Cross-sibling effects on divorce in the Netherlands

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ABSTRACT

Parental divorce has repeatedly been shown to increase the risk of divorce for offspring, but research on the influence of other social ties is scarce. This study examines the association of divorce between siblings and whether such an association varies under specific sibship characteristics. Hypotheses were tested using event history models on five complete Dutch birth cohorts (1970–1974), derived from register data. Married individuals (N = 64677) and their sibling were followed from 2000 up to 2012. Results show that individuals with a divorced sibling had a higher risk of divorce even after correcting for a number of shared background factors, including parental divorce. The divorce of a younger sibling had a weaker association with an individual's divorce risk than the divorce of an older sibling, and the effect of sibling divorce weakened over time.

1. Introduction

The rate of divorce has rapidly increased over the past few decades. Recent American figures show that around half of the marriages in the US end within their first 15 years (National Vital Statistics Report, 2008). Other Western countries, including the Netherlands, show similar upsurges in divorce rates of up to 30 to 40% of marriages over the life course (Eurostat, 2012). This begs the question whether personal divorce decisions are in fact part of a larger social phenomenon or trend. Up until now, most research on divorce decisions has focused on the role of partners' individual characteristics and the strength of their relationship (Axinn & Thornton 1992; Bumpass & Mburugu, 1977; Keith & Finlay, 1988; White 1990). Research that did focus on the larger social environment mostly emphasised intergenerational transmission: a parent-to-child transfer of union dissolution (Amato & Booth, 1991; Amato, 1996; Bumpass, Martin, & Sweet, 1991; Conger et al., 1990; Davies and Cummings, 1994). As parental divorce has been shown to be strongly related to children's divorce risk, it is worthwhile to consider the possible influence of other social ties. South and Lloyd (1995) analysed the extent to which the availability of spousal alternatives influenced the risk of divorce in rather broadly defined labour market areas. Aberg (2009) investigated the so-called *social contagiousness* of divorce and focused on the effects of the demographic characteristics within firms, like the proportion of single or divorced colleagues. In our study, we elaborate on the idea of social contagiousness of divorce, not focusing on average characteristics of the social environment but on contagiousness within one specific and highly significant social tie: the sibling.

A wide range of research has identified the sibling bond as a unique and intimate peer connection, highly influential to all manner of personal choices (Bernardi, 2003; Lyngstad & Prskawetz, 2010; Voorpostel, 2007). An individual is usually closely familiar with their siblings' experiences, and siblings often function as behavioural examples throughout life. Previous sibship research on this role model mechanism suggests that family formation is 'contagious': when a person marries or gives birth, siblings are more likely to display similar behaviour themselves (Bernardi, 2003; Bloom, Canning, Gunther, & Linnemayr, 2008; Kuziemko, 2006; Lyngstad & Prskawetz, 2010). A divorce constitutes a major and disruptive life course transition. Literature strongly suggests that an individual's susceptibility to external social influences increases when dealing with decisions on substantial lifestyle alterations (Cicirelli, 1995; Lamb & Sutton-Smith, 2014[1982]; Lyngstad & Prskawetz, 2010). Moreover, it is argued that the more one can relate to one's social ties, and the stronger the relationship is, the more likely it will be that some level of communication will take place about important life choices (ibid.). A divorced sibling, therefore, could become a role model on divorce, and provide their sibling with a frame of reference on its possible consequences.

To our knowledge, only one study has truly focused on possible network effects on divorce. Using a longitudinal survey sample, McDermott, Fowler and Christakis (2013) found evidence to suggest transmission of divorce among friends in the American town of

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Framingham. The same study also found a significant association between siblings' divorce status, and between divorce status of co-workers in small firms (McDermott et al., 2013). However, as discussed by the authors, this study had a limited demographic range (i.e. practically all survey participants were white, came from one specific town, and the majority belonged to older cohorts). Therefore, the results cannot be generalised to the larger American population, and may not be representative for contemporary divorce rates, or across countries. Our study adds to previous findings and literature on divorce in a number of ways. First of all, we too examine the main effect of a sibling's divorce event on an individual's divorce risk, using unique information on a nation-wide population subgroup in the Netherlands between 2000 and 2012. We include individuals from all manner of cultural backgrounds, from younger cohorts aged thirty onwards, among whom divorce is more prevalent. Second of all, this study is the first to investigate whether a cross-sibling effect on divorce differs depending on relationship characteristics of the sibship −focusing specifically on characteristics that may affect the strength of the sibling's role model position.

We theorise that there is a direct association between siblings' decisions on divorce because of the role model function that siblings have. However, establishing such a causal link is difficult in this type of study. Siblings share genes, a family background, and life events. Any association between behaviours of siblings could, in theory, be due to these endogenous factors rather than to 'contagion' of the behaviour itself (Manski 1993). We aim to disentangle clear endogenous factors from social influence among siblings by addressing this issue in several ways. First, we correct for shared background factors as much as possible, although we cannot control for all of them. Second, we fit additional models on both same-sex and opposite-sex twins in our dataset, in an attempt to further parse out possible genetic influences on divorce events among siblings. Third, we investigate whether the influence of the sibling's divorce wanes over time, consistent with a causal explanation. Fourth, we investigate moderators of the 'sibling effect'. We expect the cross sibling divorce association to be stronger when the sibling is more likely to function as a role model. If this is indeed the case, then this provides support for the role model theory, and for at least some causality in the relationship. Therefore, the research questions read: (1) *Does the divorce of one's sibling increase an individual's own risk of divorce?* And (2) *Does a cross-sibling effect on divorce vary according to specific sibship characteristics?*

2. Theory

The relationship between siblings is potentially one of the most intimate and long-lasting peer connections, even in adulthood (Voorpostel, 2007). While physical distance after leaving the parental home could weaken a sibling connection, brothers and sisters continue to experience important life transitions that reinforce family bonds. Family rituals associated with births, marriages or deaths, for example, encourage shared celebration and mourning and can emotionally strengthen interpersonal relationships (Lyngstad & Prskawetz, 2010). Furthermore, a sibling's experiences are usually well known to an individual, perhaps more so than those of other close ties (Bernardi, 2003). For these reasons, the importance of the sibling bond is stressed throughout ample sociological and psychological studies (Cicirelli, 1995; Lamb & Sutton-Smith, 2014[1982]; Lyngstad and Prskawetz, 2010; McDermott et al., 2013; Minett, Vandell, & Santrock, 1983; Stoneman, Brody, & MacKinnon, 1986).

There are three main explanations for a likely correlation between siblings' divorce decisions. First of all, siblings share a family, and a history. Parents' cultural capital and attitudes, the family's socio-economic position, and life events such as parental conflicts, parental divorce and other family crises will likely have shaped their attitudes towards relationship behaviour and divorce from a young age onwards (Amato, 1996; McDermott et al., 2013). For instance, a wide range of

literature suggests that children from divorced parents have a higher risk of divorce later in life themselves (Amato 2010, 1996; Amato and Booth, 1991; Bumpass et al., 1991; Conger et al., 1990; Davies and Cummings, 1994). Having grown up under comparable social circumstances, siblings further tend to share early socioeconomic characteristics and certain environmental factors associated with schooling, friendship networks, and possible neighbourhood influences (Axinn, Clarkberg, & Thornton, 1994). These common background characteristics can thus constitute a spurious cross-sibling effect on divorce; a continuation of a shared background effect.

Second of all, underlying the similar upbringing and socialisation, siblings resemble their parents, and each other, genetically (Amato, 2000). Next to potential unmeasured characteristics of the shared family background, therefore, shared genes may play a role in explaining sibling associations in divorce behaviour. Many human traits are highly heritable, i.e. influenced by our DNA. This is not only true for physical traits, but also for behavioural traits such as temperament, personality, and cognitive and social traits. A recent meta-analysis of over 2700 publications estimated heritability across all complex traits and across cultural contexts at 49%. A heritability of 47% was found for traits in the cognitive domain, 46% across psychiatric traits and 31% across the domain of social values (Polderman et al., 2015). If divorce behaviour is partly driven by genetic factors, this should lead to a resemblance between full siblings, who share 50% of their genetic material on average. Studies indeed suggest a genetic effect on risk of divorce (McGue & Lykken, 1992) that is mediated for a large part by personality factors, especially negative emotionality (Jocklin, McGue, & Lykken, 1996) and possibly also the inclination to internalise problems (D'Onofrio et al., 2007). In line with the genetic influence on divorce, studies also found a genetic influence on marital satisfaction (Spotts et al., 2004). Again, this influence was in part mediated by personality (Spotts et al., 2005).

Third of all, and of particular interest in this study, siblings can serve as role models to their brothers and sisters by providing behavioural examples on major transitions in the life course (Axinn et al., 1994; Bernardi, 2003; Cicirelli, 1995; East, 1998; Lamb & Sutton-Smith, 2014[1982]; Lyngstad and Prskawetz, 2010; Minett et al., 1983). One dominant notion in research on role model effects emphasises the importance of direct exposure to behavioural examples. It has been put forward that the mere occurrence of an event or behaviour in the social environment makes it more likely for this behaviour to be displayed by others (Booth, Edwards, & Johnson, 1991; Lyngstad and Prskawetz, 2010; McDermott et al., 2013). With regard to divorce, prior findings indeed indicate that an individual is more likely to divorce when they are exposed to divorced individuals (McDermott et al., 2013). The literature does not, however, identify a single most important causal mechanism behind such a role model effect on personal decisions. The transfer of divorce among siblings may be due to several possible processes, for instance behavioural imitation; an alteration of one's norms on relationship behaviour and divorce when witnessing a sibling go through union dissolution; or perhaps the divorce event of the sibling makes one think about their own relationship and the options available to them. Additionally, a divorce may lead to the partners' family, including siblings and their spouses, choosing sides, thus setting off wider strife. Regardless of the precise process, these possible socio-interactive mechanisms all suggest that the role model function of siblings can constitute a direct association between siblings' decisions on divorce. In this study, we derive our main hypothesis on sibling effects from the role model mechanism. Our core hypothesis reads: (H1) *Having a divorced sibling will increase the likelihood of having a divorce oneself*. Subsequently, we take an in-depth look into possible moderating factors of a cross-sibling influence on divorce. Testing these factors gives us more insight in the plausibility of the role model mechanism and thus also in the possible causality of the 'sibling effect'. To get even more insight in the underlying causality we include several observed common background characteristics into our models, investigate the influence of time

elapsed after a sibling's divorce, and run separate models on same-sex and opposite-sex twins in our data in an attempt to parse out genetic influences on divorce behaviour.

2.1. Moderating factors to a sibling effect: sibship characteristics

We expect that certain characteristics of the sibship have the potential to increase or decrease the expected effect of divorce among siblings. We anticipate this to be the case for characteristics that determine the extent to which the sibling serves as a role model to the individual. Firstly, the effect of a divorced sibling may largely be determined by the level of contact that exists in the sibship. Regular contact between siblings can be an indication of the strength of their bond, which may in turn determine the strength of their role model function (Dodds & Watts, 2005; Slomkowski, Rende, Novak, Lloyd-Richardson, & Niaura, 2005). Furthermore, more contact entails more exposure to the reasons behind a sibling's divorce, as well as exposure to the event itself and its consequences. We expect contact regularity to be largely determined by the geographical proximity between siblings. A short distance between siblings does not automatically result in a higher contact frequency, but large distances do by definition make *face-to-face* contact more difficult. For this reason, we believe the distance between siblings to be important for their contact frequency and thus for their role model function. Therefore, our second hypothesis reads: (H2) *A cross-sibling effect on divorce will be stronger for siblings who live close to each other*.

A sibling's behavioural influence on an individual, secondly, will likely be stronger when the divorced sibling has a natural disposition to assume a role model function. Literature suggests that older siblings are more likely to take up leading roles in the sibling relationship, in order to teach and manage certain aspects of their sibling's behaviour, while younger siblings tend to assume more subservient roles as the learner or managee (Minett et al., 1983; Stoneman et al., 1986). Therefore, we can anticipate the older siblings in the sibship to have a lower susceptibility to a sibling influence than their younger counterparts. For this reason, we hypothesise: (H3) *A cross-sibling effect on divorce will be weaker when the divorced sibling is younger than anchor*.

Thirdly, a cross-sibling effect on divorce will likely depend on the manner in which a person can relate to their sibling's situation. Literature on selected relationships, such as those between spouses or friends, suggests that we find our most rewarding interactions with those that are similar to us (Homans, 1974; Kalmijn, 1998; Marsden, 1988). Not until recently, however, has research further established the significance of similarity among unselected relationships, such as family connections, and siblings in particular (Eriksen & Gerstel, 2002; Voorpostel, 2007). It has been suggested that the similarity between siblings will subsequently strengthen their bond, as they will be better able to associate with each other, thus increasing empathy and reducing sibship strain or rivalry (ibid.). One element of similarity that may positively influence the sibling bond is educational level. This is an important demographic and socio-economic predictor in life course research. If siblings resemble each other with respect to educational level, further similarities in employment status and income levels later in life can be expected. We thus hypothesise: (H4) *A cross-sibling effect on divorce will be stronger in sibships with a similar educational attainment; a similar employment status; and a similar income*.

Finally, the function of the role model of the sibling could be influenced by the gender composition of the sibship (Eriksen and Gerstel, 2002; Minett et al., 1983; Stoneman et al., 1986). It has been argued that same-sex siblings are often emotionally closer than siblings in mixed-sex sibships, and display different patterns of interaction (Eriksen & Gerstel, 2002). Especially all-female sibling dyads were shown to care for, teach and support their sibling more than any other possible sibling combination (Minett et al., 1983; Stoneman et al., 1986). All-male dyads, on the other hand, did display a high level of sibling interaction, but were more likely to engage in neutral

behaviours than their all-female sibship counterparts (ibid.). Both same-sex combinations displayed higher communicative levels than mixed-sex sibships. As such, the composition of the sibling dyad could be seen as a proxy for sibling contact quality or intimacy. As the strength of the sibship bonds is expected to differ per composition, we hypothesise: (H5) *A cross-sibling effect on divorce will be strongest in female same-sex sibships (a); strong in male same-sex sibships (b); and weaker in mixed-sex sibships(c)*.

3. Methods and data

In our study, we made use of the System of Social statistical Datasets (SSD), which is an integrated, longitudinal database of numerous registers and surveys provided by Statistics Netherlands (Bakker, van Rooijen, & van Toor, 2014). We predominantly drew on register data. The SSD registers contain a number of unique variables on the entire Dutch population, including the timing and duration of marriage for all inhabitants. The marriage data also include all registered partnerships; which have the same legal status as marriage in the Netherlands (hereafter, 'married' refers to these two types of union). Furthermore, the SSD provides information on family background, which allows us to distinguish sibships and parental characteristics. All available registers are linked at the individual level, making these data exceptionally suitable for life course research. The measurement period for this study is 2000 to 2012.

3.1. Data selection

For this study, we made a number of population selections to create a sample most suitable to examine the effect of divorce among siblings. First of all, we established our anchors, or focal observations. We selected individuals at age thirty from five different birth cohorts; born in the period of 1970 to 1974. The first measurement points for these cohorts thus range from 2000 to 2004 (t_0). For those born in 1970, the measurement period starts at 2000. For those born in 1971, the measurement period starts at 2001, and so forth. The reason we selected these specific cohorts is the fact that we have mostly integral data available for this subgroup due to an expansion of the SSD in 1999. After this first selection, the set of records consisted of 1 361 959 inhabitants.

Second of all, we took into consideration only those individuals with *one* full sibling. Our dataset does not contain half-siblings, and individuals without a sibling were excluded for obvious reasons. Previous research suggests that including sibships of more than two individuals would needlessly complicate the required data handling (Lyngstad & Prskawetz, 2010). Unlike the anchor, the siblings' year of birth was not restricted to the same cohort period. In this selection, 872 857 observations were dropped, resulting in a subgroup of 489 102 individuals.

Third of all, we restricted the study population to anchors that were heterosexually married at t_0, with a sibling who was also heterosexually married at that time point. Due to this selection, we do not necessarily follow relationships from the year of marriage onwards, but assess the risk of divorce within a specific timeframe. Therefore, we will have lost information on anchors and siblings who got married young *and* divorced before the age of 30. If both siblings in the sibship were born between 1970 and 1974, one was selected at random to serve as the anchor observation in order to avoid dependencies between person-records. Additionally, sibships were only included in the study population if both siblings cohabited with their marital partner. Finally, as we planned to include an observed control for sibling's common family background, the last selection criterion entailed that socioeconomic and marital information on both parents had to be present in the SSD. After this selection, our final set of records consisted of 64 677 sibships (*N*). We subsequently reorganised the data into person-period files per year from t_0 until the final measurement in 2012, *or* until the first occurrence

of a divorce event by the anchor, after which the anchor was right-censored. The total number of observations thus created consisted of 600 345 year-files (*N. obs*).

Unmarried cohabiting partners were not included in the scope of this study. Unmarried cohabitation is quite common in the Netherlands and standard legal arrangements are available for unmarried couples to arrange (financial) rights and obligations. However, even in the present time these unions are on average less stable than marriages (Liefbroer & Dourleijn, 2006). Marriage still appears to be a clear sign of commitment and permanence, whereas cohabiters are a much more heterogeneous group in that respect. For this first extensive study on sibling influence on divorce we chose to focus exclusively on married couples so as not to overcomplicate the study.

3.2. Measures

3.2.1. Dependent variable

The dependent variable in our analyses is the anchor's time-variant risk of divorce; an instantaneous rate, indicating an individual's risk of divorce at any given time point, provided that they are still at risk, i.e. not divorced already (Allison, 1984; Blossfeld, Golsch, & Rohwer, 2012). We created the dummy variable *divorce*, coded (0) Marriage intact; or (1) Divorced. As legal divorce procedures can be lengthy, there may be a considerable time-lag between the time of partners' separation in practice and the official registration of their divorce. For this reason, in order to adequately capture the actual transition behaviour, we do not take into consideration an individual's official divorce event, but rather base our estimations on the point in time when partners are no longer registered at the same address (*de facto* separation). With this operationalisation, the timing of the actual separation event is measured much more accurately. Indeed, there may also be some time between a partner moving and registering at a new address, but due to Dutch registration legislation, this will be only a fraction of the time between separation and the registration of the official divorce event.

3.2.2. Independent variable

The sibling's time-variant divorce event (again, the *de facto* separation) enters as the main independent variable in the models. Like the dependent variable on the anchor's divorce, we created a dummy *divorce sibling* coded (0) Marriage intact; or (1) Divorced. The dummy is 0 for as long as the sibling is still married to the partner they had at $t0$, and changes to 1 permanently at the time of separation. Remarriages of the sibling do not register in this variable since we are mainly interested in the trigger of the (first) divorce event.

3.2.3. Control variables

Marital stability is known to be affected by a number of further demographic characteristics. We thus control for *gender* (female = ref); *age difference between partners* (Janssen, De Graaf, & Kalmijn, 1999); *age difference between siblings*; *higher education* (higher vocational, college or university yes/no, no = ref); *country of origin* (the Netherlands = ref) (Mulder, Ten Hengel, Latten, & Das, 2012); *interethnic marriage* (Kalmijn, De Graaf, & Janssen, 2005; no = ref); *employment status husband* (Hansen, 2005; Jones, 1989; work = ref); *employment status wife* (Rogers, 2004; work = ref); *income husband; income wife; homeownership* (Van Rooijen & Van Gaalen, 2013; rent = ref); *child(ren) in household* (no = ref). We additionally control for the type of *municipality* the anchor lives in (4 biggest cities = ref).

Furthermore, there are a number of time variables that would be relevant to include in the model. Age at marriage, the duration of marriage and age itself are all known to be related to divorce risk (Lyngstad & Jalovaara, 2010) and there could be period effects as well. Including all of these variables in the model is not possible due to multicollinearity problems. This is a direct consequence of our data structure in which $t0$ always equals age 30. The duration of the

marriage is thus related to the time-invariant variable 'age at marriage', as well as to the time-variant variable 'age': when age increases with 1, so does duration of marriage. Additionally, both duration of marriage and age are also directly related to period or calendar year. We tried to solve these complex dependencies by introducing two measures that should capture the most important time variables when analysed simultaneously in a model. First, we constructed the time-invariant continuous control *duration marriage at start*. This variable represents marital experience up to age thirty, but also age at marriage, since they are directly (inversely) related. Second, we included the time-variant continuous variable *duration marriage since start* to cover the actual measurement period of 2000 to 2012. This variable is directly related to, and can therefore also be used as a representation of, the age of the anchors and period or calendar year. To capture the effect of the total duration of the marriage, one should combine the effects of *duration marriage at start* and *duration marriage since start*.

3.2.4. Family background variables

We aim to control for similarities between siblings' divorce risks due to their shared parental history by including a number of observed background characteristics. We created two controls for the income position of the parents. Income information of the father and the mother are indications of their socio-economic position, wealth, educational level, and the division of household tasks. As such, these factors could be a further indication of the type of cultural capital likely provided to the siblings by their parents; a 'domestic transmission', for instance of particular knowledge and skills, or intellect and aptitude for work and educational attainment (Bourdieu, 1986). The time-invariant variables *father's income* and *mother's income* are defined as income from a variety of sources[1] at t_0, measured in 1000 EUR. We also include a control for the siblings' parental marital background: the time-invariant variable *composition parental home*, measured at t_0, coded (0) Parents alive and together (=ref); (1) Parents alive and divorced; (3) Father died; (4) Mother died; and (5) Both parents died. Deceased parents score '0' on the parental income variable. Parental divorce is a very important control, and it is especially revealing to compare the strength of sibling divorce associations with and without this measure. It is important to note that these family background variables may not function to fully control for siblings' shared background, since there could be other family factors (such as further crises, conflict etc.) that we cannot take into account in this study.

3.2.5. Moderating variables: sibship characteristics

The SSD does not contain direct measures on the amount of contact between siblings. It does however contain information on the geographical distance between the siblings' home addresses, which can be an important determinant of face-to-face contact. Previous family contact research suggests that the geographical distance between individuals can be used as a reliable proxy for contact opportunity and regularity in the Netherlands (Mulder & Kalmijn, 2006). A limitation to keep in mind when using this proxy is that while it can capture a part of the likelihood of personal contact, it cannot capture further communication between siblings, for instance via social media or phone, nor can it measure the quality of the relationship. With this limitation in mind, we created the time-invariant variable *geographical distance* containing the number of kilometres between the siblings' registered addresses. The kilometres were determined using the X and Y coordinates of each individual address. We subsequently constructed *distance* categories, coded (0) 0–25 km (=ref); (1) 26–50 km; (2) 51–100 km; (3) 101–200 km; to (4) 201–300 km. In the models, we experimented with other proxies (e.g. age difference between siblings), and other variable constructions (e.g. continuous distance variable, and

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[1] Personal income was defined as the sum of income from a variety of sources, consisting of wages, benefits, pension and so forth

square term) but the results remained the same.

We further constructed a time-invariant dummy variable *younger* denoting the position of the sibling in the sibship, coded (0) Older; and (1) Younger. The variable was created using the year of birth for each sibling. The 'older' category includes siblings that are older than the anchor, or have the same year of birth (i.e. twins or siblings born in the same calendar year).

Degrees obtained in higher education have been registered in the SSD since 1986, while low and middle levels of education were not officially recorded until 2003. For this reason, in our population subgroup, we have reliable integral data on anchors' and siblings' attainment of higher education (i.e. higher vocational (HBO), college, or university), but we cannot distinguish low and middle level degrees. Therefore, we first created the time-invariant dummy variable for educational similarity coded (0) Not similar; and (1) Similar, i.e. cases in which both siblings are higher educated and cases in which both of them are low/midlevel educated. Using the same coding, we created dummy variables for similarity of employment status, and similarity in income (using income quintiles for comparative purposes). Second, we created a variable for larger sibling *similarity*, included in the analyses, coded (0) Not similar, if siblings did not share a combination of *at least two* similarity measures described above (i.e. edu/work, edu/income, or work/income), and (1) Similar, if siblings did share two or three similarity measures.

Finally, we constructed the variable *sibship dyad* coded (0) Male anchor with sister (=ref); (1) Male anchor with brother; (2) Female anchor with brother; and (3) Female anchor with sister.

Table 1 provides an overview of descriptive statistics at the person-period level. Over the twelve-year measurement period, in our entire subgroup of 64 677 inhabitants in the Netherlands, a considerable total of 12 310 divorce events took place among the anchor population, as well as 10 978 events among siblings. Over half our final anchor sample (57%) consists of women. A likely explanation for this over-representation in our sample could be the fact that Dutch women, on average, get married at a younger age than men (Statistics Netherlands, 2013).

3.3. Analytic strategy

We estimate discrete-time logit models, with observations measured in units of one year, and a cluster correction for the anchor's time-varying risk of divorce. We used annual measurement points as the psychological and required legal processes involved in divorce are often lengthy, and we do not expect a sibling's divorce to have a noticeable effect on the divorce of an anchor over the course of a few months. Our hazard rate is the probability that an individual experiences a divorce event at a given time t (2000, …, 2012), provided that the individual is still at risk of divorce at time t. This hazard is the unobserved dependent variable in our models (Allison, 1982, 1984). We use a logistic regression function in order to specify how the hazard rate depends on the included covariates.

In the following analyses, we first present the raw association between divorce and siblings' divorce (model 1). In model 2, we add the set of control variables, and model 3 extends model 2 with the inclusion of family background variables. Finally, in model 4, we add the characteristics of the sibship and the interaction variables between sibling's divorce and sibship characteristic (moderating effects).

3.3.1. Genetic influences

There are several methods to get an insight into genetic influences on divorce behaviour, including adoption studies, genetic studies such as Genome Wide Association Studies, and twin studies (Plomin, DeFries, Knopik, & Neiderheiser, 2013). The SSD contains no genetic data, and data on adoption are only available from birth cohort 1995 onwards. A full twin study design is not feasible either. Twin studies compare monozygotic (MZ) twins with dizygotic (DZ) twins, either

Table 1
Descriptive statistics divorce events, moderating sibship characteristics and relevant controls at the person-period level (N. obs = 600 345).

Variable	N	Mean/%	SD	Range
Anchor divorce events	12 310			0/1
Sibling divorce events	10 978			0/1
Younger sibling		0.25	0.43	0/1
Geographical distance between siblings				0/4
0–25 km (ref.)		64.88		
26–50 km		21.84		
51–100 km		8.1		
101–200 km		4.92		
201–300 km		0.25		
Educational similarity siblings		0.79	0.4	0/1
Sibship dyad composition				0/3
Male anchor with brother		18.4		
Male anchor with sister (ref.)		24.1		
Female anchor with brother		25.58		
Female anchor with sister		31.92		
Male		0.43	0.49	0/1
Children in anchor household		0.90	0.30	0/1
Duration marriage start		4.69	2.72	Jan-16
Duration marriage since start		5.51	3.07	01-Dec
Age difference partners		2.81	2.62	0/36
Age difference siblings		3.38	1.89	0/23
Higher educational attainment		0.19	0.39	0/1
Country of origin				0/6
Native Dutch (ref.)		94.21		
Morocco		0.17		
Turkey		0.77		
Suriname		0.28		
Dutch Antilles & Aruba		0.16		
Other Non-Western		0.19		
Other Western		4.12		
Mixed marriage		0.11	0.31	0/1
Work/income husband				0/2
Work (ref.)		87.04		
On benefits		2.05		
No income		10.91		
Work/income wife				0/2
Work (ref.)		72.53		
On benefits		4.55		
No income		22.92		
Income father (1 000 EUR)		31.54	28.29	
Income mother (1 000 EUR)		7.65	15.55	
Composition parental home				0/4
Parents alive and together (ref.)		83.97		
Parents alive and divorced		8.72		
Father died		4.56		
Mother died		2.22		
Both parents died		0.53		

Individual clusters (N) 64 677

directly or through their offspring. MZ twins share 100% of their genetic material, DZ twins only 50% on average, like regular sibling pairs. So, comparing MZ twins with DZ twins yields information about the proportion of variation in a trait that is due to genes. Unfortunately, our data do not contain information about zygosity. We perform a modest robustness analysis designed to gain at least some insight in potential genetic influences on divorce in this research population. For this, we make use of the fact that MZ twins are by definition always same-sex twins, whereas all the brother-sister twins are, by necessity, DZ. That implies that a significant proportion[2] of the same-sex twins in our study sample are monozygotic. So, same-sex twins are *on average,* analysed as a group, genetically more alike than regular siblings including different-sex twins. Investigating same-sex twins and comparing them with other sibling pairs may give some insight in genetic influences, although these will necessarily be vastly underestimated.

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[2] A very rough estimation is that somewhat over half of our same-sex twins will be MZ – derived from Orlebeke 2008.

Table 2

Results from discrete-time logit model including raw association divorce and divorce of a sibling, neutral controls, family background controls, and interactions with specified sibships characteristics.

	−1 Coeff.	SE	−2 Coeff.	SE	−3 Coeff.	SE	−4 Coeff.	SE
Divorce sibling	0.287***	0.029	0.204***	0.036	.186***	0.036	0.291*	0.115
Male			−0.059**	0.022	−0.059**	0.022	–	–
Children in household			−1.902***	0.028	−1.898***	0.028	−1.904***	0.028
Age difference partners			−0.003	0.004	−0.005	0.004	−0.004	0.004
Age difference siblings			−0.033***	0.006	−0.032***	0.006	−0.030***	0.006
Duration marriage at t_0			0.050***	0.004	0.050***	0.004	0.049***	0.004
Duration marriage since t_0			0.022***	0.004	0.024***	0.004	0.024***	0.004
Higher education			−0.352***	0.032	−0.338***	0.032	−0.326***	0.035
Ethnicity (ref:Dutch)								
Moroccan			−1.333***	0.306	−1.315***	0.304	−1.339***	0.304
Turkish			−0.771***	0.109	−0.752***	0.110	−0.787***	0.1100
Surinamese			0.117	0.168	0.093	0.17	0.084	0.169
Dutch Antillean/Aruba			0.90	0.222	0.045	0.229	0.041	0.230
Other non-Western			−0.209	0.23	−0.231	0.231	−0.235	0.231
Other Western			−0.023	0.056	−0.033	0.056	−0.035	0.056
Interethnic marriage			0.137***	0.035	0.130***	0.036	0.133***	0.036
Employment husband (ref:work)								
On benefits			0.269***	0.059	0.245***	0.059	0.244***	0.059
No income			0.855***	0.044	0.872***	0.045	0.870***	0.045
Employment wife (ref:work)								
On benefits			0.946***	0.037	0.927***	0.037	0.929***	0.037
No income			−0.694***	0.043	−0.697***	0.043	−0.695***	0.043
Income husband (1 000 EUR)			0.002***	0	0.002***	0	0.002***	0
Income wife (1 000 EUR)			0.003**	0.001	0.003**	0.001	0.003**	0.001
Type of home (ref: rental)								
Purchased			−1.518***	0.023	−1.558***	0.025	−1.559***	0.025
Unknown			−0.259***	0.045	−0.259***	0.045	−0.256***	0.045
Municipality (ref: 4 biggest cities)								
35 following biggest cities			0.174***	0.050	0.195***	0.050	0.193***	0.051
Other municipalities			−0.007	0.048	0.018	0.048	0.015	0.048
Income father (1 000 EUR)					0.001*	0	0.001*	0
Income mother (1 000 EUR)					0.001	0.001	0.001	0.001
Parental home (ref alive and together)								
Parents divorced					0.271***	0.034	0.275***	0.034
Father deceased					0.043	0.050	0.044	0.050
Mother deceased					0.035	0.070	0.036	0.070
Both parents deceased					0.082	0.137	0.087	0.137
Younger sibling							0.078**	0.026
Similarity siblings							0.007	0.032
Sibling dyad (ref: male anchor with sister)								
Male anchor with brother							−0.033	0.034
Female anchor with brother							0.066	0.034
Female anchor with sister							−0.001	0.033
Geographical distance siblings (ref: 0–25 km)								
26–50 km							−0.043	0.028
51–100 km							−0.113**	0.043
101–200 km							−0.096	0.054
201–300 km							0.028	0.200
Interactions								
Younger sibling							−0.265***	0.078
Similarity siblings							−0.177	0.095
Sibling dyad (ref: male anchor with sister)								
Male anchor with brother							0.024	0.109
Female anchor with brother							0.146	0.098
Female anchor with sister							0.214*	0.094
Geographical distance siblings (ref: 0–25 km)								
26–50 km							0.103	0.085
51–100 km							−0.40	0.137
101–200 km							−0.108	0.164
201–300 km							0.314	0.592
_cons	−3.894***	0.010	−1.751***	0.067	−1.808***	0.067	−1.841***	0.074
N	64 677		64 677		64 677		64 677	
N.obs	600 345		600 345		600 345		600 345	
R^2	0.001		0.159		0.161		0.161	

Standard errors in parentheses.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

3.3.2. Time after sibling divorce

We estimate additional models on subgroups of our anchor population depending on the number of years that passed since the divorce of their sibling. The full analyses, models 1 to 4 described above, were run for groups within 0 to 2 years, 2 to 5 years, and 5 years and more after the divorce of a sibling. We expect that as time elapses after the sibling's divorce event, its impact on the divorce risks of the anchor will weaken. As genetic influences on divorce decisions between siblings do not wane over time, these models can give us a further insight into the association between siblings divorces beyond that of shared background and family characteristics.

4. Results

Table 2 contains the results from the discrete-time logit models on the effect of sibling divorce on the anchor's risk of divorce. After adding the discussed background characteristics, we find that the explanatory variables jointly covered up to 16% of the explained variance in the dependent variable (see Table 2, model 2 onwards, Nagelkerke R^2). The Wald statistics consistently suggest that the parameters in our models are jointly significant.

4.1. Model 1 and 2. association between sibling's divorce and anchor's divorce

When leaving out of consideration all covariates there is a highly significant correlation between divorce of the sibling and (subsequent) divorce of the anchor ($b = 0.287$, $p < 0.001$); a 21% significant increased risk. Anchors with a divorced sibling thus have a higher risk of divorce on average than anchors with a married sibling. In model 2, we include the subset of controls to our estimation. These are all 'neutral' controls, not related to our research question but known to influence divorce risk. Some of them −e.g. ethnicity- not only constitute an individual characteristic but are also likely to be shared with the sibling. Perhaps for this reason the coefficient of the sibling's divorce event decreases somewhat after introduction of the controls, but remains highly significant ($b = 0.204$, $p < 0.001$). Consistent with previous research, marriage duration at the start of the observation −or age at marriage inversed- and marriage duration since the start of the observation −or age, or period- are positively related to the anchor's risk of divorce. The other controls are predominantly in line with existing literature and will not be discussed in detail.

4.2. Model 3 and 4: family background and moderating sibship characteristics

In the last two models, we add the family background variables (model 3) and the moderators (interactions between 'sibling divorce' and sibship characteristics). Introducing family background characteristics does not affect the coefficient for sibling divorce much, nor its significance ($b = 0.186$, $p < 0.001$, model 3). This suggests that the family background characteristics regarding relationship structure of the parents and their socio-economic position mediates the association between siblings' divorces only to a very limited extent. There is hardly any change in the coefficients of the controls and the family background variables between the models.

The results do not lend support to our second, fourth and fifth hypothesis on the moderation of a cross-sibling effect by regular contact (close geographical distance), sibling similarity, or the sibship gender composition. We do find a negative significant interaction effect between 'sibling divorce' and 'younger sibling' ($b = -0.265$, $p < 0.001$): the positive association between sibling divorce and the anchor's divorce is weaker for anchors with an younger sibling. This result confirms our third hypothesis, which states that a cross-sibling effect on divorce will be weaker when the divorced sibling is younger than the sibling at risk. Much to our surprise, we did not find a lasting

significant interaction effect between 'sibling divorce' and the dyad composition of the sibship. At first glance, female anchors with a sister appear most likely to divorce after her sibling divorces. However, further analyses showed that these interaction effects simply express the gender difference in divorce risk, rather than the specific gender composition of the sibship. When comparing female anchors with either a brother or sister, the effect in a female/sister composition was not significantly stronger than that of a female/brother composition. Therefore, we conclude that our fifth hypothesis is not supported.

4.3. Genetic influences? robustness analyses

Our twin research population contained 257 anchors with a same-sex twin 47 of whom (18%) experienced a divorce in the observation period of 12 years. There were 108 anchors with an opposite-sex twin, 27 of whom (25%) experienced a divorce. Bivariately, divorce rates were not influenced by a divorce of the sibling: they remained at 18% and 25% respectively, regardless of whether the sibling divorced or not. Unfortunately, the number of twins was too small to estimate the full model. We performed two logistic regressions (results available upon request): one for anchors with a same-sex twin and one for anchors with an opposite-sex twin, pooling the whole observation period. The dependent variable was 'anchor divorced anywhere within 12 years' and 'divorce sibling' (at any point in time, but right-censored by anchor's divorce) was the main independent variable. In a second run of the analyses, we added the background variable 'parents divorced yes/no' measured at t_0 as another potential control for genetic influence. Neither of these four models yielded any significant results. The coefficient of sibling's divorce was not larger for same-sex twins (.548) than for different-sex twins (.709). Our main result in the full models on the entire research population − a bivariate association between anchor's and sibling's divorce − is not found for twins. Furthermore, we found no evidence for a genetic influence on divorce risks between siblings. It is likely that these findings are due to the very small number of twins in this study population, especially when examining phenomena that are relatively rare such as divorce.

4.4. Time after sibling divorce

Additional models on subgroups of our anchor population (split up according to the number of years elapsed since the divorce of their sibling: max 1 year, 1–2, 3–5 years, 5 years or longer) show that the positive association between sibling divorce and the risk of divorce of the anchor substantially weakens over time, and becomes insignificant from model 2 onwards for anchors in the '5 years and more' population subgroup (results available upon request). As genetic or other family background influences on divorce would be static over time, these results strengthen our core expectation of a causal association between sibling's divorce risks, not merely due to shared background and family characteristics, but additionally due to effects arising from a sibling role model mechanism.

5. Discussion and conclusion

In this study, we have taken a step forward in examining the impact of divorce in the wider social environment on personal divorce behaviour. Our findings show that having a divorced sibling is associated with an increased likelihood of having a divorce oneself. It is important to place this finding in perspective: many background characteristics in our analyses had a stronger effect on divorce risk than the sibling's divorce: e.g. educational level, whether there are children in the household and employment status of the partners. Still, the sibling effect is not negligible or even small: it is just as strong as the effect of parental divorce.

The fact that siblings behave alike could be due to multiple factors, including their past and present shared family environment, genes, and

forms of social contagion such as the role model mechanism, which is at the heart of our study. Unmeasured shared background characteristics may confound results, leading to an overestimation of a sibling effect on divorce (Rodríguez, 2005). One way to control for this possibility would be to include a correction for unobserved heterogeneity in the data (see e.g. Lyngstad & Prskawetz, 2010). We took a different approach and implemented a number of steps aimed at parsing out effects of shared characteristics. First of all, we included a range of shared family background characteristics in the models to correct for genetic and environmental influences as much as possible. Parental divorce in particular is strongly related to children's divorce risks (e.g. Lyngstad & Jalovaara, 2010) and including this variable probably helps to correct for both genetic similarity between siblings, as well as environmental and socialisation factors affecting both siblings. Second of all, in our group of twins, we did not find evidence for a genetic influence on divorce risk, but the group was too small to draw any definitive conclusions. This type of research would ideally require a larger twin population, especially considering the low incidence of divorce events in our small group of twin pairs. Lastly, introducing moderating sibship characteristics, our results indicate that older siblings have a stronger influence on divorce decisions than younger siblings, and that the effect of the sibling's divorce strongly decreases over time. Both of these findings corroborate our assumption that the sibling functions as a role model. All in all, we conclude that it is likely that the association between siblings' divorces is partly due to shared characteristics such as genes and family background, and partly to an actual influence of the sibling's divorce itself.

Previous studies on sibling influences, in reference to other family-oriented transition behaviour, stress the importance of direct exposure to behavioural examples (Booth et al., 1991; Lyngstad and Prskawetz, 2010), which increases the likelihood of displaying similar behaviour (for instance marriage or a transition into parenthood). Nevertheless, neither this previous research nor our present study can clarify the precise causal influence in these findings. In practice, this would require subjective data, in addition to the available registered observations, and future qualitative research to determine the interactive mechanisms behind a cross-sibling effect on divorce. The transmission of divorce behaviour between siblings could be due to behavioural imitation, or perhaps a change in one's norms on divorce when witnessing it in a close peer. Also, the divorce of a sibling could raise questions on one's own relationship quality or send a ripple through the family when spouses 'take sides'.

For sibship similarity, the geographical distance between siblings (as a proxy for contact frequency), and the gender composition of the sibship, our findings do not suggest a moderation of the cross-sibling influence on divorce. These results could in part be due to measurement constructs related to data limitations. First, for example, the educational similarity between siblings in particular could only be measured quite crudely. These constructs may be improved upon in future research by merging alternative data sources to the SSD that contain subjective measures on these matters, for instance by drawing on the Netherlands Kinship Panel Study (for an overview see Dykstra et al., 2005). Second, geographical distance may not be the best proxy for contact regularity, as it covers only the face-to-face aspect of communication, which will likely become less frequent as the distance between sibling increases. It does not cover further communication possibilities via social media or phone, nor can it measure the quality of the contact and the sibling relationship. The gender composition of the sibship, which in itself could be seen as an additional proxy for the contact regularity, as well as the quality of the sibling contact, did not yield significant results either.

In this study, due to the selection criteria for our population subgroup, we face certain research limitations. We introduced a level of selectivity to our subgroup, first of all, by selecting only those anchors that were married at age thirty, with a married sibling. Furthermore, as shown in the range of marriage duration at the start of the observation period, many anchors had been married for a number of years before their initial measurement point. For Dutch standards, anchors in our subgroup married at a relatively young age (according to Statistics Netherlands, in 2013 the average age of marriage was 37 for men and 33 for women). This might mean that our anchors and siblings are fairly traditional in their views on relationships and marriage, which may lower their chances of divorce compared to Dutch residents with a more modern outlook. We do not, however, expect this selection to affect the strength of the sibling role model mechanism. A second limitation of our study is that we selected anchors with exactly one sibling, which means that we cannot generalise our findings to individuals with more than one sibling. Nevertheless, as families of two children are very common in the Netherlands, we do cover a substantial subgroup of Dutch households (ibid.). Third of all, in most cases we do not follow individual relationships from the year of marriage onwards. For the birth cohorts included in this study, therefore, we will have lost information on individuals who got married young *and* divorced before the start of our observation period. The distinct observation window in our analyses may thus have influenced our estimations by only assessing the risk of divorce for the 'survivors'. A fourth limitation of this study is that the sample was restricted to marriages and did not take into account cohabiting relationships. It may be that cross-sibling effects are even stronger when looking at dissolution risks of cohabiting relationships. Cohabitation is less institutionalised than marriage in the Netherlands − both legally and culturally −, creating fewer barriers to dissolve a cohabiting union, and thus leaving greater room for destabilising influences such as sibling divorce.

This is the second study, to our knowledge, to look into the association between divorce risk and divorce of a sibling using a longitudinal sample. It is the first to do so using integral register data for a nation-wide population subgroup. Notably, this is the first study to assess whether a cross-sibling divorce association varies depending on specific sibship characteristics, as well as on time passed since the sibling divorce event, having carefully investigated possible genetic and family background effects. Therefore, this study provides more insight in the causality of the association: an influence of sibling behaviour. Our findings point to the importance of the wider social environment for personal divorce decisions. This study may encourage further research into the influence of individuals' other social ties and contacts, such as friends, colleagues and neighbours. Furthermore, future studies could determine whether similar cross-sibling influences operate in the dissolution of cohabiting relationships. Numbers of unmarried cohabiters are rising in the Netherlands as well as in other Western countries, and are increasingly seen as an acceptable and fully fledged long-term alternative to marriage. In upcoming years, these research options can entail a promising extension of the dominant focus in divorce literature.

Conflict of interest

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