Do males experience hiring discrimination in female-dominated occupations? An overview of field experiments since 1996

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Abstract

Previous research has documented gender discrimination in the labor market. However, within certain occupations and markets, female applicants receive a distinct advantage in the hiring process. We survey all major field experiments on gender discrimination in hiring published since 1996 for which nationally specific occupational gender distribution data is available. We match candidate callback rates with data on the proportion of females in 48 occupations within these countries. We find that female candidates were more likely to receive callbacks than males within integrated and female-dominated occupations, while occupational gender distribution was not observed to have a significant effect on male callback rates.

Keywords: hiring discrimination, field experiments, occupational segregation, gender, employment

Significant gender inequality persists in industrialized economies across the globe. Though women in OECD countries are often more highly educated than their male peers, for example, they tend to be less likely to participate in paid work (OECD, 2017). Male and female candidates might face differential treatment in the labor market, (Petersen & Morgan 1995, Rodgers & Stratton 2010), sometimes in association with parent-hood status (Correll et al., 2007, Harkness and Waldfogel 2003), other times merely in relation to the gender of their name. Such a phenomenon lacks a singular cause, but at least some of the disadvantages that women face are related to employer discrimination during the hiring process. However, the disadvantaged groups might also be male, and within specific labor markets and occupations, we can expect that female candidates might receive preferential treatment over men in the hiring process.

This paper summarizes previous randomized field experiments on gender discrimination in hiring and asks if the gender gap in callback rates is associated with occupational gender distribution.

Analyses of observational data, such as survey or register data provide solid estimates of gender inequalities in labor market outcomes, including the effects of gender on hiring probabilities. It is, however, difficult for researchers to know what other information employers have on job applicants, information that might be relevant to employer hiring decisions but unobserved to researchers. Therefore, the most reliable way to measure the causal effect of a treatment variable, such as gender or ethnicity, on employers' hiring decisions is to set up an experiment, such as a *randomized field experiment*. Randomized field experiments are acknowledged as the best way to measure discrimination in the labor market (OECD 2013), and researchers have conducted field experiments in the labor market for about fifty years now (Riach and Rich, 2002). Such experiments often involve submitting pairs of matched résumés to employers, with the goal of measuring employers' reactions to job applications that are identical save for the manipulation of one or more treatment variable(s). When researchers manipulate only one treatment variable, say applicant gender, between résumés, such tests provide an unbiased estimate of discrimination during the initial stage of the hiring process. The degree of

discrimination is quantified as the difference between observed male and female callback rates.

Whereas there are many randomized field experiments testing hiring discrimination due to ethnicity or race, there are – perhaps surprisingly – fewer field experimental studies on gender discrimination. As will be clear below, we have found less than ten randomized field experiments since the mid-1990s on gender discrimination that were suitable for our purposes. We have included only studies for which we have also found national information on the occupational gender distribution, since we want to assess whether the gender distribution of occupations matters to employers' willingness to call back male and female job applicants.

We summarize the results of seven recent field experiments on the impact of gender on hiring discrimination, matching candidate callback data with nationally specific information on the gender distributions of 48 occupations within these experiments. Second, we assess the impact of occupational segregation on male and female callback rates and associated metrics through statistical modeling.

Previous Studies and Selection Criteria

Previous correspondence studies have attempted to determine whether factors such as age, marital status and employer characteristics influence gender discrimination in the hiring process, with varying results. In the earliest study examined in this report, Neumark et al. (1996) submitted 65 pairs of fictitious résumés to waitstaff jobs at high-price, medium-price and low-price restaurants, instructing student assistants to accept interviews on behalf of the fictitious applicants. Women were less likely to receive both callbacks and post-interview job offers at high-price restaurants, which featured the highest proportion of male wait staff (72 percent), while men were less likely to receive callbacks at low-price restaurants (39 percent male). In Spain, Albert et al. (2011) responded to each of 1,062 job offers with one of five pairs of fictitious curricula, varying the age, gender and marital status of the fictitious candidates. Though women were significantly more likely than men to receive callbacks in female-dominated occupations and in one integrated occupation, men received no significant advantage in male-dominated occupations. Little conclusive evidence was found regarding the effect of marital status on callback rates for candidates of either gender, though 28-year old candidates had significantly higher callback rates than those ten years their senior (4.7 percent gap), a trend slightly more pronounced among female candidates. In China, Zhou et al. (2013) sent 19,130 fictitious matched résumés to state-owned, foreign and private firms in six cities, concluding that ownership structures appear to influence gender discrimination in the hiring process. Both foreign and privately owned firms favored female candidates, while state-owned firms demonstrated a comparatively weak preference for male candidates. Most recently, in Sweden, Bygren et al. (2017) submitted 2,144 applications to jobs within 18 occupations, altering both the gender and parenthood status of fictitious applicants. Though childless men received higher callback rates than childless women, fathers and mothers, the authors did not find conclusive evidence of discrimination against any group.

Several additional studies focusing on gender discrimination within female- and male-dominated occupations have demonstrated preferences for female candidates within female-dominated professions. Riach and Rich (2006) sent 873 matched pairs of résumés to job openings within one female-dominated, one male-dominated and two integrated occupations in London, documenting statistically significant discrimination against men in the female-dominated occupation, secretary (97.3 percent female), and against women in the male-dominated occupation, engineer (4.7 percent female). Discrimination against men was also found in both integrated occupations (accountants, 20.8 percent female; and computer analysts and programmers, 20.8 percent female). Drawing on Riach and Rich's findings, Booth and Leigh (2010) submitted 3,365 fictitious résumés to jobs within four

highly female-dominated occupations in Australia over a six-month period. Differences between female and male callback rates were found to be significant only within occupations with a proportion of females equal to or above 80 percent, with female candidates receiving a significant advantage in wait staff jobs (80 percent female) and data entry jobs (85 percent female). Carlsson (2011) documents a similar trend in Sweden, submitting matched pairs of fictitious résumés to 1,614 job openings within male-dominated, female-dominated and integrated occupations in two cities. Female candidates received a small but statistically significant advantage in both female-dominated and integrated occupations, while males received no conclusive advantage in male-dominated occupations. Carlsson thus postulates that gender segregation in the Swedish labor market results mainly from causes other than hiring discrimination.

Though the list of studies included in our analysis does not represent the results of a formal systematic review process, we have attempted to include all major relevant randomized field experiments published since 1996 for which nationally specific occupational gender distribution data is available. Still, several recent studies assessing the impact of gender on candidate callback rates could not be included in our analysis, for various reasons. In one study, Weichselbaumer (2004) developed résumés for three fictitious candidates, one designed to represent a stereotypically feminine woman, one a masculine woman, and the other an average male applicant. No statistically significant evidence of discrimination was found when comparing the callback rates of the feminine and masculine women, but women faced notable discrimination in a male-dominated occupation (network technician) and men in a female-dominated occupation (secretary). Since these data deliberately communicate heterogeneity (femininity or masculinity) among female candidates, and thereby add an additional variable, we will not include them in our survey. In another study, Baert et al. (2016) submitted résumés to various jobs targeting bachelor's degrees in business administration and jobs targeting master's degrees in business economics. However, since the authors selected jobs based on degree requirements, not occupational category, callback rates could not be matched with precise occupational gender distribution data, hindering our ability to make use of the data included in the study. Similar factors preclude us from including other relevant studies in our analysis.

Empirical Analysis

In light of findings by Riach and Rich (2006) and others, we expect that female candidates will receive an advantage in the hiring process when applying to jobs in female-dominated occupations. Following Booth and Leigh (2010), we also posit that such an advantage will grow as the proportion of females in an occupation increases. As there exists little consensus as to whether male candidates receive an advantage when applying for jobs within male-dominated occupations, we postulate that any advantage received by female candidates applying to jobs within female-dominated occupations will be larger in magnitude than that received by men when applying to jobs within male-dominated occupations. Such a hypothesis corresponds with findings by Riach and Rich (2006), Albert et al. (2011) and Carlsson (2011), as well as with a summary of six previous correspondence studies by Riach and Rich (2002).

To assess the validity of our conjecture, we match data regarding the callback rates of fictional female and male candidates from seven correspondence studies with occupational gender distribution data from the countries within which each experiment was conducted (Table 1). We represent occupational gender distribution with fractional data rather than with dummy variables (say, for male-dominated, female-dominated and integrated occupations) to more precisely determine whether advantages and disadvantages in the hiring process are affected by the magnitude of gender segregation within each occupation. We then regress male and female callback rates, the ratio of female to male callback rates and the difference between the two rates on occupation proportion female (Table 2). Though

probit models have proved popular among authors analyzing field experiment data (Booth and Leigh, 2010; Albert et al., 2011; Bertrand and Mullainathan, 2004), we refrain from performing a probit analysis because we lack candidate-level data for each of the studies. One could, theoretically, develop a candidate-level dataset by matching and combining callback rate data with sample size information, but not all studies included within this report provide data sufficient for the execution of such an analysis. Such an analysis might also yield imprecise results, given that many of the studies report only rounded callback rate figures.

Data regarding the percentage of females within each occupation and country was provided in full within each of the studies, with the exception of Bygren et al. (2017) and Albert et al. (2011). In the case of Bygren et al., occupations assessed were paired with relevant four-digit occupational codes from the *Swedish Standard Classification of Occupations* and matched with relevant occupational gender distribution data. Data on the proportion of females within up to three relevant occupations were averaged to compute gender distribution figures for occupational categories described by multiple codes (e.g. "Engineer industrial economics/machine technology/ electronics"). Precise gender distribution data could not be obtained for the occupation "marketing technicians" from Albert et al. (2011), so that this occupation has been omitted from all relevant graphs and analyses. Occupations assessed within multiple studies, such as preschool teacher (tested by both Carlsson (2011) and Bygren et al. (2017)), were considered separate occupations for the purpose of our analysis, as merging data related to such occupations would have required averaging callback rates recorded as a result of diverse résumé submission and study procedures. Bygren et al. (2017) designate some candidates as mothers and fathers, and others as childless women and men. We average the callback data (reported as proportion positive response) for mothers and childless women and for fathers and childless men to determine the respective callback results for female and male candidates.

Table 1 provides a comparison of the callback rates and gender distributions within the occupations assessed in the seven previous correspondence studies.

Results

Figures 1-3 and Tables 1-2 depict our primary results. We observe (see Table 1, bottom line) that male and female candidates have roughly the same average callback rates (27 percent, unweighted), though rates vary widely between occupations: from 2 percent to 73 percent and from 2 to 82 percent for female and male candidates, respectively. The unweighted average ratio of female to male callback rates is 1.26, suggesting a distribution of ratios skewed toward higher female callback rates.

An assessment of the impact of occupational gender distribution on female callback rates, male callback rates, the ratio of female to male callback rates and the difference between the two callback-rates reveals that only the relationship between the ratio and occupation proportion female is significant at the 5 percent level within the field experiments (see Table 2). A one percent increase in the proportion of females within an occupation is associated with a 0.76 percent increase in the ratio of females to males contacted for an interview or further communication. See also Figure 1, where we show the association between occupation fraction female and female and male callback rates. We note that for both female and male applications, the association between callbacks and the proportion females within an occupation is positive, yet the curve is flatter for male applicants than for females.

Besides the correlation between callback ratio and occupational gender distribution, the relationships that come closest to achieving conventional levels of significance within the seven experiments are those between female callback rates and occupation proportion female (p-value .063, coefficient .186) and the difference between female and male callback rates and occupation proportion female (p-value .066, coefficient .105) (Table 2).

Occupational gender distribution does not have a significant impact on male callback rates.

In our previous analyses, we have not weighted information on callback results by the number of applications submitted within each occupation, which means that callback rates within occupations in which few applications were submitted might have an outsized impact on our results. We have therefore weighted the occupations based on the number of observations within each category, and the outcome are shown in Figures 2 and 3. We note that the patterns remain the same as documented above; there is a positive association between the occupation proportion females and the ratio of female to male callback rates (Figure 3) as well as the difference between female and male callback rates (Figure 2).

Discussion

Do males face hiring discrimination in female-dominated occupations? Our results suggest that female candidates receive an advantage over males when applying to jobs within increasingly female-dominated professions, but that male candidates have similar absolute callback rates across occupations. As depicted in Fig. 3, the ratio of female to male callback rates increases as occupations become increasingly female-dominated, a significant association at conventional levels. Occupational gender distribution does however not have a significant effect on male callback rates. Thus, the association seems to be related to an apparent advantage for female applicants as they apply to jobs within increasingly female-dominated professions, rather than by a decline in male callback rates within female-dominated occupations.

Neumark et al. (1996) and Riach and Rich (2006) have demonstrated that when female candidates apply to jobs within some male-dominated occupations, the opposite trend holds: male candidates receive an advantage over females in the application process. The limitations of our sample hinder efforts to conclude whether our results support such a finding. As depicted in Figures 1-3, the bulk of the observations in our sample lie within female-dominated professions, less than three of the occupations assessed within the previous correspondence studies are over 80 percent male. Thus, it is difficult to credibly discern from our results how male and female applicants fare when applying to jobs within male dominated professions.

The ratio of the two rates may serve as a better proxy for discrimination. In an occupation with an average callback rate of 2 percent, such as accounting in China (Zhou et al., 2013) a one-percent difference in callback rates between male and female candidates is arguably far more consequential than a one-percent difference in callback rates in occupations with rates upwards of 70 percent. Ratios of female and male callback rates reflect the relative magnitudes of these differences.

Our survey faces several limitations of note. Firstly, our study does not constitute a complete meta-analysis, and we do not perform a systematic review of available literature. We also do not include factors such as parenthood status as variables in our analysis. Since the proportion of candidates designated as mothers versus as childless women in our sample does not necessarily reflect that of the population as a whole, our results may not be generalizable to the population at large.

Secondly, our study assesses callback rates only within the initial résumé submission portion of the hiring process, which could potentially render our results an underestimate (or overestimate) of the total extent of discrimination in the hiring process. Similarly, we focus only on discrimination within publicly advertised positions to which external applications can be submitted. Thus, our study does not examine discrimination associated with alternative hiring methods (e.g. internal hiring processes, promotions, network recruitment).

Finally, as aforementioned, though we assess many female-dominated and integrated occupations in our analysis, our dataset

features relatively few male-dominated occupations, limiting our ability to credibly determine the effect of gender on callback rates within male-dominated professions.

Despite its limitations, our analysis succeeds in applying a relatively novel technique to assess aggregate data on the impact of occupational gender segregation on callback rates. Rather than merely coding occupations as male-dominated, female-dominated, and integrated, we match national labor market statistics detailing the exact gender distribution of each occupation with relevant callback rates. Though at least one recent complete meta-analysis (Koch et al., 2014) employs the former method, we anticipate that the latter technique could assist in discerning differences in callback trends between, say, highly female-dominated and moderately female-dominated occupations in future research. Such an approach may be especially valuable given Booth and Leigh's (2010) finding that differences between female and male callback rates were significant only within female-dominated occupations with proportions of females equal to or above 80 percent. Still, our approach assists only in assessing studies conducted within labor markets for which reliable and specific nationally specific occupational gender composition statistics can be obtained.

Several suggestions for areas of future research follow from our findings. Additional correspondence studies assessing the impact of applicant gender on callback rates within highly male-dominated occupations could assist in determining more conclusively how applicants fare when applying to jobs within professions with few female workers. Further meta-analytic research might also assess the differences and nuances in male and female callback results within highly female-dominated, highly male-dominated, female-dominated, male-dominated and integrated occupations.

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Table 1 *Comparative results for seven correspondence studies*

Study	Location(s) and Year(s)	Occupation[1,2,3]		Occupational Gender Distribution	Callback Rates (Proportion Called Back)		Ratio of Callback Rates
		ID		Proportion female	Female	Male	Female/Male
Albert *et al.* (2011)	2005-6 Madrid**, Spain**	1	Accountants	0.49	0.07	0.06	1.09
		2	Accountants' assistants	0.46	0.11	0.08	1.44
		3	Admin. assistants/receptionists	0.70	0.10	0.03	3.06
		4	Executive secretaries	0.67	0.16	0.05	3.15
		5	Marketing technicians	–	0.02	0.02	1.00
		6	Sales representatives	0.21	0.16	0.17	0.96
Booth and Leigh (2010)	2007 Brisbane, Melbourne and Sydney, **Australia**	7	Customer service	0.68	0.29	0.26	1.12
		8	Data entry	0.85	0.33	0.19	1.74
		9	Sales	0.69	0.26	0.25	1.04
		10	Waitstaff	0.80	0.40	0.30	1.33
Bygren *et al.* (2017)	2013-15 Göteborg, Malmö and Stockholm, **Sweden**	11	Accountant and auditor	0.59	0.41	0.38	1.08
		12	Assistant nurse	0.93	0.41	0.21	1.93
		13	Chef	0.53	0.24	0.41	0.58
		14	Cleaner	0.80	0.12	0.03	3.41
		15	Elementary school teacher	0.76	0.68	0.82	0.83
		16	Engineer comp. sci., comp. specialist	0.21	0.61	0.57	1.06
		17	Engineer industrial economics/ machine technology/electronics	0.20	0.24	0.36	0.69
		18	Financial assistant	0.87	0.15	0.23	0.65
		19	High school teacher	0.58	0.51	0.53	0.97
		20	Nurse	0.90	0.50	0.72	0.69
		21	Preschool teacher	0.94	0.73	0.62	1.18
		22	Receptionist	0.81	0.18	0.25	0.74
		23	Salesperson	0.64	0.36	0.43	0.84
		24	Store personnel and cashier	0.76	0.07	0.10	0.74
Carlsson (2011)	2005-6	25	Accountants	0.75	0.21	0.13	1.62
		26	Business sales assistants	0.38	0.41	0.35	1.17
		27	Cleaners	0.80	0.11	0.08	1.38

[1] Bygren et al. (2017) divide the 18 occupations assessed in their experiment into 14 occupational categories, the latter of which have been used in this report.

[2] Neumark et al. (1996) assess only one "occupation," restaurant wait staffing, but divide the occupation into three price-related categories, providing data relevant to each. Each category has been considered a separate occupation for the purpose of this report.

[3] Zhou et al. (2013) divide the 8 occupational positions assessed in their experiment into 4 occupational categories, the latter of which have been used in this report.

	Göteborg and Stockholm, **Sweden**	28	Computer professionals	0.24	0.23	0.22	1.05
		29	Construction workers	0.01	0.20	0.30	0.67
		30	Lower secondary school teachers (language)	0.66	0.47	0.47	1.00
		31	Lower secondary school teachers (math and science)	0.76	0.55	0.57	0.96
		32	Motor-vehicle drivers	0.07	0.21	0.24	0.88
		33	Nurses	0.91	0.29	0.33	0.88
		34	Preschool teachers	0.92	0.67	0.61	1.10
		35	Restaurant workers	0.68	0.19	0.08	2.38
		36	Shop sales assistants	0.76	0.15	0.15	1.00
		37	Upper secondary school teachers	0.53	0.30	0.33	0.91
Neumark *et al.* (1996)	1994 Philadelphia, P.A., **U.S.**	38	Waitstaff in high-price restaurants	0.28	0.26	0.61	0.43
		39	Waitstaff in low-price restaurants	0.61	0.38	0.19	2.00
		40	Waitstaff in med.-price restaurants	0.49	0.43	0.62	0.69
Riach and Rich (2006)	2003 London, **U.K.**	41	Chartered and certified accountants	0.31	0.13	0.10	1.30
		42	Computer analysts and programmers	0.21	0.23	0.14	1.64
		43	Engineering professionals	0.05	0.12	0.17	0.71
		44	Secretarial and related occupations	0.97	0.19	0.09	2.11
Zhou *et al.* (2013)	2010-11 Beijing, Chengdu, Guangzhou, Shanghai, Shenzen and Wuhan, **China**	45	Accountant	0.38	0.02	0.02	0.87
		46	Marketing professional	0.41	0.06	0.05	1.32
		47	Secretary	0.72	0.03	0.02	2.08
		48	Software engineer (IT)	0.31	0.09	0.08	1.14
Average	–	–		0.58	0.27	0.27	1.26

Table 2 *Regression of callback rates, ratios and differences on occupation proportion female*

Seven Previous Correspondence Studies		
Callback Rates	Result	R^2
Female callback rate (%)	0.186 (0.063)	0.075
Male callback rate (%)	0.081 (0.496)	0.010
Ratio of female to male callback rates	0.760* (0.041)	0.090
Difference between female and male callback rates	0.105 (0.066)	0.073

Note: *P ≤ 0.05; **P ≤ 0.01; ***P ≤ 0.001. The following regression models were employed (substituting invitation rates for callback rates where indicated): $Y\left(female\ callback,\ male\ callback, \frac{female\ callback}{male\ callback}, female\ callback\ -male\ callback\right) = a + b_1 * (proportion\ females\ in\ occupation) + e$.

Figure 1 *Female and male callback rates by occupation proportion female*

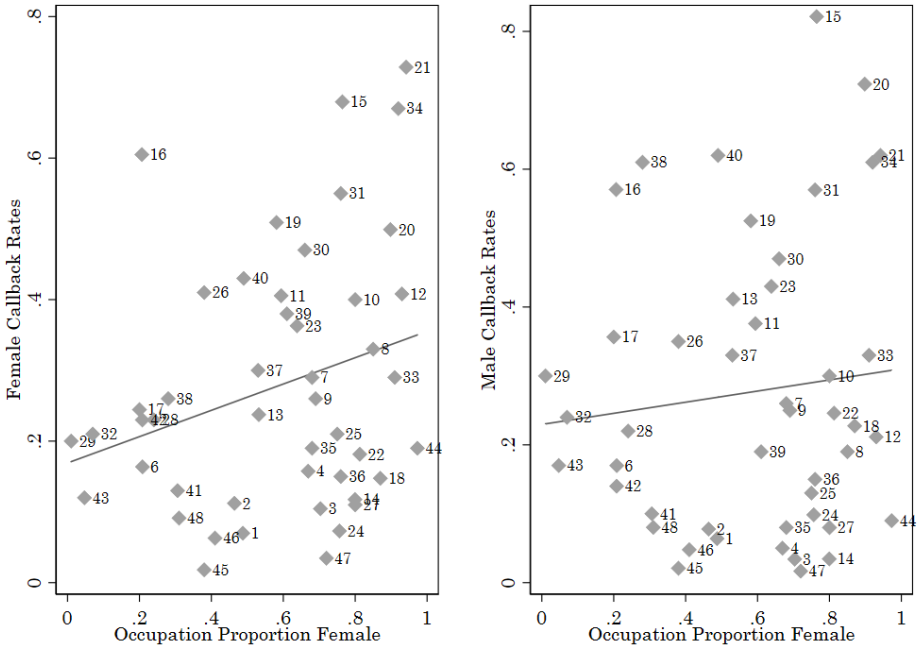

Figure 2 *Difference between female and male callback rates by occupation proportion female*

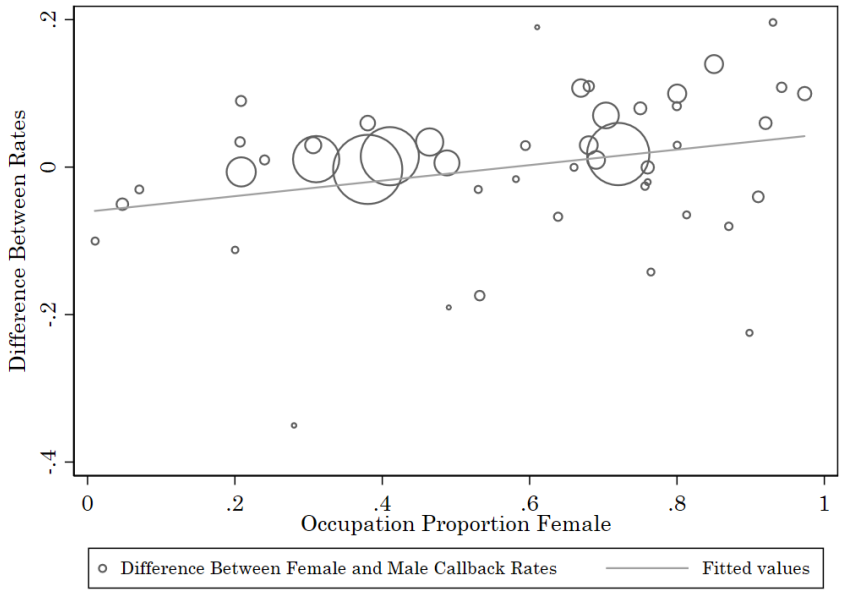

Figure 3 *Ratio of female to male callback rates by occupation proportion female*