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Working Late: Do Workplace Sex Ratios Affect Partnership Formation and Dissolution?

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Abstract

In this paper, I analyse the association between workplace sex ratios and partnership formation and dissolution. I find that the risk of dissolution increases with the fraction of coworkers of the opposite sex at both the female and male workplace. On the other hand, workplace sex ratios are not important for the overall transition rate from singlehood to partnership. The results suggest that the workplace constitutes a more important marriage market segment for individuals who are already in a partnership presumably due to higher search cost for (alternative) partners in general.

JEL classification: J12

Keywords: Partnership formation, dissolution, workplace sex ratios

1   Introduction

There is ample evidence that romantic workplace interactions are quite common. Based on a US survey conducted in 1992, Laumann et al. (1994) report that 15% of married couples and 18% of cohabiting couples met their current partner in the workplace. Åberg (2003) reports that a Swedish survey conducted in 1996 shows that 20% of Swedish adults met their current partner in the workplace. In a Dutch Survey from 1995, 8% reported to have meet their current partner at work (Kalmijn & Flap (2001)). In the data set used in the current study, which is based on Danish register data, around 7% of the partnership[1] formations occur between individuals who work for the same firm.

The probability of finding a suitable match at work presumably depends on the workplace composition. A number of studies have shown how the sex ratio in the local marriage market affects both partnership formation and dissolution (e.g. Lichter et al. (1991), Fitzgerald (1991), South & Lloyd (1992, 1995), Brien (1997), Cready et al. (1997), and Angrist (2002)).

The purpose of this paper is to investigate how the sex ratio in the workplace affects marriage market behavior. The project exploits firm and workplace level data to investigate how partnership formation and dissolution evolves for a group of Danish individuals.

In terms of analyzing partnership formation from the perspective of workplace interactions, the author of this paper does not know any other literature that address this aspect, whereas the association between sex ratios in the workplace and the risk of divorce are analyzed in (at least) three other studies. Both Åberg (2003) and McKinnish (2004, 2006) provide evidence that married individuals working in firms or occupations where the fraction of workers of the opposite sex is high have an increased risk of divorce.

In relation the latter studies, this paper also contributes to the literature on workplace composition and divorce. Compared to McKinnish (2004, 2006) who use industry-occupation level data I have access to much more precise information on the actual sex ratio of the workplace. Also, compared to Åberg (2003) the data set used in this paper offers notable improvements, primarily because Åberg (2003) only investigates formal marriages. This implies that she ignores cohabitation which is a highly common partnership form in Sweden. According to the UN Economic Commission for Europe Fertility and Family Surveys, less than 10% of Swedes marry directly without prior cohabitation.

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[1]Throughout the paper a partnership can be either cohabitation or marriage.

Also, a large fraction of relationships consists of cohabiting couples who never marry. In addition, the data set enables me to identify whether a new match is formed between two persons who prior to partnership formation, worked for the same employer. This makes it possible to get a more clear test of one of the main mechanisms through which the sex ratio at the workplace affects marriage market behavior. Namely, finding of a (new) partner at work.

The main finding of the paper is that the risk of dissolution increases with the fraction of coworkers of the opposite sex at both the female and male workplace. On the other hand, workplace sex ratios are not important in relation to partnership formation for single individuals. I argue that these results are consistent with a simple search model in which the costs of searching for partners increase if an individual is already in a partnership, and accordingly that the workplace becomes more important as a marriage market segment. In fact, the data set used in the present analysis support this presumption since the fraction of individuals who leave a partnership to form a new relationship with a coworker is twice the size of the fraction of single individuals who form a partnership with a colleague.

The structure of this paper is as follows. In Section 2 I give a brief description of related theoretical and empirical literature. Section 3 present the data. In Section 4 the empirical model is outlined. Section 5 and 6 give the results of the partnership formation and partnership dissolution analyses, respectively. Section 7 concludes.

2   Related literature

It has for some time been recognized that sex ratios are important for marriage market outcomes. Both Becker (1973), Keeley (1977), and Oppenheimer (1988) emphasize that marriage timing is a function of available partners and therefore that women marry faster if living in a male dominated marriage market and vice versa for men. Empirically, it has also been established that sex ratios affect both marriage formation and dissolution (see e.g. South & Lloyd (1992, 1995) and Angrist (2002)). Whereas these and related studies have investigated the effect of sex ratio in a geographically restricted area on marriage market outcomes, the purpose of the current study is to narrow the measure of sex ratios even further. I investigate the effect of sex ratio in the workplace on marriage market outcomes.

It is useful to approach the topic from a search theoretical perspective along the lines of e.g. Oppenheimer (1988) and Mortensen (1988). Any given individual might occupy one of two states: single or married[2]. In both states, partnership search can take place. It is however obvious that searching for a new partner while already in a marriage might be more expensive than searching when single. This observation is important for the present analysis, since I am focusing on workplace encounters and since workplaces presumably constitute a larger part of the potential marriage markets for married persons than for singles. With this is mind, I imagine that individuals search for partners to marry. Marriage offers arrive at a finite rate. The decision to accept a given marriage proposal depends on the expected return to the current partnership compared to continued search for another partner. In standard stationary search models, the optimal behavior for individuals is to follow a reservation level strategy, where the first individual who proposes marriage and has a quality that satisfies the reservation level is accepted. For a given reservation level, an increase in the number of potential partners will increase the probability of marriage. In this case I expect that individuals who are working in firms with a higher fraction of employees of the opposite sex are more likely to find a (new) partner. As workplace encounters are assumed to be more important for individuals already married (due to the higher cost of searching in other segments of the marriage market), I expect this effect to be more pronounced for married individuals than for single individuals. Clearly, individuals might increase their reservation level when they realize that the arrival rate of marriage offers increases (they become more choosy). A higher reservation level has an offsetting effect on the probability of observing a match. In the job search literature it has been shown that the former effect dominates for most parametric configuration of the distribution of offers (e.g. van den Berg (1994)). In light of this literature, I expect to find a positive association between sex ratios in the workplace and partnership formation for both single and married people, where the effect for married people in terms of divorce is expected to be more pronounced.

As mentioned earlier, there is a number of studies that have shown how the sex ratio in the local marriage market affects both partnership formation and dissolution (e.g. Lichter et al. (1991), Fitzgerald (1991), South & Lloyd (1992, 1995), Brien (1997), Cready et al. (1997), and Angrist (2002)). In terms of looking at the workplace as an isolated marriage

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[2]We will use the term married for both cohabiting and formally married couples.

market, the literature is more slim. Below I give a detailed account of the existing studies I have been able to locate, i.e. Åberg (2003) and McKinnish (2004, 2006).

Åberg (2003) approaches the subject from a sociological angle and wishes to investigate how social context affects the risk of divorce. Her measure of social context is based on coworker characteristics. She argues that coworker characteristics can affect divorce decisions through four mechanisms; opportunity-based mechanisms, belief-based mechanisms, desire-based mechanisms, and trigger mechanisms. The first relates to the observation that increased access to alternative partners increases the likelihood of finding a better match than the current. This intuition is empirically supported by studies by Udry (1981) and South & Lloyd (1995). The belief-based mechanism emphasizes that the decision to divorce is taken under imperfect information. It is not perfectly predictable how ones life will be after a divorce. It is, however, possible to gather information from already divorced colleagues on the expected outcome. Accordingly, the more divorcees a person encounters in the workplace, the more likely is the person, according to Åberg (2003), to divorce. The desire-based mechanism works through social norms. Although a person might desire to divorce, he/she be deterred from doing so if social norms are against it. Again, a social network with a large amount of divorcees would presumably increase the probability that the desire to divorce dominates the social norm not to. The trigger mechanism relates to the observation that even though the value of marriage compared to either singlehood or marriage to another partner is low, the final decision to divorce can be accelerated by some trigger event. Åberg (2003) suggests that a possible trigger event could be the news of someone else's divorce. Again, the empirical prediction from this mechanism corroborates the earlier predictions.

To justify the use of workplace characteristics as a proxy for social context or social network Åberg (2003) states that, according to a Swedish study, 50% of all employed persons socialize with their colleagues during off-hours. In addition, a Finish survey conducted in 1992 reveals that among married persons 49% of men and 40% of women had at least once fallen in love with a colleague or another person they met at work (Kontula & Haavio-Mannila (1995)).

Åberg (2003) uses the 1991 Swedish Establishment Survey, which is a representative sample of workplaces. Åberg's analysis uses annual information on around 37,000 individuals with workplace information from the years 1988-1995. Using a Cox proportional

hazard model, she estimates how various workplace and individual characteristics affect the divorce risk. Two caveats are worth mentioning. First, she only considers formal marriages. This implies that she ignores cohabitation which is a highly common partnership form in Sweden. According to the UN Economic Commission for Europe Fertility and Family Surveys,[3] less than 10% of Swedes marry directly without prior cohabitation. Also, a large fraction of relationships consist of cohabiting couples who never marry. Second, she uses information of the complete marriage for individuals in the sample although it is only conditional on observable characteristics in the period 1988-95. In essence, she has left-truncated durations (on top of that which arises from discarding periods of cohabitation prior to marriage), and it is not obvious that she controls for this in the estimation.

Her findings corroborate expectations: the divorce risk increases with the proportion of coworkers of the opposite sex and of appropriate age (15 years older and 5 years younger for women, and 5 years older and 15 years younger for men) and also with the proportion of coworkers that are divorced themselves. Åberg (2003) concludes that "..a person is 70% more likely to divorce if all her coworkers are of the opposite sex and of appropriate age, compared to when all coworkers are either of the same sex, or are too old or too young to be interesting as potential partners..".

McKinnish (2004, 2006)[4] uses the U.S. 1990 Census to calculate the fraction of workers that are female by industry-occupation cells. These fractions are then used as regressors in two different models.

The first model is a linear regression model where the dependent variable is an indicator variable that takes the value 1 if the individual is currently divorced in the 1990 Census and 0 otherwise. The finding from the basic model is that women who work in more female dominated industry-occupation cells are less likely to divorce. The same results are found for men working primarily with other men, although this effect is statistically insignificant. There are a number of cautions to this model. First, the sex-mix at the workplace might differ from that of the worker's industry-occupation cell. Second,

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[3]The country specific surveys contain between 1700 and 6000 females and are collected at different times in the different countries ranging from 1988 to 1999. For more information on these surveys see http://www.unece.org/ead/pau/ffs and Svarer (2004).

[4]The two papers address the same topic. In the following, attention is devoted to the more elaborate 2006 version.

McKinnish (2006) rightfully argues that the choice of industry-occupation cell might be endogenous to the divorce process. It is, however, not obvious in which way the estimates are biased if endogeneity is not addressed. For example, women working in more male dominated industry-occupation cells might be more independent and less family-oriented and will be more prone to divorce regardless of exposure to alternative mates. On the other hand, women working in more male dominated industry-occupation cells might have a higher level of education, and since level of education traditionally is inversely related to divorce, they might be less likely to divorce. To address the endogeneity issue, McKinnish (2006) uses two different strategies. First, she augments the basic model with industry-occupation fixed effects to remove any unobserved industry and occupation characteristics. The results are in accordance with the basic model, but now the effect for males becomes statistically significant. Second, McKinnish (2006) pursues a IV strategy in which the industrial and occupational composition of employment in the local labour market is used as an instrument. The results from this analysis show even stronger effects than the two previous models. That is, both men and women working in industry-occupation cells with a high fraction of workers of the opposite sex have an increased risk of divorce. Assuming that the IV technique works, this suggests that it is not more divorce prone individuals who seek employment in industries with a lot of alternative marriage partners.

The second model exploits NLSY79 data to construct a panel data set based on information for the years 1979-2000. The sex-mix information is still based on Census data from 1980 and 1990. Hence, while the sex-mix measure for a given occupation only changes once (at the switch from using the 1980 to the 1990 Census), the individual's occupation is recorded at each interview so the sex-mix they experience can change from year to year. Compared to the first model presented above, the data set is now substantially smaller. This has implications for the results. McKinnish (2006) was not able to successfully implement neither the fixed-effect nor the IV strategy. The results found (which are based both on OLS and a discrete-time hazard model) show that the expected effect is found for women, but that the effect for men is statistically insignificant although pointing in the right direction.

The findings in McKinnish (2006) suggest that industry-occupation sex-mix is quite important for divorce risk. Moving a woman from the 25th percentile to the 75th percentile of fraction of female in industry-occupation cell decreases the probability of divorce by

3.7 percentage points in the OLS model[5]. With a mean divorce rate of 19.4 percent this constitutes a 20 percent change in divorce risk. For men the results are significantly smaller.

In sum, both Åberg (2003) and McKinnish (2004, 2006) provide evidence that workplace sex ratios matter for divorce (although McKinnish's measure is somewhat inaccurate, since she does not have workplace data). Åberg (2003) does not address the potential endogeneity issue of sex composition. When McKinnish (2006) uses fixed-effects or IV techniques to account for endogeneity, she finds results that are in accordance with the model in which sex ratios are treated as exogenous. In particular, she finds that for women the magnitude of the explanatory variable decreases for the fixed-effect estimator compared to the OLS version, whereas it increases for the IV model. For men, both the fixed-effect and the IV lead to larger effects of sex-ratios on divorce risks. The former finding raises doubt that the endogeneity issue is satisfactorily handled. On the other hand, taken at face value McKinnish's results do not suggest that more divorce prone people are more likely to seek employment in places where the number of alternative partners is high.

3   Data

The data set used in the present analysis come from IDA (Integrated Database for Labour Market Research) created by Statistics Denmark. The information comes from various administrative registers that are merged in Statistics Denmark. The IDA sample used here contains (among other things) information on marriage market conditions for a randomly drawn sub-sample of all individuals born between January 1, 1955 and January 1, 1965. The individuals are followed from 1980 to 1995. The data set enables us to identify individual transitions between different states on the marriage market on an annual basis. In addition, the data set contains a number of demographic, socioeconomic, and workplace related variables for each individual. If a person from the sample forms a partnership

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[5]McKinnish (2005) also reports IV results that show that the divorce risk decreases by 80% when moving a woman from the 25th percentile to the 75th percentile of fraction of female in industry-occupation cell. In light of the discussion in the returns-to-schooling literature and IV estimation (see e.g. Card (2001)), this finding should be interpreted with great caution. Especially since the fixed-effect results (also reported in the article) show much smaller effects.

I also have information on a number individual characteristics of the partner. When the partnership ends the data set do not follow the partner and there is no available information on the marriage market history that follows after a break with an individual from the original sample.

The main variable of interest is the fraction of workers of opposite sex at the workplace. This number is simply calculated as the number of workers of the opposite sex divided by the total number of employees at the workplace each year[6]. A workplace is defined as a unit of a firm which has its own address and produces a given good or service. In comparison, the label "firm" is used for a legal entity that encompasses one or more workplaces. The data set contains information on the number of male and female workers on both workplace and firm level. In terms of the issue of interest in this paper, which is proximity of potential partners, the workplace level data presumably offer a more direct measure of the group of individuals that surrounds the unit of observation than firm level data do. It is not all working individuals that have a workplace identification number. This occurs if individuals perform a task that does not take place at a given workplace. I.e. taxi drivers, cleaning personal, insurance salesmen, and all other individuals who do not have a fixed address at which they perform their job. Although these individuals might be in contact with a workplace and meet others through this contact, information on the sex ratio of their workplace is missing. In the following, the fraction of workers of the opposite sex for these individuals as well as for individuals who are out of work at the moment of observation is set to 0. To distinguish from workers who do not have coworkers of the opposite sex I include a indicator variable which takes the value 1 if the fraction of coworkers is missing and 0 otherwise.

In Figure 1 the distribution of the fraction of coworkers of the opposite sex is presented.

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[6]The distribution of firm size in Denmark is very right-skewed. There is a majority of smaller entities. In around 40% of the workplaces in the sample individuals have less than 10 colleagues of the opposite sex and around 70% have less than 50. The median number of coworkers of the opposite sex is 16 for men and 27 for females.
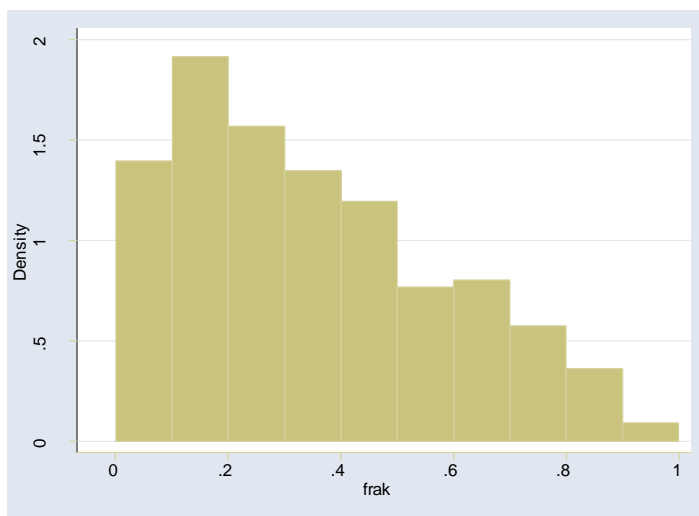
Figure 1: Distribution of fraction of coworkers of the opposite sex.

The pattern is consistent with McKinnish (2006) for the US and shows that the labour market to some extent is segmented according to sex.

I perform two sets of analysis in the paper. First, I look at partnership formation and how workplace sex ratio affects the transition from singlehood to cohabitation or marriage. Second, I investigate the issue of partnership dissolution. I present the relevant explanatory variables for the different analyses as I move along.

4   Empirical strategy

In both the partnership formation analysis and partnership dissolution analysis I use duration models. Based on the available information I construct two types of spells: single spells and partnership spells. The first type starts when an individual ends a partnership. I then follow the individuals over time until they find a new partner or the observation periods end. In the latter case the spell is right censored. This strategy implies that I delete all left censored spell. For individuals who start the observation period as single I have no information on how long time the elapsed duration has been and I therefore ignore these observations in the analysis[7]. I follow the same strategy for the partnership dissolution analysis. Here I sample all individuals who enter a relationship either as

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[7]I also conduct the analysis including left censored observation to get a picture of how sensitive the results are to the omission of these observations.

cohabiting or married and follow then until the partnership ends or the sample periods stop. Both procedures give a flow sample of single spell/partnerships. The duration model is specified as a mixed proportional hazard model. That is, it is a product of a function of time spent in the relationship (the baseline hazard), a function of observed time-varying characteristics, x, and a function of unobserved characteristics, v;

$$h(t|x_t, v) = \lambda(t) \cdot \varphi(x_t, v), \tag{1}$$

where $\lambda(t)$ is the baseline hazard and $\varphi(x_t, v)$ is the scaling function specified as $exp(x'_t\beta + v)$.

Since I only observe the transitions on the marriage market on a yearly basis, I specify a model for grouped duration data (see e.g. Kiefer (1990)). The marriage duration T is observed to lie in one of K intervals, with the k'th interval being $(t_{k-1}; t_k]$ and the convention $t_0 = 0$ for $k = 1, ..., 15$. The probability that the duration T for an individual with explanatory variables x_t is greater than t_k given that the duration is greater than t_{k-1} is given by:

$$
\begin{aligned}
P(T > t_k | T > t_{k-1}, x_k, v) &= \exp\left[-\int_{t_{k-1}}^{t_k} h(t|x_t, v)dt\right] \\
&= \exp\left[-\exp\left[x_k\beta + v\right] \cdot \Lambda_k\right]
\end{aligned}
\tag{2}
$$

where $\Lambda_{i,k} = \int_{t_{k-1}}^{t_k} \lambda_i(t)dt$. The interval-specific survivor expression (2) is henceforth denoted α_k. The probability of observing an exit out of marriage in interval k, conditional on survival until $T > t_{k-1}$, is consequently $1 - \alpha_k$. If I do not specify a functional form for the baseline hazard, the $\Lambda_{i,k}$s are just parameters to be estimated.

The individual contribution to the likelihood function is then

$$\mathcal{L} = \int (1 - \alpha_k)^j \alpha_k^{1-j} \prod_{l=1}^{k-1} \alpha_l g(v)dv, \tag{3}$$

where $g(v)$ is the probability density function of the unobservables and where $j = 1$ if the marriage is not right censored and 0 otherwise. Uncompleted durations therefore only contribute with the survivor probabilities. $g(v)$ is assumed to follow a discrete distribution with two points of support.

In relation to the partnership formation analysis I also consider a competing risks specification where I distinguish between single spells that end because an individuals find a partner at work and spells that end when a partner outside work is located. The

empirical model is then augmented accordingly. Let j_i $(i = w(\text{work}), nw(\text{not work}))$ denote the destination specific indicator. That is j_w equals 1 when an individuals forms a partnership with a coworker and 0 otherwise. The interval-specific survival probabilities are then

$$
\begin{aligned}
\alpha_k(x, z_k, v) &= \exp\left[-\int_{t_{k-1}}^{t_k} h_w(t|x, z_k, v_w)dt - \int_{t_{k-1}}^{t_k} h_{nw}(t|x, z_k, v_{nw})dt\right] &(4)\\
&= \exp\left[-\exp\left[x\beta_w + z_k\gamma_w\right] \cdot v_w \cdot \Lambda_{w,k} - \exp\left[x\beta_{nw} + z_k\gamma_{nw}\right] \cdot v_{nw} \cdot \Lambda_{nw,k}\right]\\
&= \alpha_{w,k} \cdot \alpha_{nw,k},
\end{aligned}
$$

and the corresponding likelihood function is

$$
\mathcal{L} = \int\int (1 - \alpha_{w,k})^{j_w}(1 - \alpha_{nw,k})^{j_{nw}}\alpha_k^{1-j_w-j_{nw}}\prod_{l=1}^{k-1}\alpha_l g(v_w, v_{nw})dv_w dv_{nw}. \qquad (5)
$$

As mentioned in the previous section, workplace information is missing for part of the sample. For these individuals the probability of finding a partner at work is obviously zero. I address this issue by restricting the cause-specific hazard into partnership with a coworker to zero in the likelihood function. That is, they do not contribute to this part of the model.

5 Analysis of partnership formation

The main interest here is to investigate whether the probability of exiting a single spell is affected by the fraction of coworkers of the opposite sex. In addition, I also distinguish between partnerships with a coworker and with a non-coworker. The distribution of the dependent variable is as follows:

No. of single spells	20565
No. of these:	
- that are right censored	10343
- that find partner at workplace	800
- that find partner at firm	1188

Around 5% (7%) of the partnerships formed are among coworkers from the same workplace (firm). There are good reasons to believe that this number underestimates

the true number of partnerships formed between colleagues[8]. Some firms have a policy of not employing couples, which may cause newly matched individuals to change jobs. In addition, if two individuals are employed at the same workplace, but the workplace does not have an identification number, they do not count as coworkers. Also, the data set cannot identify all partnership formations that take place in the sample, since I only consider partnerships formed by single individuals in this part of the paper. The reason why I focus on singles is that it provides a clear view of how workplace sex ratios affect this group compared to the group of individuals who are already in a relationship and for whom the workplace presumably constitutes a larger segment of their search environment[9].

In addition to information on workplace sex ratios, I use a range of other time-varying explanatory variables to describe partnership formation. Following the empirical marriage formation literature (e.g. South & Lloyd (1992)), I include information on age (and age squared), income, education, children and occupation. The income variable measures gross annual income and includes wage income, capital gains and public transfers. The income variable is deflated with the consumer price index and is measured in 1980 prices. I include 4 educational level dummies. The reference group is less than high school. Vocational education refers to individuals that have some sort of practical training, such as carpenters etc. The other categories refer to different levels of further education. Short cycle further education includes people who have studied for 14 years in total, individuals in the medium cycle further education category have studied for 16 years and long cycle further education includes people who have studied for at least 18 years. I also have an indicator variable for individuals currently attending education. I include an indicator variable that takes the value 1 if the person has children. Finally, there are two occupational dummies: white collar workers and blue collar workers, where the reference group consists of individuals who are either unskilled or not employed.

In Table 1, I present descriptive statistics and the results from the partnership analysis.

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[8]If I only consider individuals with workplace information I find that of those who find a partner 9,4% find a partner at the workplace and 12% find a partner in the firm in which they work. These number are closer to the ones reported by Laumann et al. (1994) and Åberg (2003).

[9]In the partnership dissolution analysis in Section 6 I address the issue of partnership dissolution that are followed by a new relationship with a coworker.

Table 1

	Means	Transition to partnership	Transition to partnership with:	
			Coworker	Other
Fraction of coworkers of opposite sex	0.203	0.033	2.339**	-0.144**
	0.248	*0.046*	*0.172*	*0.049*
Workplace information missing	0.429	-0.098**	-	-0.120**
		0.024		*0.025*
Age (/100 in duration model)	24.85	6.826**	-0.176	6.713**
	5.978	*0.429*	*9.273*	*0.436*
Age squared (/1000 in duration model)	653.18	-1.732**	-0.358	-1.714**
	284.35	*0.096*	*1.710*	*0.098*
Children	0.222	-0.257**	-0.285**	-0.258**
		0.022	*0.105*	*0.022*
Income (in 100,000 DKK)	0.766	0.182**	0.648**	0.163**
	0.565	*0.017*	*0.101*	*0.017*
White Collar	0.319	0.109**	0.284**	0.105**
		0.021	*0.098*	*0.022*
Blue Collar	0.108	0.029	0.184	0.022
		0.029	*0.140*	*0.030*
Vocational education	0.407	0.124**	0.082	0.127**
		0.019	*0.093*	*0.019*
Short cycle further education	0.039	0.139**	0.202	0.138**
		0.044	*0.175*	*0.046*
Medium cycle further education	0.035	0.219**	0.289*	0.206**
		0.045	*0.164*	*0.047*
Long cycle further education	0.026	0.151**	-0.329	0.164**
		0.052	*0.218*	*0.054*
Currently attending education	0.274	-0.164**	-0.333**	-0.162**
		0.020	*0.108*	*0.021*
No. of spells	20656			
Mean duration (in years)	4.034			

Note: ∗ (∗∗) indicates significantly different from 0 at the 10% (5%) level.
Standard deviations (descriptives) and standard errors in italics.

The results presented in Table 1[10] are in strong accordance with expectations. For
the explanatory variables traditionally used in empirical matching analysis, I find that

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[10]The estimated baseline hazard coefficients and the unobserved heterogeneity components are not
reported in the table. The baseline hazard shows a declining hazard rate and the inclusion of the
unobserved heterogenity terms did not improve the fit of the model. The results presented are from a
model without unobserved heterogeneity. In addition, I have also estimated versions of the models where
I distinguish between men and women, where I include the confounding variables in sequential order,
where I investigate random effects version of the models, where I included left censored observations,
and where I used fraction of coworkers of the opposite sex at the firm level as well as interaction effects
between fraction of coworkers of opposite sex and firm size as explanatory variable. Since the main results
were unaffected by these elaborations, I only report the results from the basic model. Results from the
alternative specifications are of course available upon request.

the transition rate to partnership is higher for individuals being more educated, richer and higher ranked in terms of occupation[11]. The presence of children is perhaps not the best attribute a person can bring to a new relationship. Accordingly, the matching rate is lower for individuals with children from previous relationships. Currently attending college is also not a characteristic that enhances the instantaneous probability of finding a partner. This association could be due to financial constraints in terms of acquiring housing, and it could also reflect the age dimension, i.e. that individuals tend to wait after they have finished their education before they settle down with a partner.

I find that the fraction of coworkers of the opposite sex does not affect the instantaneous probability of finding a partner. This suggests that for single people, workplaces do not constitute the most important marriage market segment, and that they are using other arenas to find partners. In addition, individuals with missing workplace information are less likely to find a partner. This probably reflects that this group on average have worse characteristics than individuals with workplace information[12]. Despite the fact that I do take level of education, income and age effects into account, I still find that this group have a harder job finding a spouse. One reason for missing workplace information is that individuals are outside the labour market. In light of Becker (1973), it could be argued that due to household specialization gains, individuals who are not active in the labour market could be more attractive partners than individuals who work. There is, however, ample evidence that there is positive assortative matching in income – also after correcting for level of education (see. e.g. Nakosteen & Zimmer (2001) and Gautier et al. (2005)).

Turning to the last columns of Table 1 where a distinction is made between leaving the single state to form a partnership with a partner who is also a colleague as opposed to a person who is not a colleague, I find that the fraction of coworkers of the opposite sex has a strongly positive effects on the transition into partnerships with a coworker and a small negative effect on the transition into partnerships with a person that is not a colleague. That is, even though the overall transition rate into partnership is not significantly affected

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[11]These results are in accordance with other studies on partnership formation (see e.g. Aassve et al (2002) and Xie et al. (2003)).

[12]Investigating the differences in the personal characteristics for individuals with workplace information compared to those without, I find that the latter group on average have lower levels of education, lower income, and are younger.

by the workplace sex mix, the result do suggests that the workplace does serve as a local marriage market, and that the gender mix at work does matter for partnership formation. In terms of the literature on sex ratios in the local marriage market it is reassuring that the probability of finding a partner at work increases in the relative supply of potential partners.

In terms of the quality of partners, I argued earlier that an increase in the arrival rate of partnership offers could affect the acceptance set of individuals. An individual who works in a workplace with a large fraction of colleagues of the opposite sex could become more choosy. One way to investigate whether this is indeed the case is to analyze the stability of partnerships that occur between colleagues as opposed to those that form between individuals who did not meet at their place of work. The next section addresses partnership dissolution.

6   Analysis of partnership dissolution

Having established that workplace sex ratios are not paramount to partnership formation for singles, the next step is to analyze how it affects the duration of relationships. Based on the previous findings by Åberg (2003) and McKinnish (2004, 2006), I expect workplace sex ratio to have a positive effect on dissolutions, since the workplace presumably constitutes a more important marriage market segment for individuals who are already in a relationship.

Some of the included explanatory variables in this part of the paper are identical to the variables used in the partnership formation analysis. The additional variables are described below[13]. I distinguish between cohabiting relationships and marriages by the indicator *married*. A variable indicating the order of relationship the individual currently occupies is measured by the *relationship number* variable.[14] This takes the value 1, if it is the first relationship in which the unit of observation is registered. Subsequent relationships with different partners raise this number. The variable, *sickness*, is an in-

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[13]The choice of explanatory variables is decided partly by what is available in the data set and partly by what is typically used as explanatory variables in the empirical divorce literature (see e.g. Becker et al. (1979) and Svarer (2004)).

[14]The measurement of the variable is a little dubious since I only have the information on previous partners for individuals who were originally in the sample. For their partners I do not know their previous relationship history.

dicator variable taking the value 1 if the individual receives sickness benefits for at least 13 weeks during the year. I also distinguish between individuals living in the Copenhagen metropolitan area and individuals living in the provinces by the indicator variable *province*. I include each individual's annual degree of unemployment. This variable is defined as the number of hours of unemployment divided by the number of potential supplied working hours.

I also include variables to capture the likeness of couples. In terms of education, I include two indicator variables that show whether the partners have the same level of education or if the male part is more educated[15]. In terms of age, I include indicator variables to show the age difference. I use a dummy for females being more than 4 years older and vice versa for males being 4 years older. I have three time-varying indicator variables for the presence of children. These are, *first child, second child* and *third+ children.*

In Table 2 descriptive statistics and results for the dissolution analysis are presented.

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[15]To avoid problems with multicollinearity, I only include educational level and age of the male. There is a large amount of literature that shows very high levels of positive assortative matching both in terms of education and age. Gautier et al. (2005) find a bivariate correlation of 0.48 between years of education for Danish couples. Similar levels are found for other countries.

TABLE 2

DESCRIPTIVE STATISTICS AND RESULTS FOR DISSOLUTION MODEL

	Descriptives[a]		Dissolution hazard	
	Mean	Std. Dev.	Coeff.	Std. err.
Fraction of coworkers of opposite sex for female	0.249	0.267	0.343**	0.063
Workplace information missing for female	0.364		0.204**	0.036
Fraction of coworkers of opposite sex for male	0.207	0.241	0.307**	0.065
Workplace information missing for male	0.371		0.173**	0.034
Same workplace at time of partnership start	0.061		-0.154**	0.059
Married	0.098		-1.114**	0.038
Relationship number	1.371		0.102**	0.029
Living outside Copenhagen	0.601		-0.349**	0.026
Children (at last year of relationship)				
First	0.48		-0.514**	0.036
Second	0.26		-0.010	0.054
Third +	0.05		-0.102	0.140
Age				
Male between 15-20	0.462		0.018	0.067
Male between 21-25	0.326		-0.058	0.054
Male between 26-30	0.143		-0.010	0.045
Female more than 4 years older	0.051		0.467**	0.059
Male more than 4 years older	0.256		0.208**	0.035
Education, male				
Vocational	0.501		-0.316**	0.032
Short cycle further	0.049		-0.321**	0.058
Medium cycle further	0.065		-0.484**	0.056
Long cycle further	0.079		-0.456**	0.056
Couple has same level of education	0.463		0.078**	0.031
Male more educated	0.298		0.206**	0.039
Income, in 100,000 DKK 1980 prices				
Female	0.584	0.362	-0.316**	0.041
Male	0.882	0.539	-0.269**	0.025
Sickness and unemployment				
Sickness, female	0.098		0.076**	0.032
Sickness, male	0.105		0.055*	0.033
Unemployment rate, female	0.124		0.141**	0.047
Unemployment rate, male	0.105		0.401**	0.052
Number of couples		19471		
Mean duration		6.881		
Dissolutions		0.369		

Note: *a*: Descriptives are measured at first year of relationship.
∗ (∗∗) indicates significantly different from 0 at the 10% (5%) level

The results presented in Table 2[16] show that the risk of divorce increases with the fraction of coworkers of the opposite sex at both spouses' workplace. The effect on the

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[16]The estimated baseline hazard coefficients and the unobserved heterogeneity components are not reported in the table. The baseline hazard shows a declining hazard rate (as in Svarer (2004, 2005)), and the unobserved heterogenity terms are statistically significant. Their presence, however, have no influence on the main results. In addition, I have estimated versions of the dissolution model with different configurations of the explanatory variables. It turned out that the effect of workplace gender composition was not sensitive to this. I therefore only present the main model. Also, I allowed for

dissolution risk from working in a workplace with no coworkers of the opposite sex compared to a workplace where all coworkers are of the same sex as the individual in question is that the divorce risk is increased by 41% (36%) for the female (male) workplace. These finding are in accordance with Åberg (2003) who also finds significant effects for both males and females. Åberg (2003) finds that the divorce risk is around 70% higher for an individual who is the only representative of her or his gender in the workplace compared to individuals who are surrounded by colleagues of same gender only. Åberg (2003) discards cohabiting couples in her analysis. Restricting the sample to formally married, I find that the divorce risk is indeed higher if the female has more male colleagues (the magnitude of the effect does not show significant changes for males) than in the regression combining cohabiting and married couples. Without knowing whether Åberg (2003) would find lower effects on divorce risk from workplace gender composition had she included data on cohabiting couples, the pattern does suggest that the workplace is more important in terms of on-the-job search the more formal the relationship is. In general, cohabiting relationships are more fragile (the dissolution rate is around 70% smaller for formally married couples than for those who cohabit), and their construction could very well differ from formal marriages (see e.g. Forste (2002) for a sociological view on the difference). Continuing the speculation and combining with the observation that partnership formation of the single individuals do not hinge on the availability of coworkers the result tentatively suggests that the costs of on-the-job search increase from cohabitation to marriage.

Again, I find that individuals with missing workplace information are less likely to succeed in the marriage market. For these individuals, the dissolution risk is higher than for individuals with workplace information. As mentioned previously, this group has less favorable characteristics in terms of education and income – traits that also matter in relation to the length of relationships, as is shown by the coefficients of income and education in Table 2.

Couples who, at the start of their relationship, share the same workplace are less likely to break up. This result, together with the finding that individuals are more likely to find a partner at work if the sex ratio works in their favour, suggests that individuals tend

interaction effects between fraction of coworkers of opposite sex and number of coworkers to look for firm size effects. There turned out to be no statistical significant difference across firm sizes so these results are not presented in the paper, but are of course available upon request.

to become more choosy when arrival rates increase. Of course, this presupposes that the length of the partnership can be used as a proxy for quality of the partnership.

In sum, the results presented above suggest that workplace sex ratio matters for partnership dissolution. This is consistent with related studies on workplace composition (Åberg (2003) and McKinnish (2004, 2006)) and also with studies that consider more widely defined local marriage markets (e.g. South & Lloyd (1995)). The result is also consistent with a standard search model interpretation in the sense that an increase in the arrival rate of alternative offers (typically) leads to higher exit rates out of the current state[17]. On the other hand, the finding could also be driven by action taken by individuals who find themselves in a less successful relationship and in order to find a new partner, look for employment in firms that, besides employment, supply a variety of potential marriage partners. In order to isolate this possibility of reverse causality from the effect of sex ratio on dissolution risk, it would be preferable to have an exogenous shock to workplace sex ratio to help identify the main hypothesis of this paper. Angrist (2002) uses variation in immigrant flows to study the effect of immigrants' marriage markets in the US. A similar natural experiment setting is unfortunately not available in the data set used in this analysis. Ideally, if the data set had information on unannounced workplace merges that suddenly changed the workplace composition, this could be exploited to obtain a cleaner measure of the effect of workplace sex ratio on dissolution risk. As an approximation, I analyzed the dissolution pattern of couples who experience a change in workplace sex ratio while working at the same workplace for three consecutive years. I compare couples where the partners worked in the same workplace for three consecutive years without experiencing substantial changes in workplace sex ratio to those who did experience either an increase or decrease in the sex ratio. The reference category consists of those who either do not have workplace information or who find a new job within three years of employment. Clearly, this is a very rough approach since I have no idea whether the changes that happen are expected. Also, I condition on relationships that last at least 3 years to identify the effect of changing sex ratio. Anyway, the results[18] show no effect of these changes if they occur at the male's workplace and that both large increases and

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[17]Further evidence on the association between arrival rates of marriage offers and divorce risk is given in Gautier et al. (2006). Here we show that couples who move to a less dense area are less likely to divorce than couples who stay in the larger cities of Denmark.

[18]The results are not presented in the paper, but are available upon request.

decreases in sex ratio at the female's workplace are associated with an increased risk of dissolution compared to couples for whom the sex ratio stays pretty much constant over the three preceding years. Taking at face value the fact that a drop in the sex ratio at the female's workplace correlates positively with dissolution risks does not support our main hypothesis. On the other hand, it is obvious that this correlation can be generated from other mechanisms than changes in the number of possible marriage partners. In fact, I compare workplaces that experience rather large changes in composition to workplaces that do not. The mere fact that these changes take place may generate tensions that spill over into the personal life. Anyway, the procedure used does not guarantee a clear cut identification result and the findings also suggest that this is not the case.

As suggested by McKinnish (2006), it could also be the case, that individuals who work in industry-occupation cells with a high fraction of colleagues of the opposite sex for some reason are more (or less) likely to divorce. To the extent that there exists a correlation between workplace sex ratios and observable individual characteristics that affect dissolution risk this should be captured by the inclusion of the other explanatory variables in the dissolution hazard model. McKinnish (2006) addresses the possibility of correlation between sex ratios and unobserved personal characteristics that might affect dissolution both in terms of a fixed effects analysis and by IV techniques. As discussed previously, neither of these elaborations change the main results in her analysis. This suggests that even if endogeneity was an issue, the direction of the bias it causes is not unambiguously determined. In the light of McKinnish (2006) and supported by the lack of confidence in being able to find a good instrument for workplace sex ratios in the available data set, I base my main conclusion of this paper on the results presented in Table 1 and Table 2[19].

I have not estimated a competing risks specification of the partnership dissolution model. First, I only observe one person from each relationship after dissolution (the partner that is merged to the original sample is not followed after dissolution). That is, a potential measure of whether a partnership ended because one (or both) of the partner(s) formed a new relationship with a coworker is not perfect. Second, the number of individuals who move from one relationship directly into a new relationship without an

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[19]I will not discuss the results for the other explanatory variables in the partnership dissolution model. The estimated coefficients are to a large extent identical with results presented and discussed in Svarer (2004) and Svarer & Verner (2006).

intervening spell of singleness constitutes around 20% of the total number of dissolutions. Of these around 10% are among coworkers from the same workplace and 13% among coworkers from the same firm. Hence, the number of transitions that would identify the parameters in the cause-specific transition rate into a new relationship with a coworker is relatively small. If I condition availability of workplace information for both individuals in the new relationship I find that 18% of the couples are colleagues. This implies that the fraction of individuals who leave a partnership to form a new relationship with a coworker is twice the size of the fraction of single individuals who form a partnership with a colleague. Hence, the workplace indeed seems to constitute a more important marriage market segment for individuals in partnerships than for single people.

7   Concluding remarks

This paper analyses the association between sex ratios at the workplace and marriage market behavior. There is ample evidence that romantic encounters at the workplace do happen. There are also several studies that document that the sex ratio in the local marriage market matters for partnership formation and dissolution. The paper distinguish between the effect of workplace sex ratios for partnership formation for single individuals and for partnership dissolution for married or cohabiting individuals. For the latter group, the workplace might constitute a more important marriage market segment due to higher search costs in other segments. Hence, it is speculated that workplace sex ratios are more important for partnership dissolution than for partnership formation among singles. The results of this paper show that this is indeed the case.

A major challenge for future work in this area is to find exogenous variation in workplace sex ratios in order to get a more clean picture of the causal effect of workplace sex ratios and partnership formation and dissolution.

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