Journal of Biosocial Science (2020), 52: 5, 664–680
doi:10.1017/S0021932019000713

CAMBRIDGE UNIVERSITY PRESS

RESEARCH ARTICLE

Do birds of a feather flock together? Factors for religious heterogamy

Martin Fieder[1]*, Alexander Schahbasi[1,2] and Susanne Huber[1]

[1]Department of Anthropology, University of Vienna, Austria and [2]Erlangen Centre for Islam & Law in Europe, Friedrich-Alexander University Erlangen-Nürnberg, Germany
*Corresponding author. Email: martin.fieder@univie.ac.at

(Received 28 January 2019; revised 28 August 2019; accepted 04 September 2019; first published online 14 November 2019)

Abstract
Social cohesion – particularly with regard to the integration of migrants – is primarily measured in terms of education, labour market participation, unemployment, income levels and poverty. When seen from a historical long-term perspective (considering the migrations of *Homo sapiens* in the past 300,000 years) admixture merged members of diverse groups and forged – in addition to social ties – 'strong biological ties' of kinship, proposing that religious heterogamy is a long-term layer of social cohesion. Accordingly, this study investigated, on the basis of more than 600,000 men and women aged 26–35 years from Austria 2001, Germany (West) 1987, Ireland 2011, Portugal 2011, Romania 2011 and Switzerland 2000, which demographic characteristics foster religious heterogamy, controlling for various confounding factors using linear mixed modelling. By far the most important factor explaining religious heterogamy was the share of adherents to an individual's religious group in their area of residence. It can be concluded that the rate of intermarriage declines with the increasing size of an individual's religious group in their area of residence. From a long-term perspective the lack of familial ties (and conjoint offspring) between religious groups could lead to a lack of social cohesion.

Keywords: Religion; Marriage; Social Cohesion

Introduction

There is ample evidence that in the course of human evolution, and also during more recent history, humans of different origins, ethnicities, religions and cultures have regularly mixed. Particularly research into ancient DNA has revealed the high levels of admixture in human history, which has left its traces in the genetic code (Reich, 2018). Thus, despite geographical, ethnic and cultural separation, admixture was a quite common event in evolutionary history (Patterson *et al.*, 2012; Jobling *et al.*, 2013; González-Fortes *et al.*, 2017, Lipson *et al.*, 2017). Patterns of admixture and, conversely, homogamy (i.e. mating with a partner of similar characteristics), however, may have differed substantially throughout history. Europe is a good example for admixture that happened over the past several thousand years, where as a result, individuals from opposite geographical regions share a vast number of common genealogical ancestors (Ralph & Coop, 2013).

Considering contemporary migration flows and demographic trends, the processes that lead to admixture of different ethnicities and religions are of particular interest. It is not necessary to go back too far in time to realize that human migration may be a rather peaceful or, indeed, a rather violent process. Examples for both can repeatedly be found in written history: for instance, the very successful integration of the Huguenots in Germany in the 17th and 18th century (Ther, 2017) on the one hand, and the disastrous consequences of the male-dominated migration to the

Americas since 1492, on the other hand. The latter has led to the partial extinction of Native Americans through infectious diseases as well as extreme violence (Skoglund *et al.*, 2015). Countless examples such as the rather peaceful migration of farmers from Anatolia to Europe during the Neolithic or the rather violent male-dominated migration from Ukraine/Russia several thousand years ago could be added (Goldberg *et al.*, 2017).

Definitions of social cohesion and successful integration do vary, but when it comes to measuring integration processes many European countries lean towards statistical monitoring of education, labour market participation, unemployment, poverty and income levels (Maxwell, 2010). There is, however, a broader context to consider, as social cohesion strives for inclusion and an equilibrium in many fields. Language is of course the cognitive basis for interactions, but there is an argument (Esser, 2001) for two important dimensions of integration: the structural dimension (systemic participation, such as the labour and the housing market) and the social dimension (social relations such as friendships). While these are suitable categories to frame ongoing integration processes, it can be argued that admixture between ethnic and religious groups is another important layer of social cohesion – particularly from a long-term perspective. In fact, seen on a more existential level, in times of dwindling resources and societal upheaval, genetic ties could serve as a mechanism to prevent intergroup violence and thus be considered highly relevant for social cohesion.

The understanding of this layer is based on the findings of evolutionary biology and the role of kinship. Kinship goes beyond social ties as it dwells on deeply rooted genetic ties among individuals and generations. Within a family, individuals share a certain proportion of genes according to their kinship relation: a mother or a father shares roughly 50% ('roughly' as there is small deviation of the maternal inheritance due to mitochondrial DNA and mutations) of her/his genes with his/her sons and/or daughters. Siblings share 50% of their genes with each other and 25% of the genes with their nephews and nieces. Grandparents share 25% of their genes with their grandchildren and 0.125% of the genes are shared by great-grandparents and great-grandchildren. This simple rule of the share of inheritance explains co-operation and prosocial behaviour among kin in animals and humans and has been described in the theory of inclusive fitness by William Hamilton (Hamilton, 1964). Meanwhile, proven on the basis of numerous studies, genetic relatedness is a fundamental principle of co-operation as helping a relative is not merely an altruistic act, but an act to transfer one's own genes to the next generation. For example, if a mother raises and nurtures her children, with each child 50% of her genetic material is transferred to the next generation. Also, in helping their grandchildren a grandmother or grandfather assures the transfer of 25% of their own genes. This simple rule explains why individuals within families help each other more than they help non-related individuals.

Based on the findings that co-operation is stronger among kin than it is among genetically non-related individuals and Hamilton's theory of inclusive fitness, the role of admixture – that is intermarriage between different ethnic and religious groups – gains importance in the realm of social cohesion.

Abstaining from evolutionary arguments, some researchers in the social sciences have also identified 'intermarriage' as an important indicator of social cohesion (Kalmijn, 1998). Equally, Chiswick and Miller (1995) found that marriage leads to a stronger exposure to the language of the destination country and improvement in language skills, and therefore to higher income and more successful integration.

Hence, determining the factors fostering religious intermarriages has been of scientific interest: for instance, Blau *et al.* (1982) showed on the basis of the US census of 1970 that i) members of relatively small groups are more likely to out-marry, and ii) heterogeneity (the number of different groups) is directly related to the rate of intermarriage. To that effect, already in 1951, Thomas (1951) found that a higher proportion of Catholics in a city was the main factor reducing the likelihood of intermarriage in Catholics. According to these studies an overall 'even distribution of the adherents of a particular religion' seems to be the most important factor fostering religious intermarriages.

https://doi.org/10.1017/S0021932019000713 Published online by Cambridge University Press

Table 1. Number of individuals and percentages of religious denomination for each census sample

	Austria 2001	Germany 1987 (West)	Ireland 2011	Portugal 2011	Romania 2011	Switzerland 2000
No religion	7867	21,704	3243	3903	172	3782
	11.2%	8.0%	8.2%	9.9%	0.1%	11.8%
Christian	56,999	232,447	33,152	35,176	162,755	25,441
	80.9%	86.2%	83.3%	89.3%	96.0%	79.3%
Muslim	5269	8889	0	105	640	2302
	7.5%	3.3%	0.0%	0.3%	0.4%	7.2%
Other	335	6756	3392	227	6029	549
	0.5%	2.5%	8.5%	0.6%	3.6%	1.7%

Given the above arguments, this study aimed to investigate i) the prevalence of religious heterogamy and ii) which demographic characteristics are associated with religiously heterogamous marriages on the basis of census data from five European countries.

Methods

Census data provided by IPUMS-International (Minnesota Population Center, 2019) were used for the analysis. To ensure the comparability of the samples in terms of political, economic and social conditions, the analysis was restricted to European countries, using census data available from any European country that provided data on the religious denomination of both spouses of a married couple, namely Austria 2001, Germany (West) 1987, Ireland 2011, Portugal 2011, Romania 2011 and Switzerland 2000 (in cases where more than one census was available per country, the most recent census was used). For Western Germany, only census data from 1987 were used, keeping in mind that it was collected long before the contemporary developments in Europe.

Only data for married men aged 26–35 years and their wives, as well as for married women aged 26–35 years and their husbands (the two samples do not overlap), were analysed, using the age span 26–35 years for the focal individual to ensure a high chance of being married and being married only once (http://ec.europa.eu/eurostat/statistics-explained/index.php/Marriage_and_divorce_statistics). Wives and husbands (irrespective of age) were associated by IPUMS-International with their characteristics to the focal individual if they lived in the same household. On the basis of encoding of religious denomination by IPUMS-International, religion was encoded as 1 = no religion, 2 = Christian, 3 = Muslim and 4 = other (Buddhists, Hindus, Jews and other religion). On basis of this encoding of religious denominations, religious homogamy was encoded as '0' if the focal individual and his/her spouse were in a religiously homogamous marriage (i.e. both spouses had the same denomination), and '1' if the focal individual and his/her spouse were in a religiously heterogamous marriage (i.e. the two spouses had a different denomination). Table 1 shows the number of cases per census.

Christians were additionally analysed in greater detail, encoded by IPUMS-International as 1 = Catholic, 2 = Anglican, 3 = Orthodox, 4 = Other Christian (encoded only in Portugal, including mostly Anglicans and other Protestants not specified in detail) and 5 = Protestant (on the basis of encoding by IPUMS-International, grouping different groups of Protestants together as 'Protestants') (see Tables 2 and 3 for number of cases per census). On this basis, it was further encoded whether the couple was in a religiously homo- or heterogamous marriage (again 0 = religious homogamy, 1 = religious heterogamy).

https://doi.org/10.1017/S0021932019000713 Published online by Cambridge University Press

Table 2. Number of cases and percentage of marriages for each religious Christian denomination for men and their wives

	Man's religion				
	Catholic	Anglican	Orthodox	Other Christian Portugal	Protestant
Wife's religion					
Catholic	94,881	240	171	52	14,338
	86.5%	59.1%	10.0%	12.7%	30.0%
Anglican	235	166	0	0	0
	0.2%	40.9%	0.0%	0.0%	0.0%
Orthodox	209	0	1518	2	28
	0.2%	0.0%	88.5%	0.5%	0.1%
Other Christian Portugal	108	0	1	348	6
	0.1%	0.0%	0.1%	85.1%	0.0%
Protestant	14,236	0	25	7	33,360
	13.0%	0.0%	1.5%	1.7%	69.9%

Table 3. Number of cases and percentage of marriages for each religious Christian denomination for women and their husbands

	Woman's religion				
	Catholic	Anglican	Orthodox	Other Christian Portugal	Protestant
Husband's religion					
Catholic	115,114	282	301	133	16,754
	86.6%	60.1%	13.5%	24.6%	29.2%
Anglican	306	187	0	0	0
	0.2%	39.9%	0.0%	0.0%	0.0%
Orthodox	190	0	1887	5	19
	0.1%	0.0%	84.4%	0.9%	0.0%
Other Christian Portugal	69	0	3	396	5
	0.1%	0.0%	0.1%	73.3%	0.0%
Protestant	17,251	0	45	6	40,516
	13.0%	0.0%	2.0%	1.1%	70.7%

Furthermore the following variables were included in the analyses: age of the focal individual in years; sex of the focal individual encoded as 1 = male and 2 = female; education of the focal individual encoded by IPUMS-International as 1 = less than primary, 2 = primary completed, 3 = secondary completed and 4 = university completed. On the basis of educational attainment of both the focal individual and their spouse, an indicator was composed for educational homo- and heterogamy, encoded as '0' if the focal individual's education level was lower than that of their spouse, '1' if both spouses had the same education, and '2' if the focal individual's education level was higher than that of their spouse. As no data on income were available, ownership of the

https://doi.org/10.1017/S0021932019000713 Published online by Cambridge University Press

dwelling where the couple lived was used as an indicator of socioeconomic status, encoded as '1' if dwelling was owned, and '0' if dwelling was not owned. Furthermore, the percentage of adherents to the focal individual's religious denomination in the geographic region where the couple lived was calculated, using the smallest geographical unit available for each census (as region was differently encoded for each census, this indicator varied between censuses). Sample sizes varied as not all variables were available for each individual.

The percentage of religiously homo- versus heterogamous marriages for each census was analysed separately for men and their wives as well as for women and their husbands. In addition, the Variance Inflation Factor (VIF) was estimated to avoid multicollinearity of the variables in the models. As the share of adherents to the focal individual's denomination in the geographical region and religious denomination are obviously collinear (VIF>2), the share of adherents and denomination was analysed in separate models (except in the case of only Christians). The following linear mixed models were performed: i) for all focal individuals and their spouses, ii) separately for men and women, and iii) including, respectively, excluding atheists, regressing being in a religiously heterogamous marriage (encoded as 0 = religious homogamy, 1 = religious heterogamy) on the focal individual's sex, age and education, spouse's age, as well as the couple's educational homo/heterogamy, owning of dwelling, and a) the share of adherents to the focal individual's denomination in the geographical region where the couple lived (percentage religion district) or b) religious denomination, on the basis of a binomial error structure and with sample identifier as random factor, thereby controlling for survey particularities and country particularities. In the models including religious denomination, the interaction between sex and religious denomination was included, and the same analyses were performed for Christians only.

Additionally, on the basis of all census individuals and their spouses, the relative contribution of the variance of being in a religiously heterogamous marriage was analysed, explained by the fixed factors according to Nakagawa and Schielzeth (2013) by comparing R^2 for the full linear mixed model including all factors and the interactions with sex, a model without the interactions with sex, as well as separate models each without interactions and excluding one explaining factor. In addition, these analyses were performed for Christians only. These calculations were performed with the help of the R library *MuMLn* (function *r.squaredGLMM*), and calculated β-values using the function *std.coef* also from the library *MuMLn*.

All general linear mixed models were performed in R 3.5.1 using the MASS library and the linear mixed model function glmmPQL for the mixed linear models and the *MuMLn* library for the variance estimation.

Additionally, if and how the results may deviate from the 'null-model' was investigated, i.e. a random mating model: everyone marries everyone with no preference for religious homogamy or heterogamy. A 'null model' was calculated according to Blau *et al.* (1982), taking sex ratios into account: for each of the 161 geographical regions in the sample, expected intermarriage rates were calculated in the case of random mating as $1-p_m\,p_f$, where p_m is the fraction of men, and p_f that of women, who were adherents of a religious group in a region (Blau *et al.*, 1982). For each religious group and the 161 regions, the expected intermarriage rates versus the actual intermarriage rates were plotted.

Results

Religious heterogamy was most prevalent in atheists and least prevalent in Christians. This holds true both for men and women (Tables 4 and 5). In Muslims, heterogamy is more common in men, where 14% are married to a Christian wife, than in women, where only 2.9% are married to a Christian husband (Table 5). Also, in a multivariate analysis of men and women and their spouses, women had a higher probability of being in a religious heterogamous marriage than men if the model included the percentage of adherents in a region (Table 6). In the model including religious

https://doi.org/10.1017/S0021932019000713 Published online by Cambridge University Press

Table 4. Marriage combinations for men and their wives by religion: number of individuals and percentages within each religious denomination

	Man's religion			
	No religion	Christian	Muslim	Other
Wife's religion				
No religion	9789	3868	272	254
	43.7%	1.6%	3.3%	3.2%
Christian	12,212	235,309	1138	1622
	54.5%	97.8%	14.0%	20.7%
Muslim	93	195	6674	25
	0.4%	0.1%	82.0%	0.3%
Other	328	1278	54	5930
	1.5%	0.5%	0.7%	75.7%

Table 5. Marriage combinations for women and their husbands by religion: number of individuals and percentages within a religious denomination

	Woman's religion			
	No religion	Christian	Muslim	Other
Husband's religion				
No religion	13,122	16,532	127	511
	71.9%	5.4%	1.4%	5.4%
Christian	4605	285,646	263	1679
	25.2%	93.6%	2.9%	17.8%
Muslim	232	1211	8650	57
	1.3%	0.4%	95.4%	0.6%
Other	290	1931	27	7210
	1.6%	0.6%	0.3%	76.2%

denomination, however, women had a lower chance than men of being in a religious heterogamous marriage (Table 7). Both models further showed that the focal individual's age, having the same or higher education than the spouse, and owing a dwelling were significantly negatively, whereas spouse's age and higher education were significantly positively associated with being in a heterogamous marriage (Tables 6 and 7). The higher the share of adherents to the focal individual's religion in an area of residence, the lower was the probability of a heterogamous marriage (Table 6). In addition, in the model including religious denomination, atheists had the highest and Christians had the lowest probability of being in a heterogamous marriage, followed by Muslims and adherents of another religion (Table 7), most likely because Christians as the majority population had the highest chance of marrying within their denomination. The interaction with sex further showed that, compared with atheists, Christian women had the highest chance of having a heterogamous marriage, followed by women with another religion, and Muslim women had the lowest probability of heterogamous marriage (Table 7).

https://doi.org/10.1017/S0021932019000713 Published online by Cambridge University Press

Table 6. General linear mixed model on heterogamy for men and women, including the share of adherents in a region

	Estimate	β-value	SE	*t*-value	*p*-value
Intercept	−1.36261	0.00000	0.29926	−4.55322	<0.0001
Women (Ref.: men)	0.08278	0.03540	0.01138	7.27203	<0.0001
Age	−0.00864	−0.02096	0.00201	−4.29450	<0.0001
Age of spouse	0.02105	0.09077	0.00107	19.64312	<0.0001
Primary completed (Ref.: <primary)	0.17806	0.01746	0.05624	3.16609	0.0015
Secondary completed (Ref.: <primary)	0.65303	0.06114	0.05600	11.66073	<0.0001
University completed (Ref.: <primary)	0.90264	0.08060	0.05690	15.86448	<0.0001
Education same as spouse (Ref. lower than spouse)	−0.33810	−0.12171	0.01343	−25.16622	<0.0001
Education higher than spouse (Ref. lower than spouse)	−0.43405	−0.10917	0.01891	−22.95278	<0.0001
Share of adherents in area of residence	−0.02956	−0.72299	0.00014	−209.43394	<0.0001
Dwelling owned (Ref.: not owned)	−0.05232	−0.02484	0.01088	−4.81101	<0.0001
df	616984				
	(Intercept)	Residual			
StdDev Random Factor:	0.7072082	0.9497817			

0 = homogamous marriage; 1 = heterogamous marriage.

Table 7. General linear mixed model on heterogamy for men and women, including religious denomination: full model including the interaction with sex

	Estimate	β-value	SE	*t*-value	*p*-value
Intercept	−0.40597	0.00000	0.30577	−1.32769	0.18430
Women (Ref.: men)	−1.35845	−0.33123	0.02207	−61.53883	<0.0001
Age	−0.01502	−0.03646	0.00214	−7.02864	<0.0001
Age of spouse	0.02519	0.10955	0.00113	22.22903	<0.0001
Primary completed (Ref.: <primary)	0.13469	0.01348	0.05915	2.27696	0.02280
Secondary completed (Ref.: <primary)	0.43311	0.04166	0.05907	7.33237	<0.0001
University completed (Ref.: <primary)	0.71016	0.06506	0.06004	11.82898	<0.0001
Education same as spouse (Ref.: lower than spouse)	−0.29659	−0.10764	0.01421	−20.87073	<0.0001
Education higher than spouse (Ref.: lower than spouse)	−0.36042	−0.09119	0.02033	−17.72773	<0.0001
Christian (Ref.: no religion)	−3.68722	−0.66896	0.01933	−190.77579	<0.0001
Muslim (Ref.: no religion)	−1.70254	−0.22064	0.03250	−52.38728	<0.0001
Other (Ref.: no religion)	−0.82127	−0.08538	0.03144	−26.12341	<0.0001
Dwelling owned (Ref.: not owned)	−0.25499	−0.12192	0.01143	−22.30720	<0.0001
Women (Ref.: men): Christian (Ref.: no religion)	2.35972	0.46406	0.02641	89.34868	<0.0001
Women (Ref.: men): Muslim (Ref.: no religion)	−0.35865	−0.03486	0.06231	−5.75575	<0.0001
Women (Ref.: men): Other (Ref.: no religion)	1.13154	0.08332	0.04329	26.13572	<0.0001

0 = homogamous marriage; 1 = heterogamous marriage.

https://doi.org/10.1017/S0021932019000713 Published online by Cambridge University Press

Table 8. General linear mixed model on heterogamy for men only including the share of adherents in a region

	Estimate	*β*-value	SE	*t*-value	*p*-value
(Intercept)	−0.75610	0.00000	0.29590	−2.55527	0.01060
Age	−0.02087	−0.04950	0.00362	−5.76836	<0.0001
Age of spouse	0.03451	0.13330	0.00209	16.53710	<0.0001
Primary completed (Ref.: < primary)	0.22099	0.02360	0.09007	2.45343	0.01420
Secondary completed (Ref.: < primary)	0.73303	0.07548	0.08933	8.20626	<0.0001
University completed (Ref.: < primary)	0.90088	0.08583	0.09127	9.87082	<0.0001
Education same as spouse (Ref.: lower than spouse)	−0.34819	−0.11564	0.02574	−13.52543	<0.0001
Education higher than spouse (Ref.: lower than spouse)	−0.51329	−0.12236	0.03474	−14.77520	<0.0001
Share of adherents in area of residence	−0.04561	−1.17919	0.00025	−180.61113	<0.0001
Dwelling owned (Ref.: not owned)	0.11385	0.05447	0.01973	5.76929	<0.0001
df	277198				
	(Intercept)	Residual			
StdDev Random Factor:	0.6476445	1.008449			

0 = homogamous marriage, 1 = heterogamous marriage.

Table 9. General linear mixed model on heterogamy for women only including the share of adherents in a region

	Estimate	*β*-value	SE	*t*-value	*p*-value
(Intercept)	−2.07827	0.00000	0.33101	−6.27856	<0.0001
Age	−0.00321	−0.00789	0.00256	−1.25263	0.21030
Age of spouse	0.02031	0.09097	0.00130	15.59403	<0.0001
Primary completed (Ref.: <primary)	0.15074	0.01401	0.07751	1.94492	0.05180
Secondary completed (Ref.: <primary)	0.58409	0.05139	0.07738	7.54869	<0.0001
University completed (Ref.: <primary)	0.93469	0.08072	0.07834	11.93123	<0.0001
Education same as spouse (Ref.: lower than spouse)	−0.33789	−0.12702	0.01656	−20.40513	<0.0001
Education higher than spouse (Ref.: lower than spouse)	−0.39814	−0.10337	0.02460	−16.18436	<0.0001
Share of adherents in area of residence	−0.01716	−0.40226	0.00020	−85.90430	<0.0001
Dwelling owned (Ref.: not owned)	−0.21279	−0.10059	0.01378	−15.44232	<0.0001
df	339772				
	(Intercept)	Residual			
StdDev Random Factor:	0.7689798	0.9579056			

0 = homogamous marriage, 1 = heterogamous marriage.

In the separate models for men and women, with the exception of 'dwelling owned' in men, signs and most significances were the same as in the models including both men and women (Tables 8 and 9 show the models including share of adherents, and Tables 10 and 11 show the models including religious denomination).

https://doi.org/10.1017/S0021932019000713 Published online by Cambridge University Press

Table 10. General linear mixed model on heterogamy for men only, including religious denomination

	Estimate	*β*-value	SE	*t*-value	*p*-value
(Intercept)	0.09816	0.00000	0.25278	0.38833	0.69780
Age	−0.03067	−0.07230	0.00360	−8.52560	<0.0001
Age of spouse	0.02868	0.11025	0.00210	13.62635	<0.0001
Primary completed (Ref.: <primary)	0.09044	0.00989	0.08716	1.03765	0.29940
Secondary completed (Ref.: <primary)	0.34065	0.03619	0.08668	3.93008	0.00010
University completed (Ref.: <primary)	0.46396	0.04578	0.08873	5.22904	<0.0001
Education same as spouse (Ref.: lower than spouse)	−0.24815	−0.08233	0.02555	−9.71281	<0.0001
Education higher than spouse (Ref.: lower than spouse)	−0.29148	−0.06898	0.03462	−8.41945	<0.0001
Christian (Ref.: no religion)	−3.75152	−1.16530	0.01932	−194.22213	<0.0001
Muslim (Ref.: no religion)	−1.67655	−0.25950	0.03257	−51.47693	<0.0001
Other (Ref.: no religion)	−0.93617	−0.14303	0.03155	−29.66955	<0.0001
Dwelling owned (Ref.: not owned)	−0.10231	−0.04903	0.01945	−5.25942	<0.0001
df	277196				
	(Intercept)	Residual			
StdDev Random Factor:	0.5289501	0.9654331			

0 = homogamous marriage, 1 = heterogamous marriage.

Table 11. General linear mixed model on heterogamy for women only, including religious denomination

	Estimate	*β*-value	SE	*t*-value	*p*-value
(Intercept)	−2.12256	0.00000	0.35204	−6.02932	<0.0001
Age	−0.00678	−0.01670	0.00260	−2.60416	0.00920
Age of spouse	0.02441	0.10946	0.00133	18.41854	<0.0001
Primary completed (Ref.: <primary)	0.19705	0.01842	0.07883	2.49963	0.01240
Secondary completed (Ref.: <primary)	0.51030	0.04534	0.07885	6.47219	<0.0001
University completed (Ref.: <primary)	0.88138	0.07610	0.07981	11.04293	<0.0001
Education same as spouse (Ref.: lower than spouse)	−0.30187	−0.11324	0.01689	−17.87786	<0.0001
Education higher than spouse (Ref.: lower than spouse)	−0.34023	−0.08789	0.02519	−13.50630	<0.0001
Christian (Ref.: no religion)	−1.29085	−0.33295	0.01807	−71.43443	<0.0001
Muslim (Ref.: no religion)	−2.07117	−0.31288	0.05314	−38.97243	<0.0001
Other (Ref.: no religion)	0.36215	0.05082	0.03086	11.73446	<0.0001
Dwelling owned (Ref.: not owned)	−0.33807	−0.16187	0.01379	−24.52258	<0.0001
df	339770				
	(Intercept)	Residual			
StdDev Random Factor:	0.8210264	0.9706628			

0 = homogamous marriage, 1 = heterogamous marriage.

https://doi.org/10.1017/S0021932019000713 Published online by Cambridge University Press

Table 12. General linear mixed model on heterogamy for men and women, including the share of adherents in a region, excluding atheists

	Estimate	*β*-value	SE	*t*-value	*p*-value
(Intercept)	−1.2416188	0	0.22753365	−5.45686	<0.0001
Women (Ref.: men)	−0.1341362	−0.51986	0.02551275	−5.25762	<0.0001
Age	−0.0306808	−0.66639	0.0043991	−6.97433	<0.0001
Age of spouse	0.0280065	1.178965	0.00228131	12.27651	<0.0001
Primary completed (Ref.: <primary)	−0.1386583	−0.533009	0.07695494	−1.80181	0.0716
Secondary completed (Ref.: <primary)	0.2568531	0.979114	0.07574665	3.39095	0.0007
University completed (Ref.: <primary)	0.5543585	1.58075	0.07904483	7.01322	<0.0001
Education same as spouse (Ref.: lower than spouse)	−0.4757251	−1.731795	0.02947084	−16.14223	<0.0001
Education higher than spouse (Ref.: lower than spouse)	−0.3584406	−1.008845	0.04118895	−8.70235	<0.0001
Share of adherents in area of residence	−0.0381464	−5.93618	0.00029665	−128.58918	<0.0001
Dwelling owned (Ref.: not owned)	−0.250385	−0.960748	0.02719771	−9.20611	<0.0001
df	555287				
	(Intercept)	Residual			
StdDev Random Factor:	0.4370097	0.9877124			

0 = homogamous marriage, 1 = heterogamous marriage.

Excluding atheists produced comparable results, except that being female was now negatively associated with being in a religious heterogamous marriage in the model including the share of adherents in a region (Table 12). Again, Muslims and adherents of other religions had a higher probability of being in a religious heterogamous marriage than Christians, and Muslim women have the lowest chance of heterogamous marriage (Table 13).

Calculating R^2, the overall model explained 25.9% of the variance. Herein, most variance was explained by the share of adherents of a denomination in a region (12.6%), followed by the religious denomination (10.9%), the random factor 'sample' (10.7%), education (1.03%), ownership of dwelling (0.95%), age of spouse (0.4%), educational homogamy (0.18%) and sex (0.016%). By analysing men and women separately, a higher proportion of variance was explained by the share of adherents as well as religious denomination in men compared with women (men: 27.6%, women: 4.6%; religious denomination, men: 26.3%, women: 4.4%).

Religious homogamy also predominated when analysing Christians only (Tables 14–16). In addition, in all three models (men and women, women only, men only) a similar pattern was found with regard to signs, and the most significant effects were for age, spouse's age, education, educational homogamy, owning of a dwelling and the share of adherents to the focal individual's religion in the couple's geographical district. Among the Christian denominations, Anglicans, other Christians and Protestants had the highest chance of heterogamous marriage, compared with Catholics, and Orthodox Christians had the lowest chance of being in a heterogamous marriage. Again, the share of adherents to the focal individual's religion in the couple's geographical district explained the greatest variance of heterogamous marriage within Christians (~13.7% of the variance explained), albeit without difference between men and women (13.6% vs 13.7% of the variance explained); religious denomination, however, was less important (only 2.3% of the variance explained) (Table 17).

Overall, the expected intermarriage rate (expected heterogamy) was very much higher than the actual intermarriage rate (actual heterogamy). For individuals, the expected intermarriage rate was

https://doi.org/10.1017/S0021932019000713 Published online by Cambridge University Press

Table 13. General linear mixed model on heterogamy for both men and women, including religious denomination, excluding atheists; full model including the interaction with sex

	Estimate	β-value	SE	t-value	p-value
(Intercept)	−4.693514	0	0.21240332	−22.09718	<0.0001
Women (Ref.: men)	0.394174	1.527666	0.03408809	11.56339	<0.0001
Age	−0.036166	−0.785531	0.00444796	−8.13092	<0.0001
Age of spouse	0.037432	1.575747	0.00229784	16.2901	<0.0001
Primary completed (Ref.: <primary)	−0.095538	−0.367253	0.07756975	−1.23164	0.2181
Secondary completed (Ref.: <primary)	0.219978	0.838547	0.07657916	2.87256	0.0041
University completed (Ref.: <primary)	0.552992	1.576854	0.07996648	6.9153	<0.0001
Education same as spouse (Ref.: lower than spouse)	−0.462394	−1.683264	0.02992673	−15.45086	<0.0001
Education higher than spouse (Ref.: lower than spouse)	−0.378596	−1.065573	0.04205298	−9.00283	<0.0001
Muslim (Ref.: Christian)	3.300911	4.332703	0.04367313	75.58219	<0.0001
Other (Ref.: Christian)	3.737414	4.890542	0.03954425	94.51222	<0.0001
Dwelling owned (Ref.: not owned)	−0.402498	−1.54442	0.02704126	−14.8846	<0.0001
Women (Ref.: men): Muslim (Ref.: Christian)	−2.367195	−2.284432	0.07611226	−31.10136	<0.0001
Women (Ref.: men): Other (Ref.: Christian)	−0.772836	−0.748522	0.05084087	−15.20107	<0.0001
df	555284				
	(Intercept)	Residual			
StdDev Random Factor:	0.3791577	0.99165			

0 = homogamous marriage, 1 = heterogamous marriage.

between 0.86 and almost 1 (in fact 0.99), but the actual intermarriage rate was below 0.8 with a mean of 0.48 (Figure 1a). For Christians (the majority group), the expected intermarriage rate was lower (between 0 and 0.8) but also the actual intermarriage rate was considerable lower (below 0.2 with and mean of 0.044), indicating that it was easy to find a Christian spouse, i.e. a member of the majority group. However, the increase of the actual intermarriage rates indicates that, in the case of more religious and more diverse regions, Christians tended to marry more frequently outside their own community (Figure 1b).

As Muslims and adherents of 'other religions' were a minority population in most of the regions, the expected intermarriage rate was very high (in Muslims between 0.994 and virtually 1 and among adherents of 'other religions' between 0.98 and also virtually 1). However, when considering the means, the actual intermarriage rates for Muslims (mean 0.28) and for 'other religions' (mean: 0.34) were considerable lower, albeit in some regions the actual intermarriage was higher, and this was caused by the small number of Muslims respectively adherents of 'other religions' (<10 individuals) in this regions, i.e. these individuals had a low chance of being engaged in a religious homogamous marriage (Figure 1c, d), and thus married outside their religious communities.

Catholics and Protestants followed a comparable pattern as Christians in general, with an increasing tendency to marry outside their religious communities, following the expected increase in intermarriage rate (Figure 2a). Although Protestants showed a steeper increase in their actual intermarriage rate compared with Catholics, some small groups of Protestants seemed to be strongly engaged in religious homogamy (indicated by the points in the lower right-hand corner of Figure 2b).

https://doi.org/10.1017/S0021932019000713 Published online by Cambridge University Press

Table 14. Christians only: General linear mixed model on heterogamy for both men and women, including the share of adherents in a region and religious denomination

	Estimate	SE	*t*-value	*p*-value
(Intercept)	−0.7053951	0.4094888	−1.72262	0.085
Women (Ref.: men)	−0.030224	0.0110211	−2.74238	0.0061
Age	−0.0032443	0.0019289	−1.68192	0.0926
Age of spouse	0.0062923	0.0011645	5.40332	<0.0001
Primary completed (Ref.: <primary)	0.5313847	0.110045	4.82879	<0.0001
Secondary completed (Ref.: <primary)	0.5140287	0.1098318	4.68015	<0.0001
University completed (Ref.: <primary)	0.624731	0.1107917	5.63879	<0.0001
Education same as spouse (Ref.: lower than spouse)	−0.0413884	0.0127064	−3.2573	0.0011
Education higher than spouse (Ref.: lower than spouse)	−0.0504014	0.0193773	−2.60106	0.0093
Share of adherents in area of residence	−0.0389641	0.0003045	−127.94562	<0.0001
Orthodox (Ref.: Catholic)	−1.677613	0.049678	−33.76972	<0.0001
Anglican (Ref.: Catholic)	1.6160408	0.0853563	18.93287	<0.0001
Other Christian Portugal (Ref.: Catholic)	0.3054261	0.0924645	3.30317	0.001
Protestant (Ref.: Catholic)	0.005378	0.0099961	0.53801	0.5906
Dwelling owned (Ref.: not owned)	−0.2209386	0.00951	−23.23215	<0.0001
df	355201			
	(Intercept)	Residual		
StdDev Random Factor:	0.8739006	0.9817714		

0 = homogamous marriage, 1 = heterogamous marriage.

Discussion

In both men and women in the study sample from European countries in 1987–2011, religious heterogamy was found to be more prevalent in atheists than in adherents of any religion. Interestingly, atheists were highly engaged in intermarriage with Christians but not with other denominations, most likely because most atheists originate from a Christian background.

Overall, women in the study had a lower chance of being in a heterogamous marriage than men. This particularly held true for Muslims, where a reasonable proportion of men, but less than 3% of women, were married to Christians. In Christians, in contrast, heterogamy was more prevalent in women than in men. A higher chance of heterogamy in women was also found in the multivariate model controlling for denomination, whereas the opposite was true in the model controlling for share of adherents to an individual's religion in their area of residence. This change in the sign between models may be attributed to the significant interaction between being a women and religious denomination: Christian women and women of other religious denominations had a higher probability of being in a heterogamous marriage compared with atheists, Christian men and men of other religions. On the other hand, Muslim women had the lowest chance of religious heterogamy. Also, in the model calculated only for women, it is obvious that Muslim women had the lowest probability of being in a heterogamous marriage. The comparably low heterogamy rates of Christian men may be attributed to the large 'marriage market' within the Christian community. The data further showed that minority religions faced a higher pressure to marry outside their communities for both men and women – a finding that was predicted by Blau *et al.* (1982).

https://doi.org/10.1017/S0021932019000713 Published online by Cambridge University Press

Table 15. Christians only: General linear mixed model on heterogamy for men only, including the share of adherents in a region and religious denomination

	Estimate	SE	*t*-value	*p*-value
(Intercept)	−0.7132714	0.4168117	−1.71126	0.087
Women (Ref.: men)	−0.0055968	0.0029833	−1.87607	0.0606
Age	0.0143913	0.0020332	7.07808	<0.0001
Age of spouse	0.4367926	0.1661587	2.62877	0.0086
Primary completed (Ref.: <primary)	0.3983218	0.1659013	2.40096	0.0164
Secondary completed (Ref.: <primary)	0.4518559	0.167162	2.7031	0.0069
University completed (Ref.: <primary)	−0.0192308	0.0215955	−0.8905	0.3732
Education same as spouse (Ref.: lower than spouse)	−0.0245895	0.0299539	−0.82091	0.4117
Education higher than spouse (Ref.: lower than spouse)	−0.0394944	0.0004538	−87.03698	<0.0001
Share of adherents in area of residence	−1.9647039	0.0806928	−24.34795	<0.0001
Orthodox (Ref.: Catholic)	1.632579	0.1267691	12.87836	<0.0001
Anglican (Ref.: Catholic)	−0.3555254	0.1539649	−2.30913	0.0209
Other Christian Portugal (Ref.: Catholic)	0.0221006	0.0148667	1.48658	0.1371
Protestant (Ref.: Catholic)	−0.2357879	0.014443	−16.32545	<0.0001
Dwelling owned (Ref.: not owned)	160722			
df	(Intercept)	Residual		
StdDev Random Factor:	0.8360755	0.9841012		

0 = homogamous marriage, 1 = heterogamous marriage.

Although in the multivariate models, in addition to sex, several parameters such as age, religious denomination, education and owning of a dwelling significantly affected the chance of being in a religiously heterogamous marriage, the most important factor in terms of variance explained was the share of adherents to an individual's religion in their area of residence. Accordingly, this fully confirms the work of Thomas (1951) and Blau *et al.* (1982) – that the increase of the share of adherents of a denomination is inversely related to the probability of being in a religious heterogamous marriage. However, by analysing men and women separately, this indicator was of much higher importance for religious intermarriage in men than in women. The same held true also for religious denomination, also explaining a much higher variance in intermarriage in men compared with women.

These findings indicate that, particularly for men, if enough potential mates from the same religious group are available within an area of residence, there seems to be no need for outmarriage. Hence, in the case of large agglomerations of people of the same religious background, the probability of admixture through intermarriage is reduced. Therefore, coinciding with urbanization, the aggregation of larger groups of religiously homogeneous people is likely to reduce intermarriage rates. This effect is higher for men than for women. The data were also in accordance to the data of Beine *et al.* (2011) concerning the size of a diaspora (i.e. the proportion of migrants of a certain ethnicity and/or religion at a certain place), who showed that the size of the diaspora explains about 71% of the variance of migration to a certain place.

The analysis of the expected intermarriage rate vs the actual intermarriage rate supports this argument, albeit among all religious groups (including individuals with 'no religion') the actual intermarriage rate was considerably lower than the expected intermarriage rate. However, if the groups were smaller they tended to practise religious intermarriage more frequently. In particular,

https://doi.org/10.1017/S0021932019000713 Published online by Cambridge University Press

Table 16. Christians only: General linear mixed model on heterogamy for women only, including the share of adherents in a region and religious denomination

	Estimate	SE	*t*-value	*p*-value
(Intercept)	−0.7447296	0.4425398	−1.68285	0.0924
Women (Ref.: men)	−0.0026143	0.0025514	−1.02465	0.3055
Age	0.0023637	0.0014297	1.6533	0.0983
Age of spouse	0.5952595	0.1468389	4.05383	0.0001
Primary completed (Ref.: <primary)	0.5870231	0.146514	4.0066	0.0001
Secondary completed (Ref.: <primary)	0.7487231	0.1479724	5.05988	<0.0001
University completed (Ref.: <primary)	−0.056407	0.0157551	−3.58024	0.0003
Education same as spouse (Ref.: lower than spouse)	−0.054777	0.0263694	−2.07729	0.0378
Education higher than spouse (Ref.: lower than spouse)	−0.0385274	0.0004104	−93.87281	<0.0001
Share of adherents in area of residence	−1.4729545	0.0634095	−23.22924	<0.0001
Orthodox (Ref.: Catholic)	1.6008663	0.1152482	13.8906	<0.0001
Anglican (Ref.: Catholic)	0.7715853	0.1191283	6.47693	<0.0001
Other Christian Portugal (Ref.: Catholic)	−0.0084112	0.0134907	−0.62348	0.533
Protestant (Ref.: Catholic)	−0.2101781	0.0126269	−16.64531	0
Dwelling owned (Ref.: not owned)	194462			
df	(Intercept)	Residual		
StdDev Random Factor:	0.9199033	0.9783355		

0 = homogamous marriage, 1 = heterogamous marriage.

Table 17. Variance explained by the different variables in the models including only married Christians

Variable	% variance explained theoretical
Sample	14.33658
% adherents	13.65649
Christian religion	2.35676
Ownership	0.58337
Education	0.10537
Education homogamy	0.01257
Age, age of spouse	0.00475
Sex	0.00070
Sum explaining factors	31.05659

members of religious minority groups with a very low number of adherents are forced to marry outside their communities.

While the models indicated that in both men and women, higher education was associated with a higher chance of being in a religiously heterogamous marriage, in terms of variance explained, compared with the size of the diaspora in a certain area, education only played a minor role (~ 1% of the variance), followed by the other explaining factors: educational homogamy, sex,

https://doi.org/10.1017/S0021932019000713 Published online by Cambridge University Press

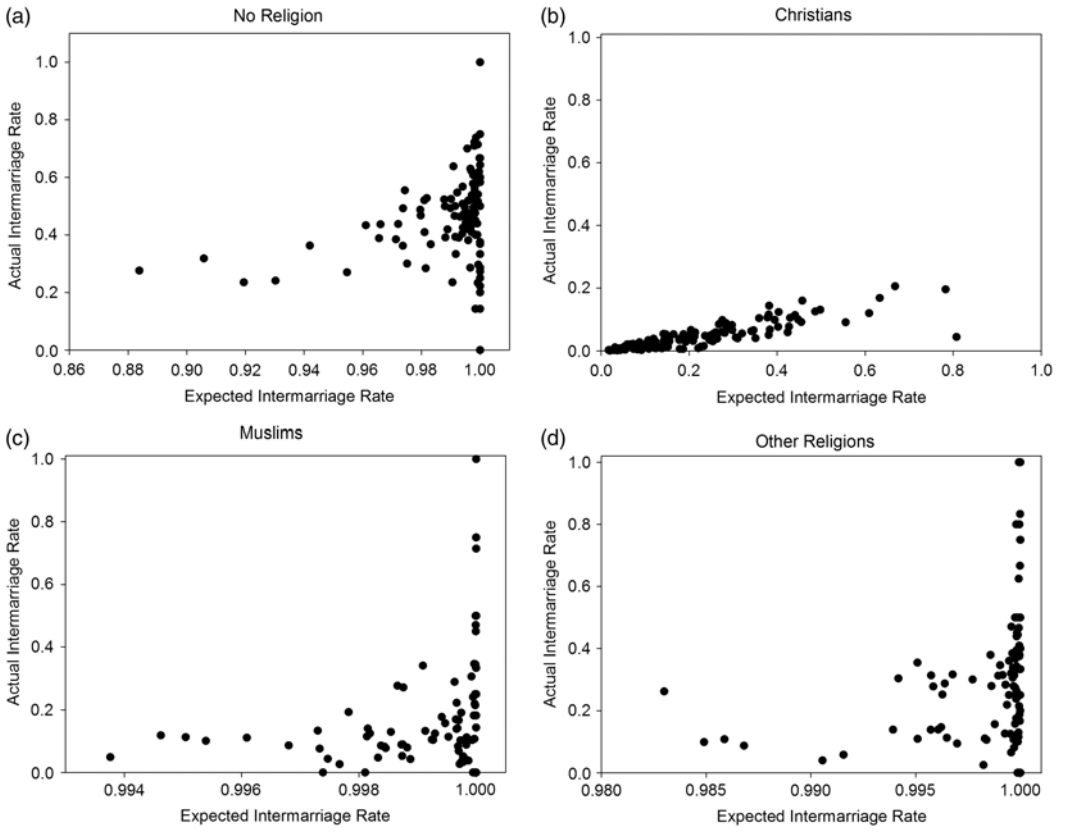

Figure 1. Expected intermarriage rate vs actual intermarriage rate for a) individuals of no religion, b), Christians c) Muslims and d) adherents of other religions.

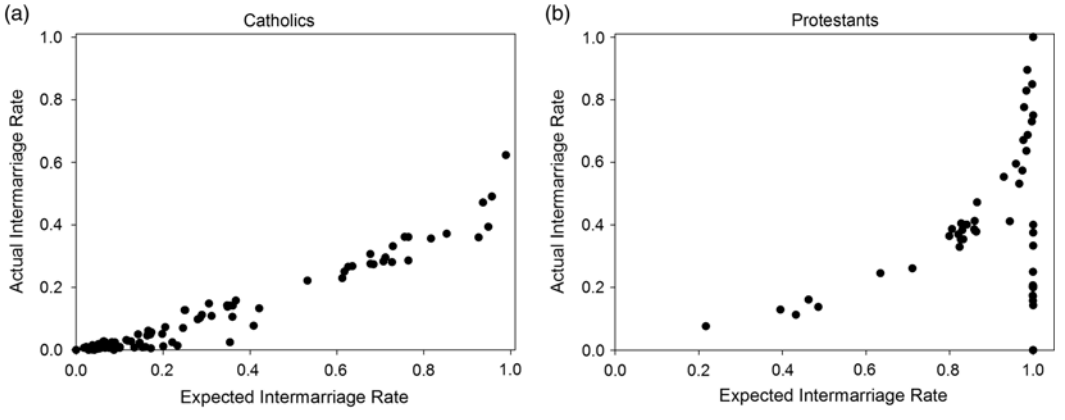

Figure 2. Expected intermarriage rate vs actual intermarriage rate for a) Catholics and b) Protestants.

age, and ownership of a dwelling only explained comparably small proportions of the overall variance of religious heterogamy. Nonetheless, the negative estimate of ownership of a dwelling indicates that individuals who had already accumulated some wealth had a lower chance of religious heterogamy compared with those who did not own a dwelling, which also held true if the spouse had the same or a higher education.

https://doi.org/10.1017/S0021932019000713 Published online by Cambridge University Press

For the analysed data, the rates of intermarriage between different religious groups correlated inversely with the size of an individual's religious group in the area of residence. Yet, by building up genetic ties across religious borders via conjoint offspring, religiously heterogamous couples (albeit of lower fertility; Fieder & Huber, 2016) foster social cohesion as family members have genetic ties even if 'separated' by religion. In such newly formed families co-operation will increase according to Hamilton's rules of 'kin selection', which – in a long-term perspective – may act as a safeguard for social cohesion and peaceful co-existence.

The initial motivation to look at the question of inter-religious marriage stemmed from witnessing the migration flows from mainly Muslim countries (such as Syria, Iraq and Afghanistan) to Europe since 2015. Considering the scope of the migration flows and the potential social impacts, it is necessary to look at intermarriage in addition to the prevailing focus on economic data. Being keenly aware that, while socioeconomic integration is subject to public policy, intermarriage is something that is rightfully beyond this realm and the reported findings of mere observational nature. Also, as diverse religious communities have co-existed in Europe for decades, this is in fact not a matter that is inherently related to migration (therefore it is referred to as social cohesion rather than integration). This leads to a strong argument for the impact of intermarriage when looking at social cohesion in the long run. This would also be in line with the findings of Adams (1983), who asserted that the issue of loyalty towards kin may have practical implications under conditions of warfare (during warfare exogamous women – stemming from the now opposing community – may be faced with contradicting loyalties, while excluding women from warfare might have resolved this antagonism).

At the same time, the analysed data sets (as well as the selection of countries and the dates of the data collection) did not match the initial motivation to study the data. However, the sample size and the diverse nature of countries studied nevertheless provide a pattern that is in line with previous findings and will help to shape future research.

The following restrictions of the analysed data should be taken into consideration. The countries and datasets were selected according to availability of the statistical data (both in terms of country selected and date of data collection). Also, it is evident that marriage is not the only form of cohabitation that is relevant in this context as any form of cohabitation that leads to offspring would support the argument. Furthermore, the issue of premarital conversion by one of the partners (in order to be able to marry) was not addressed, as the census data used did not provide any information on premarital conversion. It is, however, reasonable to assume that the issue of premarital conversion has an impact, which is probably dependent on group size and the degree of religious and/or cultural practice of the respective group. Acknowledging this potential impact on the results, there is no possibility to overcome this potential bias on the basis of cross-sectional census data.

Acknowledgments. The statistical agencies that originally produced the data were the Austria National Bureau of Statistics, Germany, the Federal Statistical Office, Ireland, the Central Statistics Office, Portugal, the National Institute of Statistics, Romania, National Institute of Statistics and the Switzerland Federal Statistical Office.

Funding. There was no funding for this study.

Conflicts of Interest. The authors have no conflicts of interests to declare.

Ethical Approval. The data used were publicly accessible census data provided by IPUMS International (https://international.ipums.org/international/). Ethical approval therefore remains with IPUMS International.

References

Adams DB (1983) Why there are so few women warriors. *Behavior Science Research* **18**(3), 196–212.
Beine M, Docquier F and Özden Ç (2011) Diasporas. *Journal of Development Economics* **95**(1), 30–41.
Blau PM, Blum TC and Schwartz JE (1982) Heterogeneity and intermarriage. *American Sociological Review* **47**, 45–62.

https://doi.org/10.1017/S0021932019000713 Published online by Cambridge University Press

Chiswick BR and Miller PW (1995) The endogeneity between language and earnings: international analyses. *Journal of Labor Economics* **13**(2), 246–288.

Esser H (2001) *Integration und ethnische Schichtung*. Arbeitspapiere – Mannheimer Zentrum für Europäische Sozialforschung.

Fieder M and Huber S (2016) The association between religious homogamy and reproduction. *Proceedings of the Royal Socity, Series B* **283**(1834), 20160294.

Goldberg A, Günther T, Rosenberg NA and Jakobsson M (2017) Ancient X chromosomes reveal contrasting sex bias in Neolithic and Bronze Age Eurasian migrations. *Proceedings of the National Academy of Sciences of the USA* **114**(10), 2657–2662.

González-Fortes G, Jones ER, Lightfoot E, Bonsall C, Lazar C, Grandal-d'Anglade A *et al*. (2017) Paleogenomic evidence for multi-generational mixing between neolithic farmers and mesolithic hunter-gatherers in the lower Danube Basin. *Current Biology* **27**(12), 1801–1810.

Hamilton WD (1964) The genetical evolution of social behaviour. II. *Journal of Theoretical Biology* **7**(1), 17–52.

Jobling M, Hurles M and Tyler-Smith C (2013) *Human Evolutionary Genetics: Origins, Peoples & Disease*. Garland Science, Oxford.

Kalmijn M (1998) Intermarriage and homogamy: causes, patterns, trends. *Annual Review of Sociology* **24**(1), 395–421.

Lipson M, Szécsényi-Nagy A, Mallick, S, Pósa A, Stégmár B, Keerl V *et al*. (2017) Parallel palaeogenomic transects reveal complex genetic history of early European farmers. *Nature* **551**(7680), 368.

Maxwell R (2010) Evaluating migrant integration: political attitudes across generations in Europe. *International Migration Review* **44**(1), 25–52.

Minnesota Population Center (2019) *Integrated Public Use Microdata Series, International: Version 7.1 [dataset]*. IPUMS, Minneapolis, MN. URL: https://doi.org/10.18128/D020.V7.1

Miller WB, Barber JS and Schulz P (2016) Do perceptions of their partners' childbearing desires affect young women's pregnancy risk? Further study of ambivalence. *Population Studies* **71**(1), 101–116.

Nakagawa S and Schielzeth H (2013) A general and simple method for obtaining R2 from generalized linear mixed-effects models. *Methods in Ecology and Evolution* **4**(2), 133–142.

Patterson N, Moorjani P, Luo Y, Mallick S, Rohland N, Zhan, Y *et al*. (2012) Ancient admixture in human history. *Genetics* **192**(3), 1065–1093.

Ralph P and Coop G (2013) The Geography of Recent Genetic Ancestry across Europe. *PLoS Biology* **11**(5), e1001555.

Reich D (2018) *Who We Are And How We Got Here. Ancient DNA and the New Science of the Human Past*. Oxford University Press, Oxford. ISBN-10: 9780198821250

Skoglund P, Mallick S, Bortolini MC, Chennagiri N, Hünemeier T, Petzl-Erler ML *et al*. (2015) Genetic evidence for two founding populations of the Americas. *Nature* **525**(7567), 104.

Ther P (2017) *Die Außenseiter: Flucht, Flüchtlinge und Integration im modernen Europa*. Suhrkamp Verlag, Berlin.

Thomas JL (1951) The factor of religion in the selection of marriage mates. *American Sociological Review* **16**, 487–491.

Cite this article: Fieder M, Schahbasi A, and Huber S (2020). Do birds of a feather flock together? Factors for religious heterogamy. *Journal of Biosocial Science* **52**, 664–680. https://doi.org/10.1017/S0021932019000713