

# Higher divorce risk when mates are plentiful: Evidence from Denmark

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**Abstract:** Work from social and biological sciences have shown that adult sex ratios are associated with relationship behaviours. When partners are abundant, opportunities for mate switching may increase and relationship stability decrease. To date, most of the human literature has used regional areas at various levels of aggregation to define partner markets. But in developed countries many individuals of reproductive age spend a considerable amount of time outside their residential areas, and other measures may better capture the opportunities to meet a (new) partner. Here we use Danish register data to test whether the sex ratio of the occupational sector is linked to divorce. Our data cover individuals in Denmark who married 1981-2002 and we control for age at and duration of marriage, education and parity. Results support the prediction that a higher proportion of opposite sex individuals in one's occupational sector is associated with higher divorce risk. This holds for both men and women, but associations are somewhat stronger for men. Our results highlight the need to study demographic behaviours of men and women simultaneously, and to consider partner markets beyond geographical areas so that differing strategies for males and females may be examined.



## Introduction

The ratio of males to females in a population has been linked to various mating and parenting behaviours. Relationship stability is one such factor which has been explored in studies of animals and humans alike. Divorce and infidelity in shore birds is more common in female-biased than male-biased species (1) and across human societies, evidence suggests that when women are scarce, long-term pairbonds are more likely to be formed and relationships are more stable (2–4). This implies that it is when *men* have more options to find another partner that relationships are more likely to dissolve. Less work has considered whether similar patterns can be seen for females when they have many alternative mates.

Part of this shortage is due to the fact that most human studies exploring sex ratio skews have defined the mating market based on area units, from states to neighbourhoods and villages (5–8). By definition, adult sex ratios of areas are the same for a couple who cohabits in that area, thus hindering any comparisons of whether men and women react differently to mate scarcity or surplus. Moreover, geographical areas may be insufficient to capture an individual's actual chances of finding a partner as these chances are often highly affected by social networks. This may be a reason for why individuals' perceptions of sex ratios in residential areas have been found to not be very accurate (9).

This study uses Danish register data to explore divorce risk as a function of the sex ratio in men's and women's occupational sector. In sociology and demography characteristics of an individual's workplace have been used to measure mating markets (10–12) and may better reflect available partners than geographical areas. The sex ratio of the occupational sector provides a measure of the opportunities to meet opposite sex partners in the everyday work environment. Compared to workplaces, individuals are more likely to remain within the same sector over time, especially in sectors where job switching is frequent.

Denmark is an ideal setting for this study. Divorce is broadly accepted also when a couple has children and both men and women typically stay active in the labour market after forming a family. Notably, the sector sex ratio in Denmark varies greatly: within the health care sector 18% are men, whereas in construction, about 92% are men (see Supplementary Table S1). Previous research from Denmark has shown that the occupational sector is linked to differences in the timing of births (13). However, family-demographic research often focuses on women and less often studies or theorizes about men's reproductive behaviours. Conversely, in the biological sex ratio literature much focus has been placed on how *male* strategies and behaviours vary with a skewed sex ratio. The detailed Danish register data allow us to shed light on the links between divorce risks of all married men and women when exposed to mate scarcity or surplus in the work environment.

We predict that many co-workers of the opposite sex in one's occupational sector is associated with a higher divorce risk. Costs and benefits of mate switching may vary for men and women, but the view of stereotyped sex roles is increasingly outdated (14) and evidence from various human and non-human societies suggest we should not necessarily expect a stronger relationship between the number of mates and reproductive success among men than among women (15). Thus, we predict that more opposite sex colleagues and lower search costs means that both sexes will be more likely to experience divorce.

## **Methods**

We use population registers comprising the entire population residing in Denmark. The data are drawn from various administrative registers that have been linked by Statistics Denmark. All information is available at the individual level and is longitudinal, including various socioeconomic, demographic and civil status histories of all men and women who were born in 1945 or later and their employment histories from 1981 and onwards. This study covers all men and women in Denmark born in or after 1945, who married an opposite sex spouse between 1981 and 2002 and who were active in the labour market in any of those years (individuals outside of the labour market are excluded). In total this renders 4 720 033 years of risk for men (102 453 divorces) and 4 954 810 years of risk for women (113 252 divorces) in employment and marriage.

Divorce risks are calculated by occupational sector (operationalized as dummies) and a set of control variables; age at marriage, duration of marriage, metropolitan residence, educational attainment and parity (for categories and distributions, see Table 1). Age at marriage is fixed and the other variables are time-varying. The 727 Danish sector codes (Danish Industrial Classification of All Economic Activities) are categorised into 47 occupational sectors, e.g. advertising, construction, hotel and restaurant, IT, health care, higher education, retail and public administration (for full list, see Supplementary Table S1). Event-history analysis for time to divorce is applied and individuals are censored if they emigrate or die. Results are presented as relative risk ratios. The sector sex ratios are plotted as the proportion of men of all individuals of reproductive age (20-44 years) in the sector during 1981-2002. Because we use the entire Danish population confidence intervals are not shown.

## **Results**

### *Demographic variables*

The results of the individual independent variables are in line with previous demographic evidence from similar countries. Divorce risk is approximately 40 percent lower for those who married after the age of 40 compared to those who married aged 16 to 22, *ceteris paribus*. Individuals who live outside the metropolitan region of Copenhagen have about 30 percent lower divorce risk. The highly educated have about half the divorce risk of those with lower education. The divorce risk is 40 percent lower for two-

child parents than those with no children (see Table 1).

#### *Occupational sector*

Figure 1a-b plots the divorce risk, net of demographic controls, over the sex ratio of the occupational sector. Results indicate that there is a negative association between the share of men in the sector and divorce risk for men, and a somewhat positive association for women. While magnitudes are not large, this is in the predicted directions; with a larger potential of finding another partner, divorce risk increases. The correlation coefficients indicate that sex composition of the sector is more strongly associated with divorce risk among men than among women ( $r = 0.187$  for men,  $r = -0.116$  for women). The sectors associated with the highest divorce risks for both men and women are the hotel and restaurant and manpower sectors, while low divorce risks are found among men and women in farming, pharmaceutical and library sectors (see Table S1).

|                              |                 | Time at risk (%) |       | Relative risks (RR) |       |
|------------------------------|-----------------|------------------|-------|---------------------|-------|
|                              |                 | Men              | Women | Men                 | Women |
| Age at marriage (years)      | 16-22           | 5.0              | 14.2  | 1                   | 1     |
|                              | 23-29           | 46.9             | 51.5  | 0.74                | 0.70  |
|                              | 30-39           | 39.4             | 28.1  | 0.67                | 0.67  |
|                              | 40 or >         | 8.7              | 6.2   | 0.61                | 0.57  |
| Residence                    | Copenhagen area | 19.4             | 19.9  | 1                   | 1     |
|                              | Rest of Denmark | 80.6             | 80.1  | 0.75                | 0.67  |
| Highest level of education   | Primary         | 23.3             | 28.4  | 1                   | 1     |
|                              | Secondary       | 52.2             | 43.9  | 0.71                | 0.66  |
|                              | Tertiary        | 24.2             | 27.8  | 0.50                | 0.52  |
| Parity                       | 0               | 17.6             | 16.5  | 1                   | 1     |
|                              | 1               | 26.9             | 25.8  | 0.74                | 0.74  |
|                              | 2               | 40.0             | 42.4  | 0.57                | 0.58  |
|                              | 3 or >          | 15.5             | 15.3  | 0.64                | 0.67  |
| Duration of marriage (years) | 1               | 11.6             | 11.5  | 1                   | 1     |
|                              | 2-3             | 20.5             | 20.4  | 3.73                | 3.53  |
|                              | 4-5             | 16.9             | 16.9  | 5.46                | 5.17  |
|                              | 6-7             | 13.7             | 13.7  | 5.37                | 4.92  |
|                              | 8-10            | 15.5             | 15.6  | 4.78                | 4.37  |
|                              | 11 or >         | 21.7             | 21.9  | 3.73                | 3.33  |

Table 1. Divorce risk (1981-2002) among individuals born 1945 or later who married between 1981 and 2002. Models control for occupational sector (see Supplementary Table S1).

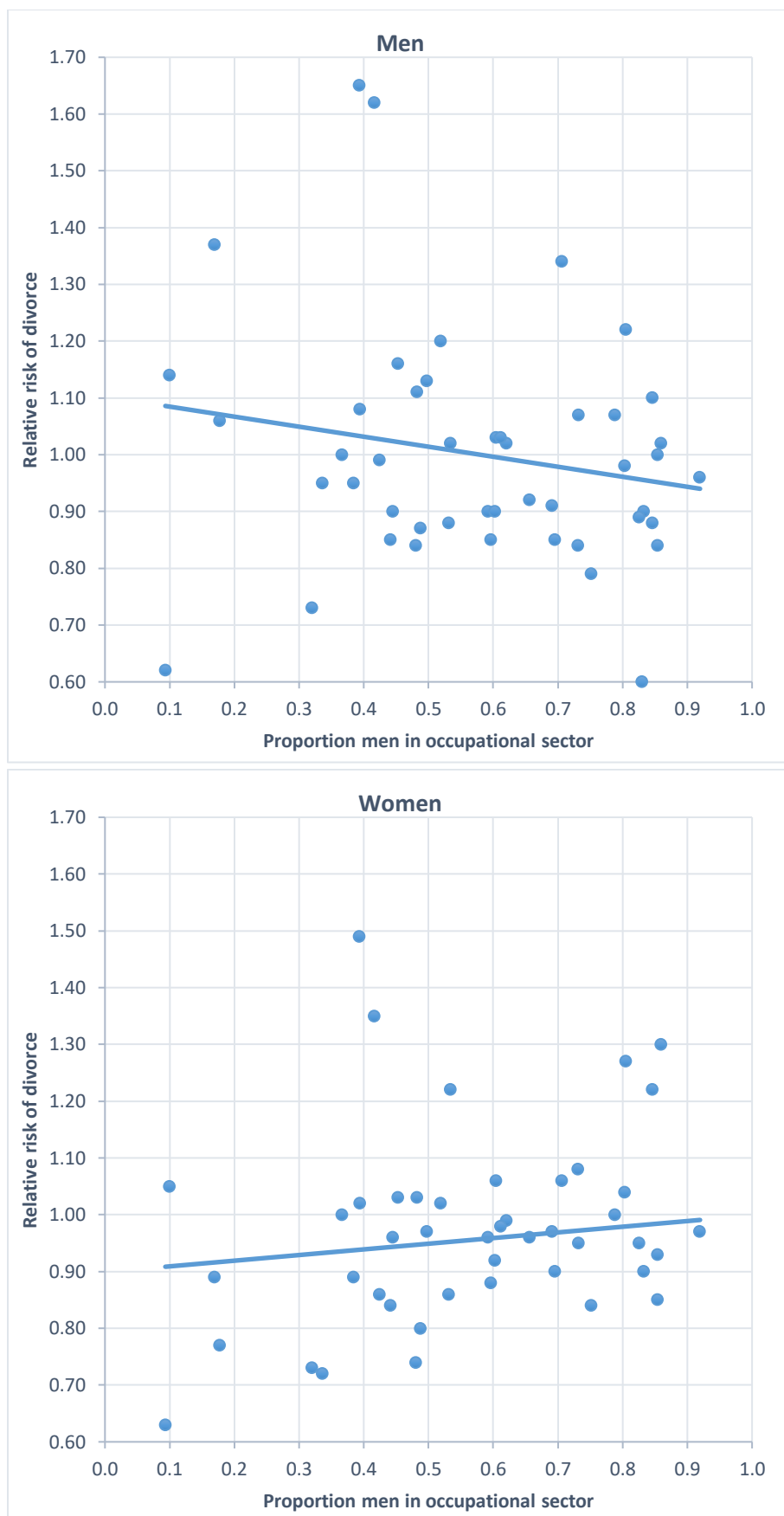


Figure 1a-b. Relative divorce risks for men (1a) and women (1b) by the proportion of men in the

occupational sector. The model includes age at marriage, duration of marriage, metropolitan residence, educational attainment, and parity.

## **Discussion**

We add to previous evidence that the adult sex ratio is associated with relationship dynamics by presenting evidence that more members of the opposite sex in one's occupational sector is associated with higher divorce risk in Denmark. We addressed the issue that area sex ratios may not accurately capture interactions with the opposite sex, and are often unable to examine whether opportunities to meet new partners differs for men and women. Results indicate that an abundance of partners of the opposite sex in one's occupational sector is associated with higher risk of divorce for both sexes, but the association appears rather weak for women.

Many people tend to partner with someone of the same educational level and field as themselves. Educational homogamy may be the result both of a preference for a partner with the same type of education and higher likelihood to meet a partner similar to oneself in educational institutions and workplaces (16). A Swedish study showed that 20% of Swedes met their current partner in the workplace and divorce risks were 70% higher in workplaces with only opposite sex colleagues of suitable age, compared to workplaces with all same-sex individuals (12). A Danish study on sex ratios of workplaces found that dissolution - but not relationship formation - was higher when partners were abundant (10). Indications that workplace sex ratios are linked to divorce, but not to probability of entering a partnership in the first hand, may reflect higher search costs and narrower partner markets for those already married.

There are several potential mechanisms for higher mate switching when mates are plentiful. Divorce may be higher when an individual is surrounded by more individuals of the opposite sex due to higher opportunities of meeting a new partner, or because the abundance of partners influences the overall perception of alternative partner choices. The relative role of these pathways are difficult to ascertain because data on the behaviours leading up to the event, or who initiated the divorce is often lacking. For example, it is possible that an abundance of alternative partners for one spouse, leads the other spouse to alter his/her strategy and that the combination of these factors eventually lead to divorce.

Some previous studies have found sex differences in behaviours linked to sex ratios in the workplace or sector. A US study found that more opposite sex partners in the occupational industry was associated with higher infidelity risk among men, but not among women. However, sample sizes were very small and the data were cross-sectional (17). Another US study incorporated the sex ratio of the spouse's workplace and found that the sex ratio of women's workplace had a greater effect on divorce than that of her husband's, but for men there was no effect of spouse's workplace sex ratio (18).



Some caution regarding selection into a given sector is warranted. It is possible that individuals who work in an occupational sector where they are outnumbered by the opposite sex differ somehow compared to same-sex peers and that this has bearing on divorce risk. Especially high divorce risks – for both sexes – in the hotel and restaurant sector and low risks in the library and farming sectors might be due to different personality types seeking to work in such sectors, different levels of stress in the work environment or the level and type of interpersonal interactions.

Many previous studies of relationship stability and sector or workplace sex ratios come from a US context, where costs and benefits of divorce as well as selection into female labour-force participation may differ from the Nordic context. We have shown that even in the egalitarian Danish setting there is a slight gender difference as the sector sex ratio appears more strongly associated with divorce among men than among women. Future research should explore both partners' alternative partner options simultaneously to uncover what circumstances lead to divorce.

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Supplementary Table 1. Relative risks (RR) of divorce by occupational sector, and exposure time (half-months) and proportion men in the sector (age 20-44). Covers the entire married population who were residing in Denmark any time between 1981-2002.

|                                   | Proportion | MEN  |               | WOMEN |               |
|-----------------------------------|------------|------|---------------|-------|---------------|
|                                   | men        | RR   | Exposure time | RR    | Exposure time |
| Farming                           | 0.83       | 0.60 | 205 802       | 0.55  | 53 659        |
| Mining                            | 0.85       | 0.88 | 10 339        | 0.56  | 1 816         |
| Food                              | 0.62       | 1.02 | 161 588       | 0.99  | 110 432       |
| Textile                           | 0.34       | 0.95 | 24 337        | 0.72  | 47 911        |
| Wood                              | 0.83       | 0.90 | 38 071        | 0.90  | 10 651        |
| Paper                             | 0.73       | 1.07 | 24 217        | 0.95  | 9 526         |
| Graphical                         | 0.60       | 1.03 | 67 412        | 1.06  | 46 825        |
| Chemical                          | 0.61       | 1.03 | 100 055       | 0.98  | 72 934        |
| Glass                             | 0.80       | 0.98 | 54 846        | 1.04  | 14 385        |
| Metal production                  | 0.79       | 1.07 | 23 687        | 1.00  | 7 990         |
| Metal work                        | 0.85       | 1.00 | 115 521       | 0.93  | 28 642        |
| Apparatus                         | 0.66       | 0.92 | 71 239        | 0.96  | 49 794        |
| Medical & optical equipment       | 0.59       | 0.90 | 30 011        | 0.96  | 26 705        |
| Vehicles                          | 0.83       | 0.89 | 236 136       | 0.95  | 68 424        |
| Furniture                         | 0.70       | 0.85 | 65 184        | 0.90  | 40 724        |
| Water & heating                   | 0.75       | 0.79 | 44 197        | 0.84  | 13 641        |
| Construction                      | 0.92       | 0.96 | 461 731       | 0.97  | 48 372        |
| Car service                       | 0.85       | 0.84 | 139 131       | 0.85  | 29 523        |
| Wholesale                         | 0.69       | 0.91 | 383 776       | 0.97  | 175 786       |
| Retail                            | 0.43       | 0.99 | 152 021       | 0.86  | 222 104       |
| Pharmacy                          | 0.09       | 0.62 | 999           | 0.63  | 11 958        |
| Hotel & restaurant                | 0.39       | 1.65 | 45 767        | 1.49  | 72 959        |
| Transport                         | 0.81       | 1.22 | 259 709       | 1.27  | 61 940        |
| Shipping                          | 0.71       | 1.34 | 62 385        | 1.06  | 25 972        |
| Postal services and telecom       | 0.60       | 0.90 | 86 148        | 0.92  | 67 638        |
| Finance                           | 0.48       | 0.84 | 275 030       | 0.74  | 305 118       |
| IT (software and hardware)        | 0.73       | 0.84 | 78 048        | 1.08  | 30 067        |
| Research & Development            | 0.49       | 0.87 | 15 705        | 0.80  | 15 713        |
| Technical & business services     | 0.60       | 0.85 | 87 521        | 0.88  | 50 950        |
| Advertising                       | 0.50       | 1.13 | 16 796        | 0.97  | 15 663        |
| Manpower                          | 0.42       | 1.62 | 7 208         | 1.35  | 16 049        |
| Cleaning                          | 0.45       | 1.16 | 33 966        | 1.03  | 47 965        |
| Services (other)                  | 0.48       | 1.11 | 32 422        | 1.03  | 35 234        |
| Public administration (ref)       | 0.37       | 1    | 130 200       | 1     | 281 689       |
| Security                          | 0.85       | 1.10 | 190 092       | 1.22  | 49 947        |
| School                            | 0.38       | 0.95 | 116 165       | 0.89  | 197 829       |
| High-school                       | 0.39       | 1.08 | 100 485       | 1.02  | 134 249       |
| Higher education                  | 0.53       | 0.88 | 36 899        | 0.86  | 35 868        |
| Health care                       | 0.18       | 1.06 | 103 421       | 0.77  | 489 806       |
| Social care                       | 0.17       | 1.37 | 109 318       | 0.89  | 894 181       |
| Sewerage, garbage, recycling      | 0.86       | 1.02 | 47 137        | 1.30  | 7 521         |
| Organizations (unions, political) | 0.45       | 0.90 | 52 796        | 0.96  | 64 274        |
| Media                             | 0.52       | 1.20 | 34 823        | 1.02  | 30 035        |
| Library                           | 0.32       | 0.73 | 3 782         | 0.73  | 12 091        |
| Leisure                           | 0.53       | 1.02 | 13 694        | 1.22  | 10 416        |
| Personal                          | 0.44       | 0.85 | 5 127         | 0.84  | 7 267         |
| Beauty                            | 0.10       | 1.14 | 2 264         | 1.05  | 24 824        |

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