Does Driving as a Form of "Gig Work" Mitigate Low-Skilled Job Seekers' Negative Long-Term Unemployment Effects?

LINFENG LI, University of Michigan, School of Information, USA

TAWANNA R. DILLAHUNT, University of Michigan, School of Information, USA

TANYA ROSENBLAT, University of Michigan, School of Information, USA

About 20% of the U.S. unemployed population has been out of the labor force for more than 6 months. The rise of the gig economy has changed the landscape of nontraditional employment opportunities for these predominantly low-skilled long-term unemployed workers. This particular type of on-demand work can be used to fill unemployment gaps and offers little to no training costs and flexible hours. Therefore, we explore whether driving as a form of gig work helps to mitigate the negative effects of long-term unemployment for low-skilled job seekers with employment gaps, and how employers evaluate workers who have held non-traditional jobs. Using a correspondence audit study with 1006 job applications, we evaluated whether a set of resumes "enhanced" with experience driving for a real-time ridesharing service received more callbacks than baseline resumes with an employment gap. We found no evidence that driving as a form of gig work increased the callback rates of applicants. In fact, we observed that in comparison to men, the callback rates for women slightly declined. Our study suggests that driving 'gigs' might not be a substitute for traditional employment on resumes for low-skilled workers. We contribute a call to CSCW to investigate methods that help to understand why real-time ridesharing services do not substitute for traditional jobs in bridging employment gaps and solutions on how to overcome it. Finally, we reflect on our use of audit studies in the new digital era and present potential CSCW and HCI contributions using this method.

CCS Concepts: • **Human-centered computing** → **Empirical studies in HCI**;

Keywords: employment; low-skilled job seekers; gig work; audit studies; resume gaps

1 INTRODUCTION

As of February 2019, the U.S. Bureau of Labor Statistics reported a total of 6.2 million unemployed individuals in the U.S., an unemployment rate of 3.8% [30]. Approximately 1.3 million of these individuals had been unemployed for more than 6 months and 3 weeks (i.e., 27 weeks), or were experiencing long-term unemployment. Those facing long-term unemployment are often perceived as having fewer social and intellectual skills, being less trainable, and being less up-to-date with technological changes [36]. As a result, some economists theorize that those with long career

Authors' addresses: Linfeng Li, llinfeng@umich.edu, University of Michigan, School of Information, USA; Tawanna R. Dillahunt, University of Michigan, School of Information, USA; Tanya Rosenblat, University of Michigan, School of Information, USA.

gaps experience intrinsic bias and often face discrimination from employers [3]. In addition, new automated applicant tracking systems that sort through high numbers of resumes can negatively impact the people with long-term unemployment [3]. Research consistently finds that those who face long-term unemployment are more than twice as likely to have left the market altogether than to have settled into stable, full-time work [29].

The rise of the digital on-demand economy, or the gig economy, provides nontraditional and contingent employment opportunities that are akin to independent contract work. The study of such platforms in HCI and CSCW as well as the use of technology for employment and entrepreneurship has been steadily increasing (e.g., [1, 13–15, 17, 19, 26, 27, 32, 35]). On-demand work has been said to aid in supporting household incomes and job growth, which benefit both workers and employers. These jobs also offer little to no training costs, low cost of entry, and flexible hours [18]. The gig economy is particularly attractive for people who value the flexibility often unavailable in traditional jobs [9].

Broadly, we would like to investigate whether gig work helps to mitigate the negative effects of long-term unemployment for low-skilled job seekers with employment gaps. However, given the variety of types of gig work available and geographic locations, we focused our study on a specific type of gig work—driving. We began our investigation with driving because real-time ridesharing platforms like Lyft and Uber have transformed the essence of traditional workspaces [38]. With fewer requirements to work for the ridesharing platforms, the unemployed job seekers can acquire such work experience more easily compared with overcoming the entry barriers to traditional driving jobs [11]. On the demand side, based on our preliminary work, driving jobs are among the top three most frequent job listings categories across major metropolitan areas.

We asked the research question: Does driving for Uber (a form of non-traditional work) help low-skilled job seekers [1] fill resume gaps? In other words, does this form of work lead to more, fewer, or as many callbacks, as low-skilled job seeker resumes with employment gaps? To answer this question, we conducted a field experiment to uncover the differences in employer responses to understand whether this form of gig work can be used to lessen the negative effects of long-term unemployment for low-skilled job seekers with employment gaps. We hypothesized that on-demand driving gigs could help these job seekers fill in their employment gaps, which would lead to more callbacks than those with unfilled gaps. We also speculated that the hypothetical skills gained from performing these gigs could lead to more callbacks than those without these skills listed. Drawing on the economics, sociology, and HCI literature, we contribute:

- Methodological insights from the use of an audit study to identify the effect of resume content on initial employer interest;
- Our early findings, which suggest that driving for a real-time ridesharing service does not substitute for traditional driving jobs in bridging employment gaps;
- Results showing unequal callback rates between men and women; and,
- A call to CSCW to investigate methods that help to understand *why* real-time ridesharing services do not substitute for traditional jobs in bridging employment gaps, and solutions on how to overcome it.

2   RELATED WORK

The effect of temporary work on long-term employment has often been discussed in economics and sociology literature (e.g., [2, 22, 28]). However, most of this literature was written at a time when the sharing economy and the concept of gig work were not prevalent. In this section, we

---

[1]We define *low-skilled job seekers* as job seekers who don't have a high level of education. In our study, all fictitious applicants are high school graduates.

first discuss the literature pertaining to the effects of temporary work on long-term employment pre-dating the rise of the sharing economy. We then provide an overview of more recent HCI and CSCW literature surrounding employment in the sharing economy.

2.1 The effects of Temporary Employment on Long-term Employment

There are discrepancies related to the effects of temporary employment on long-term employment. Economics and sociology literature suggest that temporary employment is associated with disadvantages when compared to permanent employment [22]. Yet temporary work provides job seekers with an opportunity to acquire human capital, expand contacts with potential employers, possibly transition to more stable employment, and increase employment earnings [2]. However, most of these studies "upwardly compare" temporary jobs to permanent ones and identify research opportunities to make "downward comparisons" [22]. Understanding the effect of temporary employment for those who are unemployed is also an opportunity for future research.

To address this opportunity, Gebel [22] compared the potential integrative power of working a temporary job for unemployed workers to the counterfactual situation of searching for another job while remaining unemployed. He found that working a job temporarily increases the employment chances during the following 5 years; however, these results were limited to Germany and the United Kingdom. This research confirmed findings in the Italian context [28]; however, neither long-run advantages nor disadvantages of working a temporary job were found in the flexible Swiss labor market, which demonstrate region-to-region variation.

Additional research aimed to resolve the differences between U.S. and European data because the majority of these studies (1) made use of European data, (2) used non-experimental data, and (3) assumed that temporary job selection was driven by observable characteristics up to a random factor [28]. At the time of this work, only one study showed that temporary work had a negative effect on employment outcomes [2], and these findings were based on U.S. data. Ichino et al. concluded that the cost of firing employees was cheaper in the U.S. than in all European cities where the effect of temporary work on employment had been evaluated [28]. If firing costs are higher, then employers place greater importance on worker quality before hiring, which could explain the reason for positive outcomes in countries with higher firing costs than in the U.S. The authors concluded that the effects of temporary employment will vary in countries with different employment protection regimes [28]. Another investigation to understand whether temporary jobs increased a person's chance of finding permanent employment, among low-skilled U.S. workers who participated in Detroit's welfare-to-work program, confirmed these results [2]. Autor and Houseman [2] found that temporary work did not increase and could actually decrease the chance of finding permanent employment for low-skilled workers. However, job placements with direct-hire employers[2] significantly increased employment and earnings over a seven-quarter follow-up period. Our research further explores these discrepancies but in the new gig economy context.

2.2 Employment Opportunities in the Sharing Economy

A growing body of HCI and CSCW employment research aims to support job seekers by providing platforms to support skill development [32, 35] and education and learning [16, 27]. The use of and opportunities for technology platforms like the sharing economy to support resource-constrained individuals [12, 15] and entrepreneurs has also been investigated [26]. Efforts to prevent wage theft among low-wage precarious workers also exist [19].

---

[2]In labor economics, "direct-hire employers" refer to the companies that hire their employees directly. Direct-hire jobs are to be contrasted with temporary jobs, which are mainly filled by contract employees.

Participation in non-traditional work, like that of Uber and Lyft, has increased over the last decade [9]. Such opportunities provide a flexible work environment and opportunities to earn supplemental income and are a viable option for unemployed job seekers or individuals who are resource-constrained [11]. While some have speculated that such benefits favor women, an investigation of earnings and labor supply choices among more than 1 million U.S. Uber drivers revealed about a 7% gender earnings gap among drivers [11]. This suggests that the gig economy does not close gender gaps. A Swedish investigation of gender discrimination in hiring found that women had a slightly higher callback rate to interview in female-dominated occupations but no difference in callback rates for male-dominated occupations such as driving [8]. Decomposing the positive and negative signaling effects of gig work and measuring the net effect by gender has important practical implications because it provides lessons for job applicants who might be unsure whether to disclose gig work on their formal resume.

Past HCI and CSCW work has investigated the impact of new technologies on work practices [7, 34]. More recently, the field has begun exploring the opportunities for work [12, 15] as well as the working conditions in the sharing economy [1, 17, 19]. Ahmed et al. found that Ola [3] drivers were often burdened with locating passengers in a timely manner, rarely reported earnings or reduced hours, and remained unstable in terms of having regular work [1]. While past studies have investigated the working conditions, it's unclear whether such opportunities could lead to more stable employment.

Dillahunt et al. [16] asked a similar question but in the context of Massive Open Online Courses (MOOCs), another instance of the sharing economy. In 22 interviews with MOOC learners, these researchers investigated whether MOOCs served as a platform for employability. They found that while some learners found them beneficial, taking these courses did not *land* them a job. As it is unclear whether MOOC engagement actually affects learners' job prospects; it is also unclear whether those who turn to gig work during periods of unemployment are more likely to be hired than those who do not. We raise this question and draw attention to opportunities in this space to explore similar questions and to consider methods of answering such questions quantitatively.

3 RESEARCH METHODS

We conducted an *audit study*, an approach that has been widely used in social sciences and popularized by Bertrand and Mullainathan's [5] seminal investigation of the difference in labor market outcomes between resumes with names that sounded White versus African-American. In earlier audit studies, auditors were matched on many observable characteristics except for the variable of interest (gender, sexual orientation, ethnicity) and then initiated face-to-face transactions with businesses (i.e. applied for rental housing, negotiated a price of a car, etc.). These studies were typically criticized based on the quality of their matches. The use of fictitious resumes used by Bertrand and Mullainathan removed the need for human actors by conducting the entire job application process through mail or email. This method is often referred to as *correspondence audit studies* [4]. The researcher creates a balanced set of resumes consisting of *control* resumes and *treatment resumes* that only differ in the variables of interest (in our case gig employment experience and gender). Audit studies have been widely used in the social sciences because of their lower cost; however, these methods have rarely been used in the sharing economy context [17]. In addition, changes to digitalize the employment process have increased the overall cost of executing these studies. We first provide an overview of our study before giving the details of our implementation.

---

[3]Ola is an Uber-like service that exists in India.

3.1 Study Focus and Overview

In preparation for our audit study, we conducted a preliminary investigation that consisted of job searches in eight major U.S. metropolitan areas. Based on our preliminary investigation results (Appendix A.1), we decided to focus our study on one geographic location, one job type, and one job platform, which we address in the next subsection. We then provide details of our resume profiles and our study hypotheses.

3.1.1 Addressing study limitations. First, we limited our audit study area to one major metropolitan area that is closest to our institution. As part of the audit study, we needed to compose application profiles that were indistinguishable when compared against real applications from the local area. This required us to control for home address, education records and phone numbers. Choosing a nearby metropolitan area helped us to create more realistic resumes when producing this information: with knowledge about the local neighborhoods, we generated fictitious addresses from lower-income neighborhoods and picked nearby public high schools. Further, we acquired telephone numbers with the local area code. Given our preliminary investigation results, past work in HCI and CSCW, the popularity of employment opportunities as drivers in Uber and Lyft, and because transportation jobs are typically in high demand [31], we focused on driving-related job-postings.

We also decided to conduct the experiment solely on Indeed.com. [4] As described in our preliminary investigation, we reviewed job postings available on Monster.com and found them comparable to Indeed.com for low-skilled jobs. This platform facilitates the ability for employers to post their job announcements and for job seekers to apply to these jobs directly by submitting their resumes. We created a set of artificial resumes for low-skilled male and female workers who all had long-term unemployment gaps. We then created two versions of each resume: a baseline resume without gig work experience and an "enhanced" profile with gig work. We applied for jobs using these artificial resumes on the job search platform and tracked callback rates.

3.1.2 Application profiles. We narrowly define gig work in this study as activities that are mediated by technological platforms. We created eight fictitious profiles of low-skilled job applicants with generic names (4 male and 4 female) and associated work histories. To construct credible and naturalistic resumes, we scraped a total of 1,808 publicly available Indeed.com resumes to get typical employer names, job titles, descriptions, employment durations, and associated skills, which we used to create experience entries on the resumes. Our institutional review board reviewed and granted our study exempt status. We independently considered ethical implications associated with creating a very small number of fictitious profiles on a large job search platform and decided on a research protocol to minimize potential harm to employers such as promptly declining requests for further information and interviews.

In our study, we implemented the gig work experience by creating a resume entry that reflected the experience of driving for a major ride-sharing platform. This is a well-perceived form of gig work and transportation has been highlighted as a key sector of the gig economy [20]. To match with our key treatment, we composed our intend-to-treat group as employers who posted "Driver" as part of their recruitment criteria (i.e., driver-related jobs). We investigated whether employment experience filled with gig work affects callbacks differently from having a gap on the resume (gap vs. gig work) and whether employer responses differ by gender. The main hypotheses that we tested are listed next:

H1: Having gig work to fill the unemployment gap increases the likelihood of an applicant to receive a callback .

---

[4] http://www.indeed.com; Noted as "the world's # 1 Job Site" per its default landing page found via Google search.

H2: Callback rates do not differ by gender.

While prior research found differences in pay related to gender in Uber [11], we had not seen prior literature to suggest gender differences in hiring in this specific context. Therefore, we formulated our second hypothesis based on the documentation of no difference in callbacks by gender in Sweden (including for driving jobs) [8]. Acknowledging the different social norms in gender equality in Sweden versus the U.S., our goal was to help decompose the positive and negative signaling effects of gig work and measure the net effect by gender.

3.2 Implementation

To reflect the most up-to-date change in the labor market, we maintained an hourly scraper to continuously download job postings that matched our search criteria: ("Driver jobs," "within 25 miles," "full-time") in our study area. Among all of the scraped job postings, we dropped those postings that simply pointed to external company websites and kept only those that were directly hosted on Indeed. This step dropped roughly one-half of the total postings. Given our knowledge of the local businesses that pointed to external company websites (e.g. size of business, number of postings), we did not identify any systematic differences between the two sets of job postings.

With the combination of the web-scraping tools and a job posting validity checker, we maintained a real-time repository of job-postings: because of the dynamic nature of the work environment, new jobs were posted every day and old jobs would expire. The web-scraping tools accumulated the new jobs and the validity checker visited the job-posting URL afresh daily to verify whether jobs in our raw list were still accepting applications. In total, we had an average of 500 jobs available for application at any given date.

During the job application study period, we randomly sampled from the valid list of job-postings each day. We assigned these jobs to application profiles in the application schedule list and sent two resumes to each job-posting. In total, we created eight application profiles of identical age and comparable education backgrounds on Indeed.com. Each employer received two resumes that were generated based off the two templates, where we added gig work experience to one of the resumes and left the most recent work experience empty for the other resume. Except for resumes that had gig work experience, the most recent work experience ended in March 2018. This generated an 8- to 12-months unemployment gap. To implement the gender treatment, we picked male-sounding or female-sounding first names and added White-sounding surnames based on the Frequently Occurring Surnames from the 2010 Census [10]. See Appendix A.2 for sample resumes.

To enhance the validity of the application profiles and to collect callbacks, we acquired unique phone numbers with local area codes from Twilio and created dedicated email accounts using Gmail for each profile. All phone calls were first forwarded to voicemail and then transcribed. All incoming emails for each application profile, together with the transcription of the voice recordings, were forwarded to a master email account. We retrieved all responses through the Gmail API and labeled the callbacks for each application profile. Note that callbacks can be of different types. We accounted for all positive responses, including email and voicemail responses that offered phone interviews, email and voicemail responses that arranged for onsite interviews and individualized email responses that asked for specific work experience. We dropped all automated responses that were either email confirmation of the application or a simple pointer to external assessment platforms. We did not systematically differentiate between these different types of callbacks. We classified all "No" responses and "Null" responses as "No Callback."

4 RESULTS

We submitted two waves of applications using the same set of applications profiles. We submitted
the first batch of 144 applications in November 2018 and started the second wave of applications
in February 2019.[5] By March 28, 2019, we submitted an additional 862 applications. Overall, our
callback rate was 11.63%, which is relatively high compared to other audit studies [4]. Table 1
breaks out the raw callback data by gender and treatment. Table 2 shows the corresponding callback
rates. Because of the simplicity of our design we conducted our empirical analysis by comparing
sample means (callback rates).

Table 1. Summary of callbacks by gender and treatment

	Gap		Gig		All
---	Female	Male	Female	Male	
Callback	31	35	21	30	117
No Callback	221	216	234	218	889
All	252	251	255	248	1006

Table 2. Callback rates by gender and treatment

	Gap		Gig		All
---	Female	Male	Female	Male	
Callback rate	12.30%	13.94%	8.24%	12.10%	11.63%

Note: resumes in the "Gap" condition had an unemployment history of
8—12 months because the most recent work experience terminated in
March 2018 on these resumes.

We first note that the callback rates for both men and women were lower for the gig-enhanced
resumes compared to the baseline resumes with a gap. The overall callback rate for gig-enhanced
resumes was 10.13% across all applications (men and women) and 13.12% for baseline resumes. A
simple t-test for equality in callback rates rejected the null hypothesis with borderline significance
(p-value of 0.14). This was mostly driven by women (p-value of 0.13).

Another way to look at the difference between our main treatments is to consider the 95%
confidence interval for the difference in callback rates between gig-enhanced resumes and baseline
resumes, which is $(-6.95\%, 0.98\%)$. This implies that *at best* the gig-enhanced resumes raised
callback rates by about 1% from a baseline rate of 13.52% for the "Gap" condition. This maximal
effect size was less than 10% of the baseline rate and small compared to audit studies that looked at
discrimination in labor markets [4].

Looking at gender, we did not see a statistically significant difference between callback rates
for male and female applicants without gig-enhanced resumes (p-value of 0.58). We did reject the
null hypothesis, with borderline significance equality in callback rates for gig-enhanced resumes
(p-value of 0.15). In other words, the callback rates between men and women were unequal.

---

[5]While logistical restrictions were the main reason for introducing a 2-month gap between the two waves of applications,
the gap also allowed us to avoid the Christmas and holiday season, during which the demand for driver jobs would increase
temporarily. Reassuringly, according to the "Economy At A Glance" table provided by the Bureau of Labor Statistics, the
unemployment rate in our study area remained stable during the months that we were actively sending applications.

5 DISCUSSION

To summarize, we did not find that gig-enhanced resumes—to mitigate the negative effects of long-term unemployment for low-skilled job seekers—increase callback rates in economically significant ways. This is true even if we take the upper bound of our confidence interval in the difference between callback rates for enhanced and baseline resumes. To the contrary, we found some evidence that callback rates are *lower* for gig-enhanced resumes, especially for women. One possible explanation for observing lower callback rates for gig-enhanced resumes is that gig work not only signals worker quality to the employer (which should raise callback rates) but also signals that the worker has the outside option of taking up gig work if she is unhappy with her new job. The very flexibility of gig work might therefore bolster one's resume and provide a low-friction "escape" from a regular job. To address this question, one might have to go beyond the audit-study methodology and survey employers directly. Next, we speculate on our results and reflect on the use of audit studies.

5.1 Recognizing gender differences

Occupations such as drivers are male-driven—according to Data USA,[6] 83.9% of taxi drivers and chauffeurs are male [6]. Our results showed that male profiles had a higher callback rate than female profiles, regardless of whether the resumes were "enhanced" with gig experience. Employers might apply gender stereotypes and attribute a greater demand for flexibility to female applicants with gig experience than male applicants (for example, they might assume that a female applicant needs the flexibility of gig work to take care of her children). Similarly, employers might infer that female applicants with gig experience are less willing to accept driving assignments. Past research found that women drivers appeared to avoid unsafe locations, because of either crime or the likelihood of encountering more intoxicated drivers [11]. Avoiding unsafe locations could lead to route inefficiencies and increased cost in terms of gas and vehicle wear. It would be an interesting extension to better understand these gender differences. In other words, are women hurt more in other domains by disclosing gig work on their resumes? It would require looking at job categories other than "Drivers" to understand how robust this finding is.

5.2 Methodological reflections

In this section, we reflect on the methodological contribution of our audit study and discuss the challenges that we experienced. "The audit study is a specific type of field experiment that permits researchers to examine difficult to detect behaviors, such as racial and gender discrimination, and decision-making in real-world scenarios"[21, p. 3]. In a labor market setting, we examined employers' interview decisions by presenting our application profiles to them as naturally as possible. We did this by conforming to the industry standard of crafting and submitting applications, and responding to the callbacks in a timely manner. However, today's application process has been fully digitalized and highly integrated, which posed a number of challenges. In our reflection, we highlight some of the specific changes and the resulting impact on our study.

5.2.1 Digitalization of employment and its impact on audit studies. Executing large-scale audit studies was relatively easy in the early 2000s when employers still posted job openings in local newspapers and accepted mail applications. No technology platform vetted applications and ensured unique emails and phone numbers, for example. Early studies could therefore create thousands of resumes with multiple treatment arms by simply printing and mailing customized resumes [5].

---

[6]Data   USA   provides   the   most   comprehensive   visualization   of   U.S.   public   data: https://datausa.do/profile/soc/533041/#employment

However, the rise of job listing sites has fundamentally changed the nature of audit studies. These sites require that applicants spend a considerable amount of time creating a profile and completing sometimes lengthy surveys. Now, employers on these sites can search applicants' profiles and send invitations for interviews, which transforms the traditional job-search process. While digitization is likely to decrease *average* combined search cost (the sum of frictional costs that are borne by employers and workers) by making the matching process more efficient, past research suggests that it might do little to help under-served job seekers, who sometimes lack experience in completing these online onboarding processes [37].

5.2.2 Challenges in the new digital era. Perhaps ironically, job sites make automated creation of profiles and applications for audit studies far more labor-intensive than previously. There are two new types of barriers not present in early audit studies: (1) creating a profile requires great care to not be screened out as a spammer; and (2) some employers demand additional interactions in addition to the standard application form.

First, consider profile creation. In our setting, a unique email address and telephone number identifies an application profile. We needed to prepare and register eight sets of these identifiers on Indeed to conduct our audit study. We customized the home address, telephone number, and education records to the local area, which would need to be replicated for any new metropolitan areas.

Because job applicants typically use free consumer email providers, we created personal Gmail accounts for our fictitious applicants. At the time of our Gmail account setups (October 2018), Google required a *valid* phone number to receive a verification code during the account setup process. The same phone number could be used for at most two accounts, which required us to purchase four prepaid AT&T SIM cards. We then rented local phone numbers on Twilio ($1 per month) in the study area and set up a call-forwarding and transcription service to Google Voice. We could not use Google Voice directly because no local area codes were available in our study area. To finish the account setup, we needed to populate all required fields in Indeed, which took more than an hour for each application profile.

Although we used a program to specify which profiles applied to which openings, completing the application was difficult, if not impossible to automate. The steps required to complete an application differ by employer and could take anywhere from 20 seconds to 10 minutes. In some cases, employers asked for full employment history, which needed to be carefully copied from the resume and pasted to the HTML form on Indeed.com. However, other questions and tasks were often required such as leadership aptitude surveys and work-preference-related questions such as preferred shifts and earliest start date. Employers also asked about specific work experience such as whether an applicant had experience driving a forklift or working as a manual laborer. Such heterogeneity in the application process posed automation challenges.

Our experimental design required us to commit to finish all the jobs that were assigned with an application profile. In total, we logged a minimum of 60 hours to manually send out all of the applications for one metropolitan city, a minimum of 1 hour for each valid digital profile, and 10 hours to create a basic research infrastructure for a new metropolitan area.[7] Moreover, to submit 1,000 applications in a new city, a minimum of 60-person hours will be needed at a rate of 16 applications an hour. Lower average search costs could move more of the hiring process to these sites over time compared to alternative channels such as word-of-mouth and social networks, which were traditionally used to fill more than half of all job openings [23].

---

[7]List of infrastructures include: web-scrapers for jobs and resumes, email forwarding from personal Gmail accounts to a master email account, call-forwarding from the local phone number to the voicemail, and an auto script to refresh the application schedule list daily .

Our work also identified key execution steps for automating and replicating these new types of audit studies across geographic regions. Studying digital job searching requires innovative HCI solutions and opens several future work opportunities.

5.2.3 Opportunities for audit studies in CSCW and HCI. There has been a growing body of HCI and CSCW research around employment and the sharing-economy [17]. To strengthen this literature, we reflect on how audit studies could lead to new contributions to the field. We envision future work focused on measuring the extent of labor market discrimination by creating fictitious profiles that vary in numerous aspects of an applicant's identity. For example, an applicant's gender or ethnicity can be easily primed by using appropriate names. Political attitudes or sexual orientation can be indirectly inferred through entries in "hobbies," "volunteer experience," or "work experience," and homeless status can be revealed via addresses, or the lack thereof [24, 25]. The audit study method can be fruitfully applied to other sharing-economy applications where individual profile characteristics might indirectly affect subsequent outcomes. For example, Sariisik [33] used the audit study method to document discrimination against users with Arab/Muslim-sounding names on Airbnb. Because user profiles on some platforms have a rich set of identity-based features (such as profile photos, which can reveal gender, physical attractiveness, ethnicity or social class), audit studies can help researchers identify the impact of those characteristics on job search or product market outcomes. Informed by such research, online platforms have the potential to overcome documented discrimination by changing their platform design. Platform users, such as job seekers, can be coached on how to minimize possible bias by curating the information they indirectly reveal through their profiles.

6 LIMITATIONS

We acknowledge the methodological limitations of our study. Because we only submitted resumes to one U.S. city, we limited generalizability across the U.S. because of the strong cultural and economic variances. Transportation is the largest gig-economy sector in the country, and transportation jobs, in particular, are in high demand [31]. Nevertheless, it would be interesting to consider other industries, especially those employing more highly skilled workers such as programmers. In addition, drivers tend to be dominated by men [11]. The addition of more gender-balanced gig work (e.g., freelance in Upwork, services offered in TaskRabbit) or more women-dominated fields (e.g., babysitting in Sittercity.com [8]) could help to strengthen our results, especially as they relate to understanding gender-based differences in gig work. For example, would experience with Sittercity.com help with applications to traditional employment such as childcare centers or nursing homes?

In the job search context, audit studies showcase *which* resumes employers respond to—not *why* they respond to those resumes. Understanding *why* women seem to benefit the least (and are potentially hurt) by disclosing gig work on their resumes is an area worth exploring further. This signals another limitation of our study: a discussion with employers who responded to our study would add a rich and complementary perspective to our results; however, obtaining honest insights on potentially discriminatory behaviors could be challenging. Further investigations are needed to understand how to streamline audit studies in this context and how to effectively complement this method with a qualitative approach. Finally, the U.S. unemployment rate was historically very low at the time of the study, even though we selected a U.S. city with a higher unemployment rate than the national average. This could dampen the positive signaling effect of gig work because

---

[8]Sittercity.com is an online marketplace that supports families, individuals and corporate employees who wish to hire local in-home care such as babysitting, senior care, pet care and even housekeeping.

employers could compete even for lower-ability workers and amplify the negative signaling effect of workers having better outside options.

7 CONCLUSION

Our work contributes to the growing sharing-economy literature, especially to the few quantitative studies that exist [17]. Specifically, audit studies such as ours provide a clean methodology to identify the effect of resume content on initial employer interest. However, as mentioned as a limitation, audit studies in the digital employment domain are becoming more challenging to implement as advances in artificial intelligence make the initial application process more interactive. Further investigations within HCI and CSCW are needed to understand how to ease the burden of executing these studies.

Our early results suggest that driving for a real-time ridesharing service does not substitute for traditional driving jobs in bridging employment gaps. This has important implications for both job seekers and policy makers. Job applicants might not want to emphasize such gig work on their resumes if the net signaling effect is negative. Policy makers should be encouraged to gain a better understanding of the direct *and* indirect costs and benefits of working for certain gig work platforms. Finally, if we are to support job seekers in making informed decisions about what to include or not include on their resumes, we must understand, going forward, *why* driving for a gig platform had the impact it did.

ACKNOWLEDGMENTS

REFERENCES

[1] Syed Ishtiaque Ahmed, Nicola J. Bidwell, Himanshu Zade, Srihari H. Muralidhar, Anupama Dhareshwar, Baneen Karachiwala, Cedrick N. Tandong, and Jacki O'Neill. 2016. Peer-to-peer in the Workplace: A View from the Road. In *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems (CHI '16)*. ACM, New York, NY, USA, 5063–5075. https://doi.org/10.1145/2858036.2858393

[2] David Autor and Susan Houseman. 2005. *Do Temporary Help Jobs Improve Labor Market Outcomes for Low-skilled Workers? Evidence from Random Assignments*. National Bureau of Economic Research.

[3] Kristen Bahler. 2017. Unemployment Is Really Low. So Why Can't These People Find Jobs? (2017). http://money.com/money/4758109/unemployment-is-really-low-so-why-cant-these-people-find-jobs/ [Accessed: 2019-08-15].

[4] Marianne Bertrand and Esther Duflo. 2016. *Field Experiments on Discrimination*. Working Paper 22014. National Bureau of Economic Research. https://doi.org/10.3386/w22014

[5] Marianne Bertrand and Sendhil Mullainathan. 2004. Are Emily and Greg more employable than Lakisha and Jamal? A field experiment on labor market discrimination. *American Economic Review* 94, 4 (2004), 991–1013.

[6] William T Bielby and James N Baron. 1986. Men and women at work: Sex segregation and statistical discrimination. *Amer. J. Sociology* 91, 4 (1986), 759–799.

[7] John Bowers, Graham Button, and Wes Sharrock. 1995. Workflow from within and without: Technology and cooperative work on the print industry shopfloor. In *Proceedings of the Fourth European Conference on Computer-supported Cooperative Work ECSCW'95*. Springer, 51–66.

[8] Magnus Carlsson. 2011. Does hiring discrimination cause gender segregation in the Swedish labor market? *Feminist Economics* 17, 3 (2011), 71–102.

[9] M. Keith Chen, Judith A. Chevalier, Peter E. Rossi, and Emily Oehlsen. 2017. *The value of flexible work: Evidence from Uber drivers*. Technical Report. National Bureau of Economic Research.

[10] Joshua Comenetz. 2016. Frequently occurring surnames in the 2010 Census. *United States Census Bureau* (2016).

[11] Cody Cook, Rebecca Diamond, Jonathan Hall, John A. List, and Paul Oyer. 2018. *The gender earnings gap in the gig economy: Evidence from over a million rideshare drivers*. Technical Report. National Bureau of Economic Research.

[12] Tawanna R. Dillahunt. 2014. Fostering social capital in economically distressed communities. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. ACM, 531–540.

[13] Tawanna R. Dillahunt, Nishan Bose, Suleman Diwan, and Asha Chen-Phang. 2016. Designing for Disadvantaged Job Seekers: Insights from Early Investigations. In *Proceedings of the 2016 ACM Conference on Designing Interactive Systems (DIS '16)*. ACM, New York, NY, USA, 905–910. https://doi.org/10.1145/2901790.2901865

[14] Tawanna R. Dillahunt, Jason Lam, Alex Lu, and Earnest Wheeler. 2018. Designing Future Employment Applications for Underserved Job Seekers: A Speed Dating Study. In *Proceedings of the 2018 Designing Interactive Systems Conference.* ACM, 33–44.

[15] Tawanna R. Dillahunt and Amelia R. Malone. 2015. The Promise of the Sharing Economy among Disadvantaged Communities. In *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems (CHI '15)*. ACM, New York, NY, USA, 2285–2294. https://doi.org/10.1145/2702123.2702189

[16] Tawanna R. Dillahunt, Sandy Ng, Michelle Fiesta, and Zengguang Wang. 2016. Do Massive Open Online Course Platforms Support Employability?. In *Proceedings of the 19th ACM Conference on Computer-Supported Cooperative Work & Social Computing (CSCW '16)*. ACM, New York, NY, USA, 233–244. https://doi.org/10.1145/2818048.2819924

[17] Tawanna R. Dillahunt, Xinyi Wang, Earnest Wheeler, Hao Fei Cheng, Brent Hecht, and Haiyi Zhu. 2017. The Sharing Economy in Computing: A Systematic Literature Review. *Proceedings of the ACM on Human-Computer Interaction* 1, CSCW, Article 38 (Dec. 2017), 26 pages. https://doi.org/10.1145/3134673

[18] Jane Dokko, Megan Mumford, and D.W. Schanzenbach. 2015. Workers and the Online Gig Economy. A Hamilton Project Framing Paper. *The Hamilton Project: Advancing Opportunity, Prosperity, and Growth* (2015).

[19] Lynn Dombrowski, Adriana Alvarado Garcia, and Jessica Despard. 2017. Low-Wage Precarious Workers' Sociotechnical Practices Working Towards Addressing Wage Theft. In *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems (CHI '17)*. ACM, New York, NY, USA, 4585–4598. https://doi.org/10.1145/3025453.3025633

[20] Diana Farrell, Fiona Greig, and Amar Hamoudi. 2018. The Online Platform Economy in 2018: Drivers, Workers, Sellers, and Lessors. *JPMorgan Chase Institute* (2018).

[21] S. Michael Gaddis. 2018. *Audit studies: Behind the scenes with theory, method, and nuance.* Vol. 14. Springer.

[22] Michael Gebel. 2013. Is a temporary job better than unemployment? A cross-country comparison based on British, German, and Swiss panel data. *SOEP paper* 543 (2013).

[23] Mark S. Granovetter. 1995. *Getting a job: A study of contacts and careers.* University of Chicago Press, Chicago. http://www.worldcat.org/search?qt=worldcat_org_all&q=9780226305813

[24] David G. Hendry, Norah Abokhodair, Rose Paquet Kinsley, and Jill Palzkill Woelfer. 2017. Homeless Young People, Jobs, and a Future Vision: Community Members' Perceptions of the Job Co-op. In *Proceedings of the 8th International Conference on Communities and Technologies (C&T '17)*. ACM, New York, NY, USA, 22–31. https://doi.org/10.1145/3083671.3083680

[25] David G. Hendry, Jill Palzkill Woelfer, and Thuy Duong. 2017. U-District Job Co-op: constructing a future vision for homeless young people and employment. *Information Technology & People* 30 (2017), 602–628. http://www.emeraldinsight.com/doi/full/10.1108/ITP-05-2015-0117

[26] Julie Hui, Kentaro Toyama, Joyojeet Pal, and Tawanna Dillahunt. 2018. Making a Living My Way: Necessity-driven Entrepreneurship in Resource-Constrained Communities. *Proceedings of the ACM on Human-Computer Interaction* 2, CSCW, Article 71 (Nov. 2018), 24 pages. https://doi.org/10.1145/3274340

[27] Julie S. Hui, Darren Gergle, and Elizabeth M. Gerber. 2018. IntroAssist: A Tool to Support Writing Introductory Help Requests. In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems.* ACM, New York, NY, USA, 22.

[28] Andrea Ichino, Fabrizia Mealli, and Tommaso Nannicini. 2005. Temporary work agencies in Italy: A springboard toward permanent employment? *Giornale degli economisti e annali di economia* (2005), 1–27.

[29] Alan B. Krueger, Judd Cramer, and David Cho. 2014. Are the long-term unemployed on the margins of the labor market? *Brookings Papers on Economic Activity* 2014, 1 (2014), 229–299.

[30] Bureau of Labor Statistics. 2019. Economic News Release: Employment Situation Summary. (2019). https://www.bls.gov/news.release/empsit.nr0.htm [Accessed: 2019-04-03].

[31] Bureau of Labor Statistics. 2019. Occupational Employment and Wages Summary. (Mar 2019). https://www.bls.gov/news.release/ocwage.nr0.htm [Accessed: 2019-04-03].

[32] Niloufar Salehi and Michael S. Bernstein. 2018. Ink: Increasing Worker Agency to Reduce Friction in Hiring Crowd Workers. *ACM Transactions on Computer-Human Interaction (TOCHI)* 25, 2 (2018), 10.

[33] Merve Sariisik. 2018. *Identity Discrimination in the Sharing Economy: A Field Experiment.* University of Michigan Working Paper.

[34] Lucy A. Suchman. 1987. *Plans and situated actions: The problem of human-machine communication.* Cambridge University Press.

[35] Ryo Suzuki, Niloufar Salehi, Michelle S. Lam, Juan C. Marroquin, and Michael S. Bernstein. 2016. Atelier: Repurposing expert crowdsourcing tasks as micro-internships. In *Proceedings of the 2016 CHI conference on human factors in computing systems.* ACM, 2645–2656.

[36] Eva Van Belle, Ralf Caers, Marijke De Couck, Valentina Di Stasio, and Stijn Baert. 2017. Why is unemployment duration
      a sorting criterion in hiring? *IZA Discussion Paper No. 10876. Available at SSRN: https://ssrn.com/abstract=2998986*
      (2017).
[37] Earnest Wheeler and Tawanna R. Dillahunt. 2018. Navigating the Job Search as a Low-Resourced Job Seeker. In
      Proceedings of the 36th Annual ACM Conference on Human Factors in Computing Systems (CHI '18). ACM, New York,
      NY, USA, 10.   https://doi.org/10.1145/3173574.3173622
[38] Niam Yaraghi and Shamika Ravi. 2017. The current and future state of the sharing economy. *Available at SSRN:
      https://ssrn.com/abstract=3041207* (2017).

A APPENDIX

A.1 Details of our preliminary investigation

In preparation for our audit study, we conducted preliminary job searches in eight major metropolitan areas in the U.S., including Chicago, Detroit, New York, Miami, Los Angeles, Atlanta, Seattle and the Dallas–Fort Worth. For each metropolitan area, we searched Indeed.com for full-time jobs within a 25-mile radius. Further, to target lower-skilled jobs, we restricted the searches by salary ranges ($20K–30K$, $30K–40K$, $40K–50K$ and $50K–60K$). For each set of search results, we categorized the first 200 jobs into sensible bins where each bin had at least 10 jobs (rare jobs were collected into the "Others" bin) and aggregated the categories across salary ranges. The search-and-categorize exercise generated a distribution of jobs for each of the eight metropolitan areas. To enhance the external validity in our job search, we repeated the exercise on Monster.com, which is the head-to-head competitor of Indeed. Based on a set of comparisons of the distributions of jobs, both across the two job sites and across the eight metropolitan areas, we observed that: (1) The types of jobs on Indeed are not systematically different from the type of jobs on Monster. (2) The distributions of jobs within the metropolitan areas are also indistinguishable from one another; and (3) After combining all the jobs that we searched, driving jobs, in particular, made up a stable fraction in all metropolitan areas.

A.2 Sample resumes

Note that the city, state, ZIP code, and phone numbers were included in the original study.

Sample Resume, version 1, with gig work.

Firstname Lastname
City, State, XXXXX
xxxxxxxxxxxxx@gmail.com
(xxx) xxx-xxxx

Authorized to work in the US for any employer

Work Experience

Driver
Gig_Company - City, State
March 2018 to Present

- Drive clients to and from local locations through the Metro area
- Follow all traffic laws and regulations
- Provide excellent customer service

Valet Driver
Hotel XXXXXX - City, State
January 2016 to March 2018

- Greet customers in a pleasant manner and inquire into their car parking needs.
- Drive customers' vehicles to designated parking locations in a safe manner.
- Provide customers with a receipt in exchange of handed-over keys.
- Ascertain that vehicles are properly parked in designated lots and locked before being left alone.
- Use hand signals, batons and lights to direct customers' vehicles in available parking spots.
- Take receipt tags from customers, locate their cars and drive them to the waiting areas.

Parking Attendant
XXXX Parking - City, State
June 2014 to December 2015

- Maintain great customer service
- Accept debit and cash transactions
- Answer any questions needed
- Maintain parking lot area
- Greet and give directions (if needed)

Pizza Delivery Driver
XXX XXXXX's Pizza - City, State
October 2011 to May 2014

- Received and delivered quality products to customers
- Communicated with kitchen staff
- Maintained kitchen work areas, equipment, and utensils in clean and orderly condition Answered telephone calls and responded to inquiries.
- Performed all transactions in a cordial, efficient and professional manner

Sample Resume, version 1, with gig work, continued.

- Took food orders and relayed orders to kitchens or serving counters
- Washed dishes, glassware, flatware, pots, and/or pans using dishwashers or by hand
- Cleaned and sterilized equipment and facilities

Team Member
XXX King - City, State
July 2010 to October 2011

- Works as food cashier
- Meet and greet customers
- Take food and drink orders
- Prepared food and drink orders
- Answer questions about menu items, policies, and services
- Provide excellent customer care
- Maintain a clean work environment

Education
_____

BBBBB High School - City, State
August 2007 to May 2010

Sample Resume, version 2, without gig work

Firstname Lastname

City, State XXXXX
xxxxxxxxxxxxxxx@gmail.com
(xxx) xxx-xxxx

Authorized to work in the US for any employer

Work Experience

Driver
XXX Landscape Supply - City, State
May 2016 to March 2018

- Deliver landscape supplies and consumer goods to customers
- Process customer orders
- Load & unload products

Hand Lawn Mower and Leaf Blower
XXXXXXXX Services, INC - City, State
August 2015 to April 2016

- Completed range of landscaping duties including raking, shoveling
- Operating weed-whacking equipment, hand lawn mower, leaf blower, riding mower

Truck Driver
XXXXXX, LLC - City, State
March 2012 to August 2015

- Pre and post vehicle inspections. Maintain all vehicle fluid levels.
- Recommend vehicle service when required. Update daily logs and documents.
- Pick up and deliver truckload automotive parts/products between various suppliers.

Warehouse Associates
XXXX - City, State
September 2010 to February 2012

- Perform customer service, meet and greet customers, organize store products, meet customer needs with desired products, and housekeeping duties as well
- Unload trucks for inventory

Education

AAAAAAA High School - City, State
August 2007 to May 2010

Received April 2019; revised June 2019; accepted August 2019