perception of intergenerational mobility rates does influence the tolerance for inequality and that this effect is mediated by the belief that peoples' economic situation is the product of their own efforts (Shariff, Wiwad, & Aknin, 2016). Nevertheless, even the intergenerational mobility literature explicitly focusing on the inequality of opportunity usually focuses on final socioeconomic outcomes. Our results show that this alone is not enough. A large share of the inequalities related to the status attainment process remains hidden when analyzing only final outcomes. Even if the distribution of the positions observed here as final outcomes would seem equal by social origin, the process of status attainment leading to them is not necessarily equal and accordingly might be considered as unjust. A life course approach that focuses on "destination as a process" is thus promising to complement the analyses of social origin effects on final outcomes, generating new insights into how processes of attainment unfold over time.

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Appendix A. Distributions of parental background variables

See Table A1.

Table A1
Separate distributions of background variables for unrelated and sibling dyads in M3.

	Unrelated dyads		Sibling dyads	
	%	N	%	N
Gender constellation of dyad				
Both female	24.1	5,184	24.0	2,772
Both male	26.2	5,635	26.0	3,004
Opposite sex	49.6	10,665	50.0	5,770
Highest education of parents				
Basic education	26.4	5,664	26.7	3,082
Vocational upper secondary	40.5	8,695	40.2	4,640
General upper secondary or postsecondary non-HE	16.9	3,623	16.8	1,944
Bachelor's degree (polytech. + univ.)	7.5	1,613	7.5	867
Master's degree or higher	8.8	1,889	8.8	1,013
Parental divorce or separation				
Together	85.2	18,302	85.2	9,835
Divorced or separated	14.8	3,182	14.8	1,711
Parental income (age 5 to 10)				
1. Quartile (lowest)	24.8	5,318	26.5	3,057
2. Quartile	25.1	5,400	25.0	2,889
3. Quartile	25.3	5,431	24.4	2,820
4. Quartile (highest)	24.8	5,335	24.1	2,780
Parental unemployment				
No parents unemployed	90.1	19,350	89.9	10,378
At least one parent unemployed	9.9	2,134	10.1	1,168
Living region at age 17				
Helsinki region	20.9	4,490	20.6	2,373
Southern Finland (excl. Helsinki)	24.1	5,170	23.7	2,733
Western Finland	22.9	4,929	22.8	2,627
Eastern Finland	13.2	2,832	13.2	1,525
Northern Finland	18.9	4,063	19.8	2,288
Age difference				
Born in the same year	16.7	3,580	4.8	555
1 to 3 years	65.7	14,118	75.3	8,689
3 to 5 years	17.6	3,786	19.9	2,302

Appendix B. Supplementary tables

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.alcr.2019.04.015.

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