Accepted: 31 July 2018
DOI: 10.1002/psp.2208

RESEARCH ARTICLE

WILEY

Migration patterns of parents, children and siblings: Evidence for patrilocality in contemporary Finland

Asim Ghosh[1,4] | Venla Berg[2] | Kunal Bhattacharya[1] | Daniel Monsivais[1] | Janos Kertesz[3,1] | Kimmo Kaski[1,5] | Anna Rotkirch[2]

[1] Department of Computer Science, Aalto University School of Science, Espoo, Finland

[2] Population Research Institute, Väestöliitto—Finnish Family Federation, Helsinki, Finland

[3] Center for Network Science, Central European University, Budapest, Hungary

[4] Raghunathpur College, Raghunathpur, West Bengal, India

[5] The Alan Turing Institute, London, UK

Correspondence
Anna Rotkirch, Population Research Institute, Väestöliitto—Finnish Family Federation, Helsinki, Finland.
Email: anna.rotkirch@vaestoliitto.fi

Funding information
H2020 Future and Emerging Technologies, Grant/Award Numbers: 641191, 654024, 662725, 266898 and 276439; CONACYT (Mexico), Grant/Award Number: 383907

Abstract

Family members are known to serve as geographical attractors in migration, yet evidence for sex-biased family migration in developed societies is mixed. We investigate gender differences in migration of family members in Finland. Using the FinnFamily register data set (N = 60,000 index individuals and their close kin), we explore family coresidence and migration within the 19 administrative regions of Finland in 1970–2012. We study the propensity for regional migration by gender and age, the likelihood for children to reside in the same region as their parents and to reunite after migration to different regions, and whether siblings function as regional attractors. Finland experienced intense regional migration to the capital area during the study period. Individual migration propensity peaked at infancy and at 18–28 years. Throughout their lives, most Finns live in the same region as their family members: over 65% with parents, over 55% with full sibling(s), and over 50% with half sibling(s). Siblings are likely to migrate to the same region, and having more siblings strengthens this attraction. Results also indicate some degree of patrilocality. Daughters migrate earlier and with higher rates than sons, whereas sons are at any age more likely to live in the same region as their parents. The propensity for adult brothers to live in the same region is also higher than for other sibling pairs. Family members serve as important geographical attractors to each other through the life course in contemporary Finland, and this is more pronounced for males than for females.

KEYWORDS

family migration, internal migration, parents, siblings

1 | INTRODUCTION

Close kin tend to have strong social relations throughout their lives (Hamilton, 1964; Neyer & Lang, 2003; Rotkirch, 2018; Salmon & Hehman, 2015). Family ties are characterised by substantial flows of support and assistance, also in contemporary wealthy and urbanised societies (e.g., Madsen et al., 2007; Mulder & Kalmijn, 2006; Stewart-Williams, 2008; White & Riedmann, 1992; Wrzus, Hanel, Wagner, & Neyer, 2013). European parents and their adult children help each other in many ways, including frequent provisions of emotional and practical support as well as financial assistance (Bordone, 2009; Coall & Hertwig, 2010; David-Barrett et al., 2016; Michielin, Mulder, & Zorlu, 2008; Szydlik, 2016). Kin help flows both between and within family generations. In addition to parents and children helping each other, siblings support each other in ways that are more altruistic and less based on reciprocity than help provided to close friends (Hughes, 1988; Rotkirch, Lyons, David-Barrett, & Jokela, 2014).

Geographical proximity is a central ingredient for the salience of family ties. Adult children may continue to live in the area of their childhood or move back to it at later stages of life, and parents may move closer to their adult children in order to care for their grandchildren or to receive help themselves as they age

(e.g., Blaauboer, Mulder, & Zorlu, 2011; Geist & McManus, 2008; Pettersson & Malmberg, 2009). A life course perspective on migration processes is therefore warranted (Mulder, 1993), ideally using longitudinal data in order to trace how actual family relations evolve as individuals age (Kolk, 2017).

Family migration processes can be investigated using data on residential proximity. Previous studies have consistently demonstrated that close kin tend to live close to each other in adulthood (Lundholm, 2015; Mulder & Cooke, 2009). Young adults often move away from their parents due to educational and job opportunities in urban centres. Once children reach their late 20s, however, the geographical distances between adult children and their parents and grandparents often remain remarkably stable and small (Kolk, 2017). Thus most contemporary Swedes have at least some close kin within both a 20- and a 75-km radius from their place of residence throughout their lives, and every second Swede born in the 1970s is living in the same municipality as at least two of her or his parents or grandparents (ibid.). However, comparable data on family migration across the life course remain scarce, especially using longitudinal data (Bordone, 2009; Pers & Mulder, 2013; van den Broek & Dykstra, 2017). The few existing studies of such nature include research using register data from the United States (Geist & McManus, 2008), Norway (e.g., Løken, Lommerud, & Lundberg, 2013) and Sweden (e.g., Blaauboer, Strömgren, & Stjernström, 2013; Kolk, 2017); we know of no previous study from Finland.

This study investigates family migration patterns of contemporary Finns and within Finland. It explores kin relations as the basis for residential choices and the residential patterns of kin networks, or in other words, which close family members act as an attractor in internal migration. We are especially interested in gender differences of kin migration, including sibling differences. Throughout human history, sex-biased migration has been very common, so that either females have stayed in or near their natal home, and males moved at marriage (matrilocality), or males stayed and females moved (patrilocality). The ethnographic record tells us that agricultural societies are overwhelmingly patrilocal (Fortunato, 2011), whereas foraging societies may also often be matrilocal (Wilkins & Marlowe, 2006). In the Nordic countries including Finland, neolocality, or a family system favouring residential independence of newlyweds, has been the dominating practice for centuries (Therborn, 2004). In neolocality, couples and their children live separately from older family generations, yet they may still stay close to either maternal or paternal kin or to both. In contemporary Western societies, neolocality is the prevailing norm. However, also today, neolocality can coexist with some degree of patrilocality or matrilocality, although this aspect of industrialised societies has not received much focused attention.

Existing research suggests that in the Netherlands, married couples are living closer to the parents of the husband than the parents of the wife (Blaauboer et al., 2011). A study from Norway found—to the surprise of the researchers—that married couples reside closer to the husband's than the wife's parents (Løken et al., 2013), and a Swedish study similarly found that females where more likely to move to the male's place when couples started a coresidential union (Brandén & Haandrikman, 2013). Other studies using register data from the Nordic countries indicate that men are more likely than women to live close to their ageing parents, contrary to the cultural expectations about adult daughters acting as carers for their parents (e.g., Malmberg & Pettersson, 2007). However, previous studies also indicate some preference for matrilocality in contemporary Europe. For instance, maternal kin is more involved in grandparenting than paternal kin is and thus often likely to live closer to the daughter's rather than their son's household (Szydlik, 2016). In Finland, maternal grandmothers are most involved in grandparenting, and previous studies indicate that spouses who have a child feel closer to the wife's kin (Danielsbacka, Tanskanen & Rotkirch, 2015, 2018).

In the aforementioned Dutch study, no differences in distance to the parents of husband and wife were found among couples with children, indicating that the general patrilocal tendency (couples live closer to kin of the husband) was balanced by a matrilocal tendency (couples with children live closer to maternal kin,) neutralising the first trend (Blaauboer et al., 2011). Again, matrilocality is likely to be related especially to caring work, for instance, grandparenting, or to adult daughters moving closer to their parents later in life in order to take better care of them (Malmberg & Pettersson, 2007, 695).

Sex-biased migration also means that either sisters or brothers are likely to remain closer to each other geographically. From a child's perspective, having a maternal uncle or aunt around and cousins from these relatives indicates matrilocality, whereas having a paternal uncle or aunt and cousins from these relatives indicates patrilocality. Yet longitudinal evidence from sibling studies of contemporary developed societies is very scarce and mixed. Using data on siblings in the United States in the 1980s and 1990s, White (2001) found no strong gender differences in sibling geographical proximity by gender while Blaauboer et al. (2013) found that the more sisters in a sibship, the higher likelihood of geographic dispersal this latter result was also reported for Germany by (Rainer & Siedler, 2009).

Investigating the geographical attraction posed by siblings is further complicated by the fact that individuals have varying number of siblings ("sibship size"). Theoretical models indicate that individuals with more siblings should be overall more strongly connected to each other, yet sibling conflict and dispersal is also to be expected, especially when resources in the parental region are scarce (Hughes, 1988). Nevertheless, empirical evidence for the influence of sibship size on migration is mixed and varies with study population. For instance, evidence for geographical attraction among siblings was reported from the United States (e.g., White, 2001) but not for Sweden (Blaauboer et al., 2013). Furthermore, siblings can have different degrees of biological relatedness. Full siblings share around half of their genes, whereas half siblings share a quarter of their genes. This difference is likely to affect family relationship dynamics (Rotkirch, 2018). Different degrees of relatedness may influence geographical proximity, conflict, and support between siblings (e.g., Hughes, 1988; Tanskanen, Danielsbacka, Jokela, David-Barrett, & Rotkirch, 2016). However, most previous studies, including all sibling studies mentioned above, have investigated only relations between full siblings.

This study contributes to previous studies of family migration in three main ways. First, we systematically investigate gender differences in how internal migration affects parent–child and sibling

relations at all ages, including early childhood. Second, we analyse the likelihood that different kin pairs reunite if they have moved apart, which has only rarely been done with longitudinal data and which further highlights the attraction of living close to specific family members at different life stages. Third, we study geographical proximity among full and half siblings, which to our knowledge has not been previously done with nationally representative data. Our three main research questions are

- the propensity of males and females to migrate as a function of age;
- the probability for daughters and sons to reside in the same region as their mothers and fathers and their likelihood to reunite in the same region if they have at some stage been regionally separated; and
- the propensity of siblings to reside in the same region with each other with respect to gender, sibship size, and type of sibling relation (half versus full sibling).

Due to the lack of published migration data, we begin by providing an overview of regional migration patterns in Finland during the study period, detailing the sending and receiving regions and net regional migration flows. This is necessary in order to contextualise the processes of microscale family migrations.

2 | COUNTRY BACKGROUND

During the latter half of the 20th century, Finland rapidly transformed from a poor and agrarian country to a wealthy and postindustrialised society with a current population of around 5.5 million. The postwar period is characterised by urbanisation and a diminishing rural population, with migration flows from the sparsely populated northern and eastern parts of the country to the urban centres in the southern and western parts. International migration, which is not studied here, included a large emigration wave in the 1950s to more prosperous countries, especially to neighbouring Sweden, and later a modest degree of surplus immigration as international migrants and refugees have moved to Finland (Eriksson, 1989).

During our study period, the median age at which Finns entered their first union (either through marriage or cohabitation) remained relatively stable at around 25 years of age (Jalovaara, 2012). The age of having the first child rose from around 25 to 28 years for women, whereas men were typically 2 years older than women when they had their first child. The median number of children in Finland was two children during the whole study period and total fertility rates fluctuated between 1.5 and 1.87 (Myrskylä, Goldstein, & Cheng, 2013). Fertility rates have for decades been highest in the Pohjanmaa region and lowest in the big cities.

Educational and labour market opportunities became ever more concentrated in larger Finnish cities with simultaneous large-scale educational expansion during the study period (OSF, 2017a). Especially women's educational level has increased strongly since the 1950s, and Finnish women are currently on average more highly educated than the men are. Women's labour market participation is also strong: Finnish women typically work full time, and the employment rates are quite similar between the genders, with 58% of women and 61% of men being employed of all 15- to 74-year-old Finns in 2016 (OSF, 2017b). Finland has introduced several female- and family-friendly welfare state-policies aimed at promoting social equality, gender equality, and maternal work force participation. These policies include free or inexpensive health care and education, care for the elderly, and a subjective right to public day care for children who are under 3 years old (Anttonen, 1999).

Such developments in educational levels and welfare state policies have allegedly had a major impact on internal migration flows including family migration (Nivalainen, 2010). On the one hand, the educational expansion and urbanisation drive young people to move to university towns and families to move into larger cities or their vicinities (e.g., Lehtonen & Tykkyläinen, 2018). Because Finnish women are more highly educated than men, regional migration created quite unbalanced sex ratios on a municipal and regional level (Lainiala & Miettinen, 2013). On the other hand, public services provide help with childcare and care for the elderly, which alleviates the need for kin help. Hence, only few Finns provide full-time grandchild care or full-time care of their elderly parents; nevertheless, grandparents are still in many ways involved in the lives of families with young children and adult children provide care for their ageing parents (Danielsbacka, Tanskanen, Jokela, & Rotkirch, 2011).

3 | DATA AND METHODS

This study uses the FinnFamily data, a representative multigenerational data set of the late 20th century population of Finland derived from the Population Register Centre of Finland. It consists of about 60,000 randomly selected Finns—referred to as "index persons"—from six birth cohorts of years 1955, 1960, 1965, 1970, 1975, and 1980, each having about 10,000 people constituting 11–16% of the total birth cohort. The data altogether includes information of 677,409 individuals, which are the index person, their parents and parents' other children (i.e., the index person's siblings and half siblings), the children and children's children of the index persons, and their siblings and half siblings. Hence, the data comprise families of four family generations: the zero generation with the mothers and fathers of the index persons; the first generation with the index persons, their siblings and half siblings; the second generation with children of the index persons, their siblings and half siblings (a generation of cousins); and the third generation with the grandchildren of the index persons, their siblings and half siblings (a generation of second cousins). Figure 1 shows an example of a typical family structure in our data. Please note that in the case of half siblings, the data includes the half sibling's other parent, either mother or father (randomly selected), in order to avoid including two half siblings that are not genetically related.

The FinnFamily data includes detailed demographic information of every subject, namely, the date and region of birth, the time of death, yearly information of the place of residence (i.e., region), and the time of the first five moves abroad and back to Finland. The data set was created for the Population Research Institute at Väestöliitto—Finnish

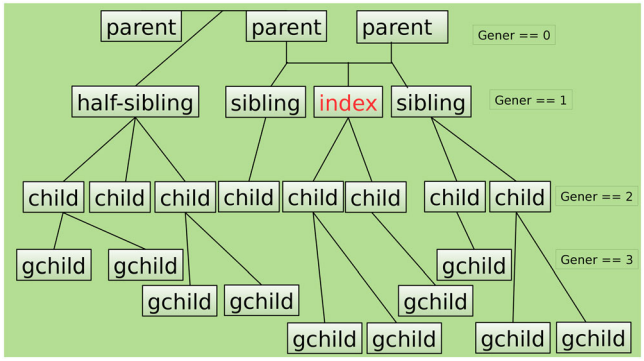


FIGURE 1 The structure of data associated with every individual index person including individual level information from his or her parents to all genetically related offspring and offspring's offspring. Note that the data set includes information of the index person's half sibling

Family Federation by Statistics Finland. The analytical samples used here vary depending on the level of analysis as outlined below.

3.1 | Analysis of individual migration

Finland is divided into 19 administrative regions, and we investigate migration flows within these regions. The descriptive regional and migration analysis considers the data of all the index persons and their family members; thus, the sample size is N = 674,285. We provide detailed analyses of the migration patterns of Finnish family members moving from one region ("maakunta" in Finnish) to another region over the years from 1970 to 2012. Please note that because Finland's administrative regions are quite large, coresidence in the same region does not equal coresidence in the same town or village. Migration flows are illustrated using the flow circle method introduced in Abel (2016) and Abel and Sander (2014).

3.2 | Analyses of family pairs

For the first research question related to regional coresidence of parents and children, index persons are the children. When investigating reunion after regional separation, we detected 5,228 events for father-child pairs and 5,851 for mother–child pairs in the data set, which are used for this analysis. For the analysis concerning sibling attraction, we included only those index persons who have at least one sibling, two siblings, and three siblings, with the sample size being 20,556; 14,306; and 6,964, respectively. Having more than three full siblings was very rare during the study period; less than 5% of families had five or more children (Ruokolainen & Notkola, 2007). Our data has 24,113 female index persons and 25,045 male index persons with at least one full sibling and 2,851 female index persons and 2,986 male index persons with at least one half sibling.

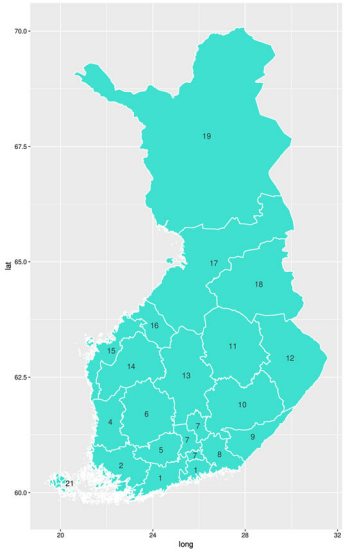
$$r = \frac{\Sigma\frac{e_{ii}}{N} - \Sigma\frac{a_i b_i}{N^2}}{1 - \Sigma\frac{a_i b_i}{N^2}}$$

where e_{ii} is the number of sibling pairs staying in the same region i after siblings had migrated, and a_i and b_i are the total numbers of observed younger individual siblings and older individual sibling for the given region i, respectively. The variable i is summed over all the possible regions for migration, and N is the total number of sibling pairs moving from the given region.

4 | RESULTS

The results section first presents an overview of internal population migration between 19 regions in Finland over the four decades from 1970 to 2012, followed by results for specific gendered family pairs. Figure 2 (on the left) illustrates the geographical locations of Finland's 19 regions and the corresponding indices used to denote them. The

Label	Region
m1	Uusimaa
m2	Varsinais-Suomi
m4	Satakunta
m5	Kanta-Hame
m6	Pirkanmaa
m7	Paijat-Hame
m8	Kymenlaakso
m9	Etela-Karjala
m10	Etela-Savo
m11	Pohjois-Savo
m12	Pohjois-Karjala
m13	Keski-Suomi
m14	Etela-Pohjanmaa
m15	Pohjanmaa
m16	Keski-Pohjanmaa
m17	Pohjois-Pohjanmaa
m18	Kainuu
m19	Lappi
m21	Ahvenanmaa



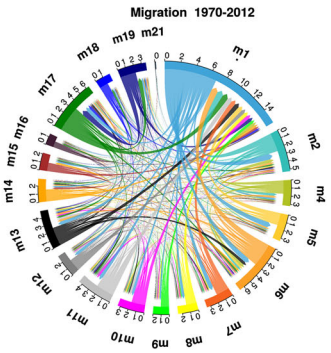


FIGURE 2 (Left) Locations of Finland's 19 regions and corresponding labels. (Right) Regional migration: Approximately 28% of the total number of individuals in our sample participate in this migrational flow pattern. Tick marks on the circle indicate migration flows in units of 10,000 individuals

names of the regions, corresponding indices, and the number of FinnFamily data index persons sampled per region are listed in Table A1.

4.1 | Region-to-region migration patterns

Most regions of Finland have witnessed a sizable population movement in the form of migration towards the three main urban centres during the study period: the capital Helsinki in Uusimaa region (m1), the former capital Turku in Varsinais-Suomi region (m2), and the city of Tampere in Pirkanmaa region (m6). As Figure 2 (on the right) and especially Figure 3 illustrate, these three urban centres experienced more immigration than emigration, that is, gained in population during the study period, whereas other regions like Satakunta (m4), Pohjois-Pohjanmaa (m17), and Kainuu (m18) predominantly lost inhabitants.

Figure 2 (right) visualises the total number of individuals that moved from one region to another region over the study period. Cumulative numbers and tick marks on the circle indicate the number of individuals in units of 10,000. Approximately 28% of the total number of individuals in the sample participated in this migration flow. The crucial role of the capital Helsinki in region m1 (Uusimaa) in the migration dynamics of the whole country can be easily observed: Uusimaa serves as the main attractor of immigration from the other regions. When individuals are not moving to Uusimaa, they tend to move from their region of residence to a neighbouring region. These observations are corroborated with the matrix of migrational outflows from one region to another region in relative terms (%) in Figure A1.

In order to investigate whether migration to cities was especially prominent at some specific time period, we analysed changes in migration flows at two different time windows, namely, in 1970–1980 and in 2000–2010. We chose an earlier and later period in order to have the largest time span between the selected points of comparison. However, no significant differences between these two time periods were found, except for minor changes in the ranking order of the largest inflows in the case of two regions (m4 and m17).

Figure 3 depicts the net flow (=outflow − inflow) of individuals between all the pairs of regions. Tick marks on the circle plot indicate the number of individuals in units of 1,000. We see how the Uusimaa region (m1) with the capital Helsinki is the largest attractor of internal migration, followed by Pirkanmaa region (m6) with the city of Tampere and Varsinais-Suomi region (m2) with the city of Turku. Correspondingly, several regions (m4, m10, m12, m14, m16, m18, and m19) were predominantly losing their population at the time through internal emigration, whereas the remaining regions (m5, m7, m8, m9, m11, m13, and m17) turn out to be quite balanced in their net flow of internal migration. Interestingly, there is a noticeable flow of people from region m1 to m5, unlike the flows between all the other regions and region m1. Hence, the Kanta-Häme region (m5) serves as an attractor for the capital Uusimaa region (m1). This is probably due to Kanta-Häme being within a 100-km radius from the capital city, Helsinki, with cheaper house prices and good daily transportation connections (rail and bus) to and from the Uusimaa region.

The overall pattern for regional migration flows looks quite similar when one separates them by gender, although some differences can

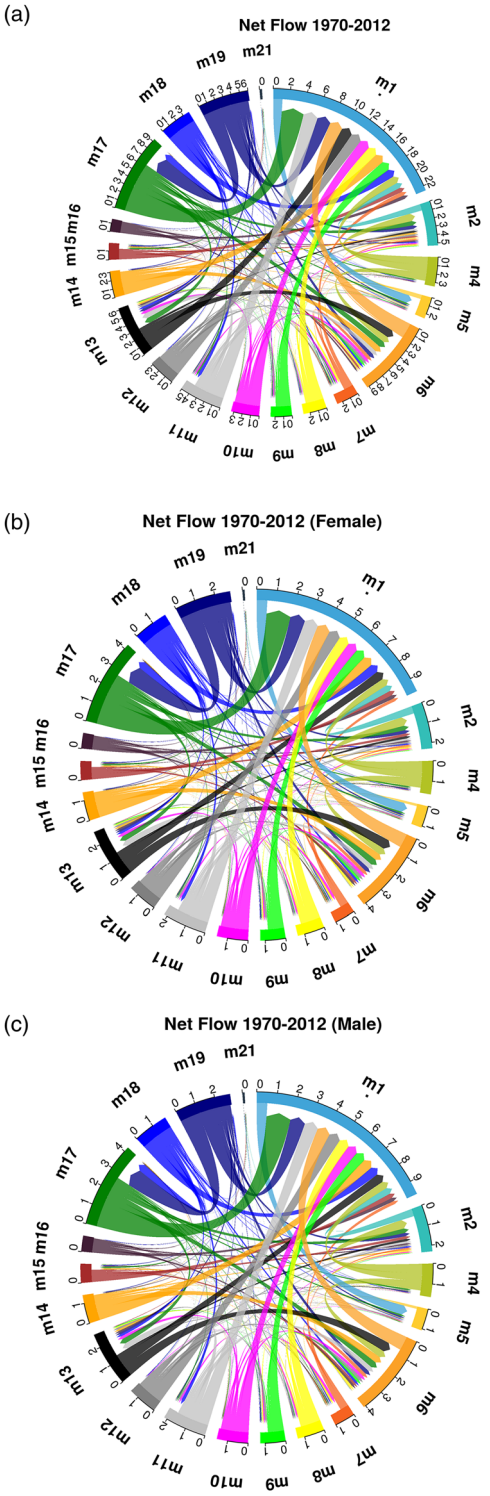


FIGURE 3 (a) The net flows (=outflows − inflows) of Finns between different regions. The Uusimaa (m1) is the most prominent attractor followed by Pirkanmaa (m6) and Varsinais-Suomi (m2). Also note that Kanta-Häme (m5) serves as an attractor for Uusimaa (m1). Tick marks on the circle indicate net flows of people in units of 1000 individuals. (b) The net flows (=outflows − inflows) of Finnish females between different regions. Main results and labels are the same as in Figure 3a, but the order of the most important attractors vary. Tick marks on the circle indicate net flows of females in units of 1,000 individuals. (c) The net flows (=outflows − inflows) of Finnish males between different regions. Main results and labels are the same as in Figure 3a, but the order of the most important attractors vary. Tick marks on the circle indicate net flows of males in units of 1000 individuals

be detected (Figures 3b and 3c). For both males and females, Uusimaa (m1) receives the highest migrant net flows, followed by Pirkanmaa (m6) and Varsinais-Suomi (m2). Most men and women move to Uusimaa (m1) from Pohjois-Pohjanmaa (m17). However, the following sending regions of females are, by flow size, Pohjois-Savo (m11), Pirkanmaa (m6), Lappi (m19), and Keski-Suomi (m13), whereas Lappi (m19), Pohjois-Savo (m11), Pirkanmaa (m6), and Pohjois-Karjala (m12) are for males. To Pirkanmaa (m6), the top region of net flows for both males and females originates from Keski-Suomi (m13), whereas Keski-Pohjanmaa (m17) ranks second for females and fourth among males, Satakunta (m4) ranks second for males but third for females, and Etelä-Pohjanmaa (m14) sends the third largest net flow of females but fourth largest of males. Finally, to Keski-Suomi (m13), the net flow of females stems from Pohjois-Pohjanmaa (m17) and Pohjois-Savo (m11), whereas among males, the order of these sending regions is reversed.

4.2 | Two migration peaks in individual life courses

Our first research question was the age dependence of individual mobility. Figure 4 presents the likelihood of the index person to move from one region to another as a function of his or her age. We can see a strong age dependence in the migration pattern of individuals during their life course. Two migration peaks occur at two specific stages of life. The first peak appears during the infancy of the index person, between birth and the first 3 years of life, when 2.0–3.3% of index individuals moved from one region to another. This is likely to reflect family migration as parents move due to changes in their work or studies, having more children, or since they wish to move closer to their own parents or siblings (see below). The individual likelihood to migrate then declines in childhood so that Finns around the age of 16 show a very low propensity to change regional residence: only around 0.5% of them do so on a yearly basis.

After age 16, the likelihood of switching region accelerates rapidly and continues to do so, peaking around the age of 26 years. The second peak illustrates how Finns as young adults move away from the region where their parents live (and allegedly also away from their parental home) due to employment opportunities, occupational training, or university studies. As we showed above, individuals usually move either to the capital Helsinki or to a neighbouring region.

During the study period, Finns typically entered parenthood in their late 20s and early 30s. Hence, Figure 4 also reflects a generational flow (although the individuals in these analyses are not related to each other): when young parents move, their very young children also move together with them. Later in life, when individuals have turned 40, their likelihood to switch regions decreases to a yearly rate at around 1%.

We detect some distinct gender differences in individual migration probabilities. Migration in young adulthood takes place a couple of years earlier for young women than for young men, and migration rates are higher for women. Finnish women start moving to another region at the age of 17 and their migration likelihood peaks at around age 23, when as many as 7% of them migrate yearly. Male migration starts at the age of 18 and accelerates less sharply to a 6% yearly rate, peaking at around age 25. Gender differences are statistically significant from the late teenage years until the late 20s.

4.3 | Geographical separation and reunification of parent–child pairs

Our second research question concerns the migration patterns of parents and their children. Now, our focus shifts from the migration of individuals to the regional coresidence of child–parent pairs. To investigate how often parents and children live in the same region, we measure the proportions of child–parent pairs (daughter–mother, son–mother, daughter–father, and son–father) residing in the same region as a function of the index person's (the child's) age. Results indicate that around two thirds of adult Finns live in the same region as their parents do (see Figure 5). Until their teens, almost all Finnish children live in the same region as their mother, and more than 95% live in the same region as their father. From around the age of 17, the proportions of individuals who live in the same region as their parents rapidly decline. These proportions subsequently stabilise at around the age of 32 years to relatively high values of more than 65%.

Again, we detect some gender differences in the migration patterns of young adults. For all ages, the percentages of son–mother and son–father pairs are clearly higher than the corresponding

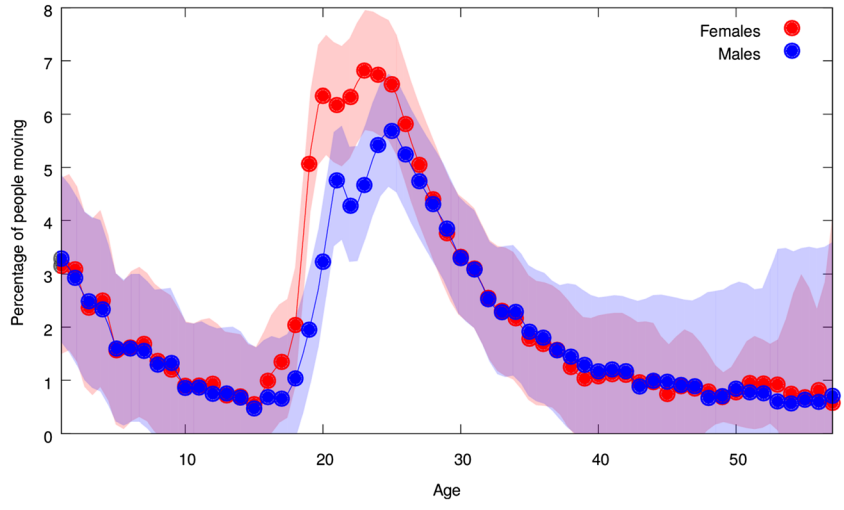


FIGURE 4 The percentage of index individuals (sampled from six different birth cohorts) migrating from one region to another region every year; shaded regions indicate 95% confidence intervals. The likelihood to move peaks at infancy and at 18–28 years of age

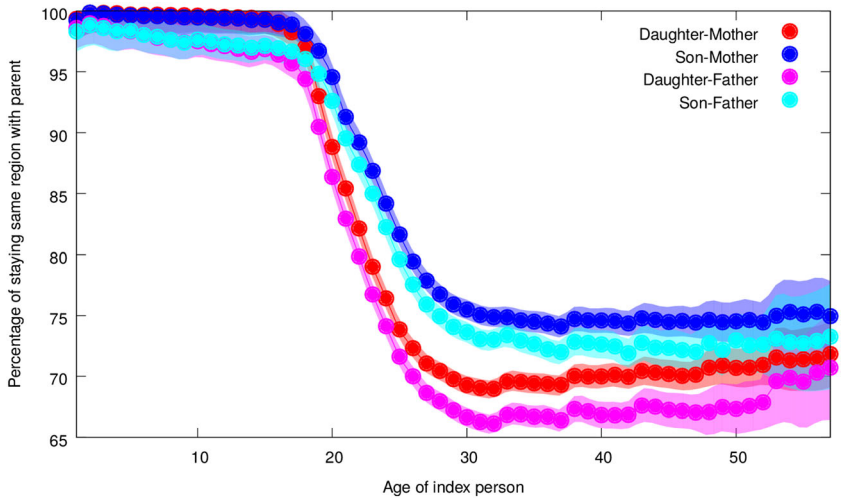


FIGURE 5 Child–parent pairs living in the same region as a function of the index person's (i.e., child's) age

percentages for daughter–mother and daughter–father pairs. Compared with daughters, sons at any given age more often reside in the same region as their parents. Both women and men also live more often in the same region as their mothers than their fathers (which is not surprising, because in Finland, divorce rates are high and single parents are more likely to be women; furthermore, the male lifespan is shorter than that of women). Consequently, sons and mothers have the highest and fathers and daughters the lowest propensity to live in the same region.

These results give some indication of patrilocality, because males of the younger generation are more likely to stay geographically close to their parents than females are. However, and interestingly, the proportions of daughters living close to their parents increases slightly as women reach middle age, whereas a corresponding increase is not observed for the sons. This matrilocal pattern may indicate a "grandmother effect" of maternal grandmothers living close to their daughters.

Next, we investigated how likely parent–child pairs are to reunite following a separation. We focus on child–parent pairs in which either party has moved to a different region but later coreside in the same region again. Table A2 features descriptive statistics of parent–child reunions for all the four different child–parent pairs and for different age groups of the index person.

Figure 6 shows the relative percentages of child–parent pairs that reunited as a function of the child's age. Until the child reaches 12 years of age, parents and children have become residentially separated are highly likely to be reunited. The probability of reunion peaks at the age of 12 years for women and 13 years for men. During the ensuing teenage years and until the child is in his or her mid-20s, reunion is unlikely. Reunion probability declines somewhat before the general migration probability of individuals rises (which happens at age of 17 years for women and 18 years for men, see Figure 4) and especially so for daughters.

Until the early 20s, child–father pairs are significantly more likely to reunite than child–mother pairs are. However, fewer mothers are living separately from their children in the first place at this stage of life (see also Figure 4). One can surmise that the reasons for mothers to live in another region than a young child may be quite severe, for instance, related to illness, imprisonment, or child custody care, thus hindering reunion. By contrast, fathers would probably more often have lived in another region than the child due to "softer" and more common reasons such as parental separation or work assignments, which would make reunion somewhat easier.

Past the late teenage and early adulthood years, parents and children are again more likely to reunite geographically and live in the same region. Many individuals return to their birth regions after

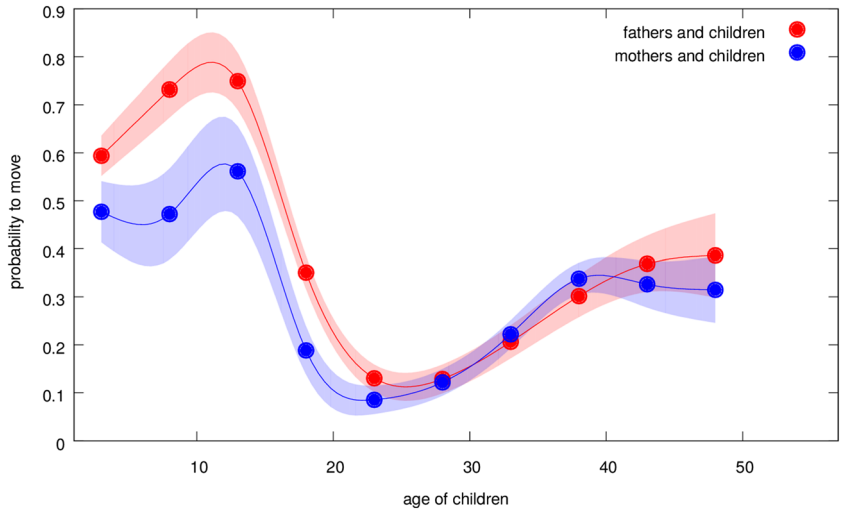


FIGURE 6 Likelihood of reunion after separation by age of the index person for child–father and child–mother dyads. Reunion is least likely when the child is 12–25 years old and more likely for child–father dyads compared with child–mother dyads

finishing their studies. Because most Finns became parents in their late 20s during the study period, this result is also likely to reflect parents moving to the regions of their adult children (or vice versa) in order to help with grandchild care.

4.4 | Geographical attractions of siblings

Our third and last research question concerned the geographical attraction that siblings represent to each other. In order to measure sibling attraction, we first calculated the proportion of an index person and one randomly chosen full or half sibling living in the same region as a function of the age of the index person. Table A3 presents the numbers and percentages of one sibling, two siblings, and three siblings living in the same region with the index person (their sibling) for different age groups of the index person.

We investigated four types of full sibling pairs: (a) a female index person and her sister, (b) a female index person and her brother, (c) a male index person and his sister, and (d) a male index person and his brother. The second and third categories are expected to be identical because both measure mixed-sex sibling pairs. For all these cases, the propensity for full siblings to live in the same region was overall quite high, over 55% at any age. Unsurprisingly, full siblings are very likely to live in the same region (and probably often in the same household) as young children. As the peak of internal regional migration in young adulthood sets in, the likelihood to live in the same region as a sibling decreases. Two brothers are more often living in the same region than any other sibling pairs do.

We further measured the same proportions for half siblings through the following pairs: (a) female index person and her half-sister, (b) female index person and her half-brother, (c) male index person and his half-sister, and (d) male index person and his half-brother.

Figure 7 (right) presents the variation in the percentages of half siblings living in the same region as a function of the age of the index person. For all four sibling pairs studied, the propensity of an individual to live in the same region with a half sibling decreases with age. Half siblings overall show a lower propensity to stay close to each other than full siblings do. This is understandable, given the lower likelihood to share the same household in childhood among half siblings compared with full siblings. Interestingly, however, this difference between full and half siblings gradually disappears after the index person has turned 30 years old. In middle and old age, Finns are almost as likely to live in the same region with their full as with their half siblings.

Unlike the results for full siblings, among half siblings, there were no statistically significant gender differences. Yet proportions are again highest for half-brother pairs, indicating a similar trend in favour of patrilocality among half siblings as among full siblings.

In order to assess the effects of sibling relations on migration, we need to take into account sibship size or how many siblings an index person has. For this analysis, we consider full siblings only. Figure 8 (left) shows proportions of full siblings living in the same region as a function of the age of the index person. Index persons have one sibling, two siblings, or three siblings. Results show that overall, full siblings are less likely to live in the same region as they age. This is obvious, because each individual has some propensity to migrate independently of the number of his or her siblings. To assess the effect of sibship size, we chose the probability to stay with a single sibling in the same region as the base value p. The null expectation for two siblings to live in the same region as the index sibling would then be p^2 (p to the power 2), and for three siblings, it would correspondingly be p^3 (p to the power 3).

The average percentage for a single individual to stay in the birth region is 70%. Assuming no sibling attraction, the probability for finding two full siblings in the same region is around 50%. The actual observed value is 65%, which is 30% higher than the null estimate. Similarly, the expected null model value for two siblings and for three siblings to stay in the same region with their index sibling are around 35% and 25%, respectively. The actual results are 50% for two siblings and 38% for three siblings, which is 43% and 52% higher than the expected null model. Hence, compared with the null models, the likelihood of full siblings to reside in the same region is higher than expected and increasing as the numbers of siblings increase; see Figure 8 (right).

Finally, we quantify sibling attraction through the assortativity coefficient, r, which denotes a preference of individuals to be connected to other similar individuals in the social network (Newman, 2002). The coefficient r ranges −1 (the network is completely disassortative) via 0 (the network is devoid of such correlations) to 1 (the network is completely assortative); see Section 3 for the detailed definition of r. To calculate r, we counted the number of full sibling pairs living in the same region after both had moved somewhere else from their birth region.

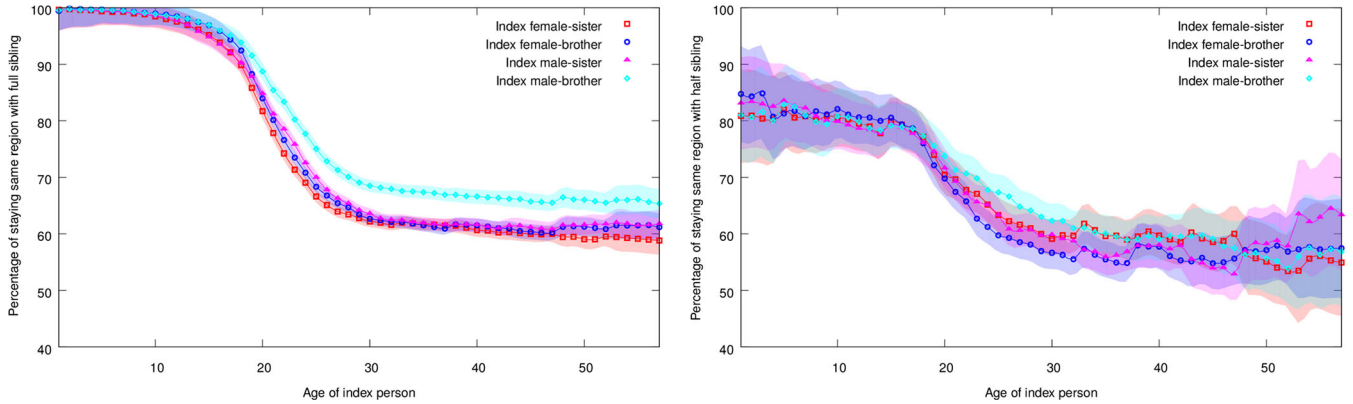


FIGURE 7 (Left) Full siblings living in the same region as another sibling by age (N females = 24,133; N males = 25,045). Brothers most often live in the same region. (Right) Half siblings living together with another randomly chosen half sibling by age (N females = 2,851; N males = 2,986)

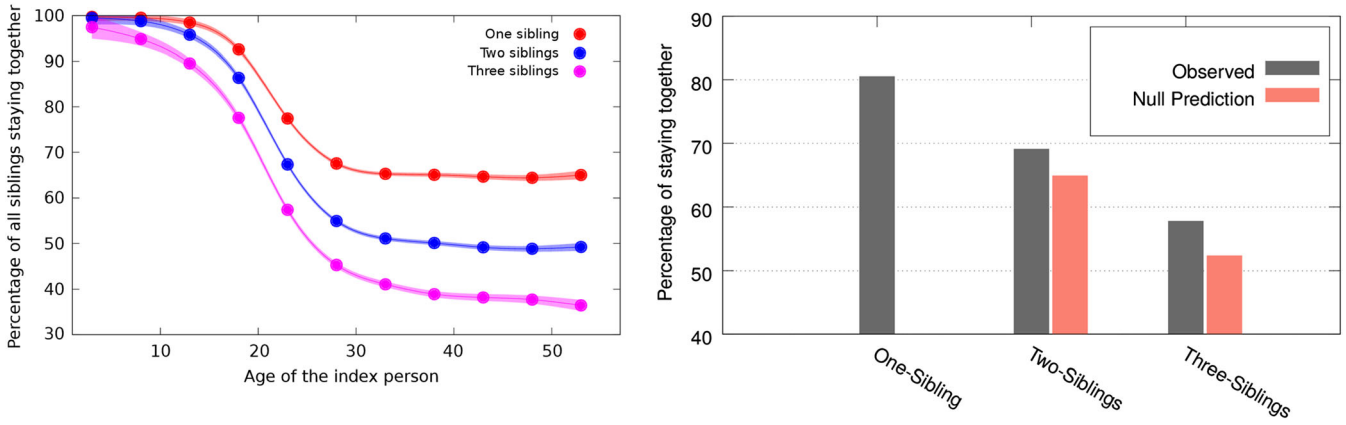


FIGURE 8 (Left) Percentage of full siblings living in the same region as a function of the age of the index person with one sibling (N = 20,556), two siblings (N = 14,306), and three siblings (N = 6,964), respectively. (Right) Percentage of full siblings living in the same region, averages of yearly sums from 1970 to 2012

Table 1 presents the assortativity coefficient, r, for sibling pairs for each region. We observe that the values are positive, indicating assortativity, and within the range from 0.23 to 0.55. The highest value is associated with the capital region m1 or Uusimaa. This indicates the existence of sibling attraction or a tendency for siblings to remain geographically close also when both siblings migrate.

5 | DISCUSSION AND CONCLUSION

In contemporary urbanised societies, individuals have many opportunities and incentives to migrate within their native countries, yet family members often choose to stay geographically close to each other. Although family migration has been a longstanding research topic, studies using nationally representative and longitudinal data are rare (but see Geist & McManus, 2008; Kolk, 2017). This study used high quality and large register data and represents a first comprehensive analysis of family member migration across the full life course of individuals in Finland.

TABLE 1 The assortativity coefficient, r, by region for sibling pairs moving to another region (every sibling has 18 other regions to migrate to). A positive value of r implies that siblings attract each other, zero implies no attraction, and negative value would imply repulsion

Birth place	Sibling pairs move from birth place	Pairs remain together in same places after move	Assortativity coefficient r	Error σ_r
1	414	246	0.553	0.069
2	235	136	0.377	0.094
4	329	145	0.302	0.106
5	170	95	0.298	0.097
6	303	149	0.334	0.087
7	222	119	0.329	0.089
8	139	65	0.266	0.088
9	179	83	0.242	0.089
10	407	168	0.251	0.087
11	470	214	0.291	0.084
12	331	164	0.319	0.085
13	332	153	0.311	0.087
14	336	150	0.314	0.090
15	166	77	0.339	0.091
16	113	42	0.234	0.088
17	516	225	0.298	0.081
18	309	124	0.275	0.086
19	432	192	0.298	0.095

We were especially interested in sex-based migration patterns. Although European adults mostly live separately from their parents and siblings, geographical proximity to either daughter (matrilocality) or sons (patrilocality) can indicate prevailing gender differences in marital systems and kin assistance. Previous studies have shown mixed evidence for contemporary European countries, and we wished to investigate in which direction, if any, Finnish residential patterns were inclined.

Over the 40-year study period, Finland witnessed strong regional migration either to a neighbouring region or to the capital and its surroundings in the Uusimaa region, where now more than 25% of the population is living. Finns were most likely to migrate in their infancy, due to their parents moving, as well as between ages of 18 and 28, when yearly migration rates were at their all-time highest, reaching 6% among sons and 7% among daughters.

Sons and mothers have the highest and fathers and daughters the lowest propensity to live in the same region. Parents and children who for some reason have become residentially separated are highly likely to start living in the same region again when the child is 0–12 years old. By contrast, during the teenage years and until the child is in his or her mid-20s, reunion is unlikely. Past the late teenage and early adulthood years, parents and children are again more likely to live in the same region. Thus, later in life, patterns of regional coresidence stabilise, and from age 30 and onwards, most Finns live in the same region as their family members: around 65% with their mothers and fathers, over 55% with their full sibling(s), and over 50% with their half sibling(s).

The persistent geographical attraction of close family members is similar to that reported in previous studies, for instance, Mulder and Kalmijn (2006), using Dutch data and Kolk (2017), using Swedish data. One novelty of our study is the inclusion of half siblings. Half siblings

in Finland are overall somewhat less likely than full siblings to reside in the same region, also in adulthood. However, these differences almost disappeared with age. This is an interesting finding, indicating that despite the many documented differences between full and half siblings (e.g., Salmon & Hehman, 2015; Tanskanen et al., 2016), geographical differences between full and half siblings are negligible in contemporary Finland, at least on a regional scale. Future research should preferably investigate the topic with more detailed measures of geographical distance.

This study also assessed in detail how sibling attraction varies with number of siblings. It reported increased sibling attraction in regional migration with sibship size, so that individuals with more siblings were more likely to reside in the same region with their siblings compared with unrelated individuals. We also found that if siblings migrate, they are more likely to migrate to the same region with each other than with an unrelated individual. Our results are in line with general expectations from sibling studies (cf. Salmon & Hehman, 2015) but contrary to the finding from a study of migration of Swedish siblings, which found that sibship size predicted geographical dispersion and not proximity (Blaauboer et al., 2013). These Finnish and Swedish studies are not directly comparable regarding research data and methods; Sweden also has higher population density and much higher proportions of first and second generation immigrants than Finland does—hence, both methodological and country differences may underlie our different results.

We found indications of some degree of patrilocality. First, adult sons are more likely than daughters to live in the same region as their mothers and fathers are. Daughters move away from their parents more often and earlier and at a higher rate than sons do and then stay more separated from the parents. This is due to the educational structure of the population in Finland, where a larger proportion of women than men have a degree on tertiary education (OSF, 2017a). Another reason for the gender difference is the mandatory national or military service for men in Finland, which is typically served straight after completing their secondary schooling. During their service time of about 1 year, sons keep their previous domicile or home address, whereas daughters often leave the parental home to enrol in higher education in another region. Thus, a larger proportion of Finnish men will not leave their region of birth during their young adulthood or at least not in official residence registers. This has led to a situation where in some regions of Finland, the male/female ratio is as high as 1.3–1.4 for Finns aged 20–25 years. These skewed sex ratios of Finns in their affect how many Finns end up unmarried and/or childless and partly explain the high rates of childlessness in Finland (Lainiala & Miettinen, 2013).

Although gender differences in the propensity to migrate exist, they disappear after the migratory peak at 18–28. Also after that age, however, daughters remain less likely to live in the same region as their parents. This indicates that a large proportion of the women who migrated in their youth become employed and have children without moving back. True, the proportions of adult daughters living close to their parents increases slightly as women reach middle age. This matrilocal pattern may indicate a matrilocal "grandmother effect" of maternal grandmothers living close to their daughters (Palchykov, Kaski, Kertész, Barabási, & Dunbar, 2012; see also for Sweden Svensson, Lundholm, de Luna, & Malmberg, 2015). In Finland, as in most other developed countries, maternal grandparents are known to provide more grandchild care compared with paternal grandparents, and the relationship between adult daughters and their mothers is typically emotionally very close (Danielsbacka et al., 2011; Danielsbacka et al., 2013; Danielsbacka et al., 2015; cf. Fergusson, Maughan, & Golding, 2008). Despite this trend, however, Finnish males are overall throughout their lives more likely to stay geographically close to their parents than females are. At most, the difference is around 7 percentage units.

Unlike Kolk (2017), who reported that gender differences are mainly related to the timing of leaving the parental home, we thus find persistent gender differences among adult Finns. This finding is in line with similar research on marital migration from Norway, although the Norwegian study concentrated on couples (Løken et al., 2013), and with the study by Chudnovskaya and Kolk (2015) from Sweden, who found that adult daughter's lived further away from their mothers than adult men lived from their mothers at the time of the birth of the first child.

Second, patrilocality is also suggested by our finding that two adult brothers are more likely to live in the same region compared with other sibling pairs. The finding was statistically significant for full sibling pairs only, but the trend was similar among half sibling pairs as well. The fraternal attraction stems from the higher likelihood of sons to stay in their birth region: a lower push factor for internal migration among Finnish men in general. Additionally, it may reflect cultural and industrial opportunities or a higher pull factor to stay: for instance, a higher likelihood for males to become employed at local factories or to start a family business together. Our data allows us to investigate this interesting question of professional similarities within families in the future.

To our knowledge, this is the first time the higher propensity of female than male dispersal in the contemporary Finnish population has been documented. Among the limitations of our study is that we used a relatively crude measure of internal migration (regional units). However, our results are remarkably similar to those documented using more fine-scaled residential data from Sweden (Kolk, 2017). This study also raised questions for future research, such as a description of the change in family structures over time and its interplay with migration, and a more detailed investigation of the sex-based migration shown here, using data on education and income (cf. Blaauboer et al., 2013). These and related tasks remain to be solved in future work.

In sum, internal migration patterns in Finland are affected by two major forces: career attraction and kin attraction (cf. Geist & McManus, 2008). Career attraction is especially visible in how the education and labour market are attracting people to move to the major cities, most importantly to the capital Helsinki and its surroundings. Kin attraction means that close kin preferentially help and cooperate with each other and leads to the fact that most Finns stay in the same region as their close biological kin. Furthermore, sibling attraction was observed to be higher for larger sibship sizes, indicating a synergy of family ties. Our results fully support Austin Hughes's notions of the importance of kin as a basis of human residential group formation (Hughes, 1988). Contemporary western humans seem to

balance their educational and occupational aspirations with the need to be close to their parents and siblings. We conclude that family attraction remains a strong factor for internal migration in contemporary Finland. Geographical attraction is somewhat stronger for sons and brothers than for daughters and sisters, suggesting patrilocal tendencies.

ACKNOWLEDGEMENTS

The authors thank the two anonymous referees for useful comments and Statistics Finland for providing the FinnFamily data. We are grateful to support from the Academy of Finland, 266898 (V. B. and A. R.) and 276439 (A. G., K. K., K. B., and D. M.), and J. K. acknowledges support from H2020 FETPROACT-GSS (CIMPLEX), 641191. D. M., K. B., and K. K. also acknowledge support from EU HORIZON 2020 FET Open RIA project (IBSEN), 662725 and EU HORIZON 2020 INFRAIA-1-2014-2015 program project (SoBigData), 654024. K. K. acknowledges the Rutherford Foundation Visiting Fellowship at The Alan Turing Institute, UK. D. M. also acknowledges CONACYT (Mexico) for the Grant 383907.

ORCID

Anna Rotkirch http://orcid.org/0000-0002-9429-1499

REFERENCES

Abel, G. (2016). Updated circular plots for directional bilateral migration data. https://gjabel.wordpress.com/2016/05/18/updated-circular-plots-for-directional-bilateral-migration-data/. Accessed: 12-05-2017.

Abel, G. J., & Sander, N. (2014). Quantifying global international migration flows. *Science*, *343*(6178), 1520–1522. https://doi.org/10.1126/science.1248676

Anttonen, A. (1999). *Child home care allowances: An innovation in Finnish family policy*. Studies in social security and health, 52. Helsinki: The Social Insurance Institution.

Blaauboer, M., Mulder, C. H., & Zorlu, A. (2011). Distances between couples and the man's and woman's parents. *Population, Space and Place*, *17*(5), 597–610. https://doi.org/10.1002/psp.648

Blaauboer, M., Strömgren, M., & Stjernström, O. (2013). Life course preferences, sibling ties, and the geographical dispersion of sibling networks. *Population Space and Place*, *19*(5), 594–609. https://doi.org/10.1002/psp.1742

Bordone, V. (2009). Contact and proximity of older people to their adult children: A comparison between Italy and Sweden. *Population, Space and Place*, *15*(4), 359–380. https://doi.org/10.1002/psp.559

Brandén, M., & Haandrikman, K. (2013). Who moves to whom? Gender differences in the distance moved to a shared residence. *Stockholm Research Reports in Demography*, *19*.

Chudnovskaya, M., & Kolk, M. (2015). Educational expansion and intergenerational proximity in Sweden: Developments in geographical distance between young adults and their parents, 1980–2007. *Population, Space and Place*, *23*(1), e1973. https://doi.org/10.1002/psp.1973

Coall, D. A., & Hertwig, R. (2010). Grandparental investment: Past, present, and future. *Behavioral and Brain Sciences*, *33*(1), 1–19. https://doi.org/10.1017/S0140525X09991105

Danielsbacka, M., Tanskanen, A., Hämäläinen, H., Pelkonen, I., Haavio-Mannila, E., Rotkirch, A., … Roos, J. P. (2013). *Sukupolvien vuorovaikutus. Auttaminen ja yhteydenpito suurten ikäluokkien ja heidän lastensa elämässä*. [Helping and contacts in the lives of Finnish baby boomers and their adult children.]. Väestöntutkimuslaitoksen julkaisusarja, 58. Helsinki: Väestöliitto.

Danielsbacka, M., Tanskanen, A. O., Jokela, M., & Rotkirch, A. (2011). Grandparental child care in Europe: Evidence for preferential investment in more certain kin. *Evolutionary Psychology*, *9*(1), 147470491100900102. https://doi.org/10.1177/147470491100900102

Danielsbacka, M., Tanskanen, A. O., & Rotkirch, A. (2015). The impact of genetic relatedness and emotional closeness on intergenerational relations. *Journal of Marriage and Family*, *77*(4), 889–907. https://doi.org/10.1111/jomf.12206

Danielsbacka, M., Tanskanen, A. O., & Rotkirch, A. (2018). The "Kinship Penalty": Parenthood and in-law conflict in contemporary Finland. *Evolutionary Psychological Science*, *4*(1), 71–82. https://doi.org/10.1007/s40806-017-0114-8

David-Barrett, T., Kertesz, J., Rotkirch, A., Ghosh, A., Bhattacharya, K., Monsivais, D., & Kaski, K. (2016). Communication with family and friends across the life course. *PLoS One*, *11*, e0165687. https://doi.org/10.1371/journal.pone.0165687

Eriksson, T. (1989). International migration and regional differentials in unemployment and wages: Some empirical evidence from Finland. In I. Gordon, & A. Thirlwalld (Eds.), *European factor mobility—Trends and consequences* (pp. 59–73). London: Palgrave Macmillan. https://doi.org/10.1007/978-1-349-10044-6_5

Fergusson, E., Maughan, B., & Golding, J. (2008). Which children receive grandparental care and what effect does it have? *Journal of Child Psychology and Psychiatry*, *49*(2), 161–169.

Fortunato, L. (2011). Reconstructing the history of residence strategies in Indo-European-speaking societies: Neo-, uxori-, and virilocality. *Human Biology*, *83*(1), 107–128. https://doi.org/10.3378/027.083.0107

Geist, C., & McManus, P. A. (2008). Geographical mobility over the life course: Motivations and implications. *Population, Space and Place*, *14*(4), 283–303. https://doi.org/10.1002/psp.508

Hamilton, W. D. (1964). The genetical evolution of social behaviour. ii. *Journal of Theoretical Biology*, *7*(1), 17–52. https://doi.org/10.1016/0022-5193(64)90039-6

Hughes, A. L. (1988). *Evolution and Human Kinship*. Oxford: Oxford University Press.

Jalovaara, M. (2012). Socio-economic resources and first-union formation in Finland, cohorts born 1969–81. *Population Studies*, *66*(1), 69–85. https://doi.org/10.1080/00324728.2011.641720

Kolk, M. (2017). A life-course analysis of geographical distance to siblings, parents, and grandparents in Sweden. *Population, Space and Place*, *23*(3), e2020. https://doi.org/10.1002/psp.2020

Lainiala, L., & Miettinen, A. (2013). Skewed marriage markets and sex ratios of Finnish people in their twenties. *Finnish Yearbook of Population Research*, *48*, 51–63. https://journal.fi/fypr/article/view/40928

Lehtonen, O., & Tykkyläinen, M. (2018). Path dependence in net migration during the ICT boom and two other growth periods: The case of Finland, 1980-2013. *Journal of Evolutionary Economics*, *28*(3), 547–564.

Løken, K., Lommerud, K., & Lundberg, S. (2013). Your place or mine? On the residence choice of young couples in Norway. *Demography*, *50*(1), 285–310. https://doi.org/10.1007/s13524-012-0142-8

Lundholm, E. (2015). Migration and regional differences in access to local family networks among 60-year olds in Sweden. *Journal of Population Ageing*, *8*(3), 173–185. https://doi.org/10.1007/s12062-015-9117-z

Madsen, E. A., Tunney, R. J., Fieldman, G., Plotkin, H. C., Dunbar, R. I., Richardson, J.-M., & McFarland, D. (2007). Kinship and altruism: A cross-cultural experimental study. *British Journal of Psychology*, *98*(2), 339–359. https://doi.org/10.1348/000712606X129213

Malmberg, G., & Pettersson, A. (2007). Distance to elderly parents: Analyses of Swedish register data. *Demographic Research*, *17*, 679–704. https://doi.org/10.4054/DemRes.2007.17.23

Michielin, F., Mulder, C. H., & Zorlu, A. (2008). Distance to parents and geographical mobility. *Population, Space and Place*, *14*(4), 327–345. https://doi.org/10.1002/psp.509

Mulder, C. (1993). *Migration dynamics: A life course approach*. Amsterdam: University of Amsterdam.

Mulder, C. H., & Cooke, T. J. (2009). Family ties and residential locations. *Population, Space and Place*, *15*(4), 299–304. https://doi.org/10.1002/psp.556

Mulder, C. H., & Kalmijn, M. (2006). Geographical distances between family members. In P. Dykstra, M. Kalmijn, T. Knijn, A. Komter, A. Liefbroer, & C. Mulder (Eds.), *Family solidarity in the Netherlands* (pp. 43–61). Amsterdam: Dutch University Press.

Myrskylä, M., Goldstein, J. R., & Cheng, Y. H. A. (2013). New cohort fertility forecasts for the developed world: Rises, falls, and reversals. *Population and Development Review*, *39*(1), 31–56. https://doi.org/10.1111/j.1728-4457.2013.00572.x

Newman, M. E. (2002). Assortative mixing in networks. *Physical Review Letters*, *89*(20), 208701. https://doi.org/10.1103/PhysRevLett.89.208701

Neyer, F. J., & Lang, F. R. (2003). Blood is thicker than water: Kinship orientation across adulthood. *Journal of Personality and Social Psychology*, *84*(2), 310. https://doi.org/10.1037/0022-3514.84.2.310

Nivalainen, S. (2010). *Essays on family migration and geographical mobility in Finland*. Pellervon taloustutkimus PTT.

Official Statistics of Finland (OSF). (2017a). Educational structure of population [e-publication]. ISSN=2242–2919. Helsinki: Statistics Finland [referred: 12.5.2017].

Official Statistics of Finland (OSF). (2017b). Working life. http://tilastokeskus.fi/tup/tasaarvo/working-life/index_en.html. Accessed: 12-05-2017.

Palchykov, V., Kaski, K., Kertész, J., Barabási, A.-L., & Dunbar, R. I. (2012). Sex differences in intimate relationships. *Scientific Reports*, *2*, 370. https://doi.org/10.1038/srep00370

Pers, M., & Mulder, C. H. (2013). The regional dimension of intergenerational proximity in the Netherlands. *Population, Space and Place*, *19*(5), 505–521. https://doi.org/10.1002/psp.1729

Pettersson, A., & Malmberg, G. (2009). Adult children and elderly parents as mobility attractions in Sweden. *Population, Space and Place*, *15*(4), 343–357. https://doi.org/10.1002/psp.558

Rainer, H., & Siedler, T. (2009). O brother, where art thou? The effects of having a sibling on geographic mobility and labour market outcomes. *Economica*, *76*(303), 528–556. https://doi.org/10.1111/j.1468-0335.2008.00696.x

Rotkirch, A. (2018). Evolutionary family sociology. In R. Hopcroft (Ed.), *Oxford handbook of evolution, biology and society* (pp. 451–478). Oxford: Oxford University Press. https://doi:10.1093/oxfordhb/9780190299323.013.3

Rotkirch, A., Lyons, M., David-Barrett, T., & Jokela, M. (2014). Gratitude for help among adult friends and siblings. *Evolutionary Psychology*, *12*(4), 147470491401200401. https://doi.org/10.1177/147470491401200401

Ruokolainen, A., & Notkola, I. (2007). Hedelmällisyys. [Fertility]. In S. Koskinen, T. Martelin, I.-L. Notkola, V. Notkola, K. Pitkänen, M. Jalovaara, et al. (Eds.), *Suomen väestö* (2nd renewed ed.) (pp. 77–113). Helsinki: Gaudeamus.

Salmon, C., & Hehman, J. (2015). Evolutionary perspectives on the nature of sibling conflict: The impact of sex, relatedness, and co-residence. *Evolutionary Psychological Science*, *1*(2), 123–129. https://doi.org/10.1007/s40806-015-0013-9

Stewart-Williams, S. (2008). Human beings as evolved nepotists. *Human Nature*, *19*(4), 414–425. https://doi.org/10.1007/s12110-008-9048-y

Svensson, I., Lundholm, E., de Luna, X., & Malmberg, G. (2015). Family life course and the timing of women's retirement—A sequence analysis approach. *Population, Space and Place*, *21*(8), 856–871. https://doi.org/10.1002/psp.1950

Szydlik, M. (2016). *Sharing lives: Adult children and parents*. Routledge. https://doi.org/10.4324/9781315647319

Tanskanen, A. O., Danielsbacka, M., Jokela, M., David-Barrett, T., & Rotkirch, A. (2016). Diluted competition? Conflicts between full-and half-siblings in two adult generations. *Frontiers in Sociology*, *1*, 6. https://doi.org/10.3389/fsoc.2016.00006

Therborn, G. (2004). *Between sex and power. Family in the world 1900–2000*. London: Routledge. https://doi.org/10.4324/9780203643297

van den Broek, T., & Dykstra, P. A. (2017). The impact of siblings on the geographic distance between adult children and their ageing parents. Does parental need matter? *Population, Space and Place*, *23*(6), e2048. https://doi.org/10.1002/psp.2048

White, L. (2001). Sibling relationships over the life course: A panel analysis. *Journal of Marriage and the Family*, *63*(2), 555–568. https://doi.org/10.1111/j.1741-3737.2001.00555.x

White, L. K., & Riedmann, A. (1992). Ties among adult siblings. *Social Forces*, *71*(1), 85–102. https://doi.org/10.2307/2579967

Wilkins, J. F., & Marlowe, F. W. (2006). Sex-biased migration in humans: What should expect from genetic data? *Bioessays*, *28*(3), 290–300. https://doi.org/10.1002/bies.20378

Wrzus, C., Hanel, M., Wagner, J., & Neyer, F. J. (2013). Social network changes and life events across the life span: A meta-analysis. *Psychological Bulletin*, *139*(1), 5. https://doi.org/10.1037/a0028601

How to cite this article: Ghosh A, Berg V, Bhattacharya K, et al. Migration patterns of parents, children and siblings: Evidence for patrilocality in contemporary Finland. *Popul Space Place*. 2019;25:e2208. https://doi.org/10.1002/psp.2208

APPENDIX A

The FinnFamily data set consists of data of about 60,000 randomly selected Finns, named as index-persons, from six birth cohorts of years 1955, 1960, 1965, 1970, 1975, and 1980, each with about 10,000 people, and index persons' parents and parents' other children, that is, siblings and half siblings as well as the index persons' and their (half) siblings' children and children's children. In the case of half siblings, the data include the half sibling's other parent, either mother or farther (randomly selected), to avoid including two half siblings that are not genetically related. Thus, the data structure depicted in Figure 1 represents a part of the index person's family tree with his or her mother and father, siblings and half siblings, cousins, and second cousins. Table A1 presents the labelling and the names of the 19 regions with the number of randomly selected index persons in each region. Figure A1 shows a matrix of migration outflows in relative terms (%) from one region to another. Table A2 shows the numbers and percentages of reunions or "who moves to whom" for different child—parent pairs after having lived in a different region but later moved to the same region for different age groups of the index person (child). Table A3 shows the numbers and percentages of one sibling, two siblings, and three siblings living in the same region with the sibling index person for different age groups of the index person.

TABLE A1 The labelling and names of the 19 regions of Finland with the number of randomly sampled index persons in each region

Label	Region	Index persons	Label	Region	Index persons
m1	Uusimaa	10851	m12	Pohjois-Karjala	1929
m2	Varsinais-Suomi	3320	m13	Keski-Suomi	2426
m4	Satakunta	2489	m14	Etelä-Pohjanmaa	2131
m5	Kanta-Häme	1443	m15	Pohjanmaa	1580
m6	Pirkanmaa	3723	m16	Keski-Pohjanmaa	715
m7	Päijät-Häme	1818	m17	Pohjois-Pohjanmaa	4226
m8	Kymenlaakso	1080	m18	Kainuu	1327
m9	Etelä-Karjala	1299	m19	Lappi	2364
m10	Etelä-Savo	1872	m21	Ahvenanmaa	251
m11	Pohjois-Savo	2984			

TABLE A2 Reunion of child–parent pairs: The numbers and percentages of reunions or "who moves to whom" after having lived in a different region and then reuniting, for different age groups sampled over all index persons

	Parents move to children's place/total cases between the pair (percentage with 95% confidence)			
Age Group	Mothers to daughters	Mothers to sons	Fathers to daughters	Fathers to sons
1–5	49/116 (42.2 ± 9.4)	65/123 (52.8 ± 8.9)	167/286 (58.4 ± 6.0)	191/317 (60.3 ± 5.8)
6–10	15/43 (34.9 ± 16.9)	36/65 (55.4 ± 12.4)	158/217 (72.8 ± 8.5)	183/249 (73.5 ± 8.0)
11–15	29/54 (53.7 ± 13.4)	35/60 (58.3 ± 13.2)	190/255 (74.5 ± 8.1)	171/227 (75.3 ± 8.7)
16–20	77/512 (15.0 ± 6.8)	79/316 (25.0 ± 7.3)	174/609 (28.6 ± 4.9)	185/415 (44.6 ± 4.9)
21–25	160/1912 (8.4 ± 3.9)	127/1453 (8.7 ± 4.5)	199/1755 (11.3 ± 3.9)	206/1355 (15.2 ± 4.2)
26–30	213/1735 (12.3 ± 3.9)	198/1644 (12.0 ± 4.0)	182/1436 (12.7 ± 4.2)	182/1391 (13.1 ± 4.3)
31–35	264/1117 (23.6 ± 4.0)	224/1081 (20.7 ± 4.2)	169/843 (20.0 ± 4.9)	173/816 (21.2 ± 4.8)
36–40	204/560 (36.4 ± 4.6)	187/597 (31.3 ± 4.8)	102/353 (28.9 ± 6.5)	122/390 (31.3 ± 5.9)
41–45	104/281 (37.0 ± 6.4)	78/277 (28.2 ± 7.4)	59/161 (36.6 ± 8.5)	66/178 (37.1 ± 8.0)
46–50	54/146 (37.0 ± 8.9)	36/140 (25.7 ± 10.8)	28/69 (40.6 ± 12.4)	28/76 (36.8 ± 12.4)

TABLE A3 The numbers and percentages of one sibling, two siblings, and three siblings living in the same region with the sibling index person, for different age groups of the index person

	No. of siblings stay all together/No. of siblings (%)		
Age group	One sibling	Two siblings	Three siblings
1–5	47,096/47,226 (99.72 ± 0.9)	17,235/17,326 (99.47 ± 1.5)	5,528/5,672 (97.46 ± 2.5)
6–10	76,235/76,596 (99.52 ± 0.7)	38,684/39,163 (98.77 ± 1.0)	13,582/14,320 (94.84 ± 1.5)
11–15	90,471/91,874 (98.4729 ± 0.6)	55,739/58,195 (95.77 ± 0.8)	22,442/25,070 (89.51 ± 1.0)
16–20	93,376/100,887 (92.55 ± 0.5)	59,143/68,486 (86.35 ± 0.6)	25,002/32,231 (77.57 ± 0.8)
21–25	76,698/99,061 (77.42 ± 0.4)	45,278/67,202 (67.37 ± 0.4)	18,196/31,703 (57.39 ± 0.6)
26–30	65,742/97,289 (67.57 ± 0.4)	36,114/65,748 (54.92 ± 0.4)	14,071/31,064 (45.29 ± 0.6)
31–35	55,408/84,839 (65.30 ± 0.4)	29,615/57,963 (51.09 ± 0.4)	11,590/28,209 (41.08 ± 0.6)
36–40	42,156/64761 (65.09 ± 0.4)	23,350/46,611 (50.09 ± 0.5)	9,376/24,094 (38.91 ± 0.7)
41–45	29,167/45,084 (64.69 ± 0.5)	17,502/35,616 (49.14 ± 0.5)	7,560/19,797 (38.18 ± 0.8)
46–50	17,949/27,853 (64.44 ± 0.7)	11,836/24,241 (48.82 ± 0.6)	5,430/14,399 (37.71 ± 0.9)
51–55	9,406/14,459 (65.05 ± 0.9)	6,429/13,060 (49.22 ± 0.9)	2,985/8,192 (36.43 ± 1.2)

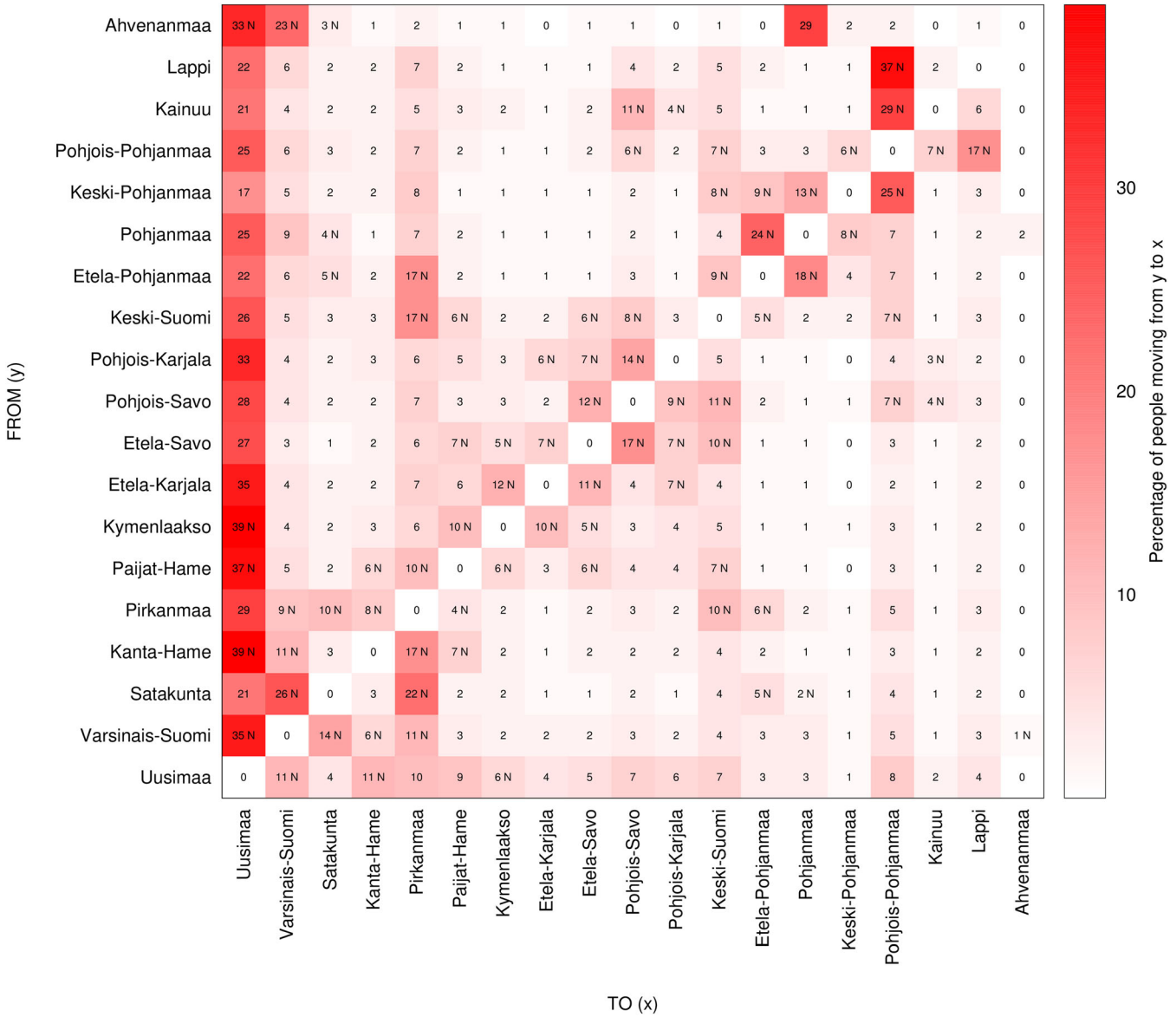


FIGURE A1 The percentages of people moving from one region to another region. The total outflow is scaled to 100% for each region such that each row adds up to 100. It is notable that a large fraction of people from different regions go to region m1 (Uusimaa) such that few regions are getting large fraction of people migrating from neighbouring regions (see for example region m6 [Pirkanmaa] and region m17 [Pohjois-Pohjanmaa]). With extra N in the box we indicate if two regions are neighbouring each other