VERA BRENČIČ
University of Alberta, Canada

I Z A
World of Labor
Evidence-based policy making

Interaction between technology and recruiting practices

While technology has improved sharing and managing information, there are legitimate concerns about the quality of information and its use in recruitment

Keywords: recruitment, internet, employment websites, social media sites, artificial intelligence

ELEVATOR PITCH

Employers are steadily increasing their reliance on technology when recruiting. On the one hand, this technology enables the wide dissemination of information and the management of large quantities of data at a relatively low cost. On the other hand, it introduces new costs and risks. The ease with which information can be shared, for example, can lead to its unauthorized use and obsolescence. Recruiting technologies are also susceptible to misuse and to biases built into their underlying algorithms. Better understanding of these trade-offs can inform government policies aiming to reduce search frictions in the labor market.

Length of time job ads and resumes are posted on employment websites

Source: Based on data in Brenčič, V. "Developments in the market for employment websites in the US".
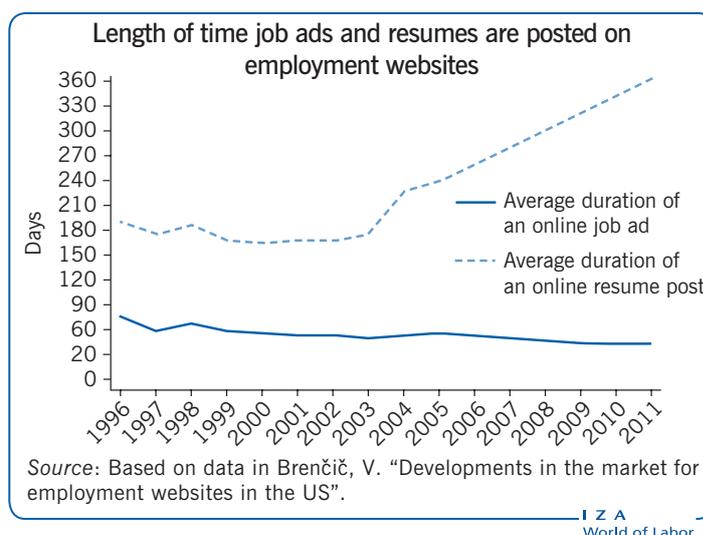
KEY FINDINGS

Pros

⊕ Online job boards have improved the ease with which information about available job opportunities can be shared and updated.

⊕ Online platforms for contract labor enable employers to hire from a larger and more diverse pool of applicants.

⊕ Better information about job searchers has tilted employers' hiring in favor of disadvantaged job searchers and increased the number and quality of matches, especially for technical jobs.

⊕ Better information about employers has increased the quality of matches as evidenced by lower turnover.

Cons

⊖ The ease of information sharing on websites that host job boards and resume banks can lead to stale information about jobs and resumes.

⊖ Employers can use social networking sites to get information about workers without the workers' knowledge.

⊖ The use of technology might not improve hiring and can lead to shorter tenure of new hires.

⊖ Exclusive reliance on technology to analyze data can result in inefficient hiring because of biases and manipulation.

AUTHOR'S MAIN MESSAGE

With its declining costs and widespread adoption, information and communications technology (ICT) will continue to affect all aspects of recruiting. ICT shapes how required job skills are determined, affects how information about available jobs is disseminated, and helps with the evaluation of potential new hires. Evidence suggests that employers looking for workers with technical skills, non-cognitive skills, and less experience benefit the most from using ICT when recruiting. This suggests that public policy could improve outcomes across a wider group of employers and job searchers, by offering training and incentives that enhance users' ICT skills.

1

MOTIVATION

Prior to the widespread adoption of information and communication technology (ICT), employers with job vacancies advertised their jobs in newspapers, placed help-wanted signs on their premises, contacted employment agencies, and encouraged employees to spread the word about job openings. Because employers were rarely surveyed about these activities, employer recruiting was not well documented. As a result, researchers have limited understanding about the recruiting process for this period. For the most part, existing research documents the types and number of recruiting channels employers used and the amount of time employers put into analyzing information they received through their various recruiting efforts. Very little data exist on what information employers used and how the available information affected hiring decisions.

Advancements in ICT have led to the introduction of tools that help to store, share, access, and analyze large amounts of data. The widespread adoption of the internet, for example, introduced new tools for information sharing. Craigslist, Monster, LinkedIn, and Careerbuilder are some examples of websites that offer platforms for posting job ads and resumes online. Another group of websites for contract labor offers platforms for actual delivery of jobs that can be conducted and monitored online. Websites like Upwork (formerly oDesk), Amazon's mTurk, and eLance allow employers to hire from a pool of workers from every part of the world. These websites often provide unprecedented levels of detail about prospective workers (e.g. past performance measures, evaluations from past employers, past wages) and job openings. Other websites, like Glassdoor, have emerged to provide a depository of reviews of employers and their workplaces at a level of detail that was not previously available to those without ties to the employers. In a similar way, social networking sites have become a depository of information that employers can access to gain information about their job applicants. Advancements in ICT have also allowed for the introduction of tools such as artificial intelligence (AI), which help with the analysis of information.

Because these new tools leave behind a trail of information that can be stored and analyzed, the wide adoption of ICT is offering new insights into recruiting processes. The black box of recruiting is beginning to be unpacked. However, a growing body of research also offers insights into the costs and risks of using ICT in recruitment. Some of these arise due to a lack of skills needed to use ICT effectively, improper use and low quality of information, and the potential for misuse of tools that help with the analysis of information. This article reviews evidence on the benefits and risks of increasing reliance on ICTs as they substitute and complement traditional recruitment practices.

DISCUSSION OF PROS AND CONS

Setting hiring requirements

The first stage of recruiting begins by identifying the need to hire a worker to do tasks that cannot be completed by existing workers. In doing so, employers identify the skills that are required to complete the tasks. Advancements in ICT can affect this stage in two ways.

First, ICT can be used to identify changes in the required skills linked to various occupations. An example of such efforts is the pan-European-led CEDEFOP. The purpose

of this project is to collect descriptions of job openings from online job boards, analyze their content, and identify information about the required skills, wage offers, and so on. These efforts are motivated by the need to inform decisions over training and schooling by, respectively, employers and job searchers. The information gathered can also inform employers about the need to update skill requirements.

The second channel through which ICT can influence recruiting is the skill requirements of recruiters themselves. One study shows, for example, that managers hire worse people (e.g. with shorter tenure) when they ignore the recommendations of a job test administered to applicants [1]. While the authors do not provide direct evidence for the finding, one explanation they offer is that the managers do not have adequate skills to use recommendations. If this explanation is correct, then recruiters need to be equipped with proper skills to use ICT effectively.

Information sharing: Dissemination and access

The next two stages of recruiting involve the dissemination of information about the job opening and the gathering of information about prospective hires. The internet has become the main channel through which ICT supports these two stages of recruiting.

Employers' use of the internet for sharing information about available jobs started in the early 1990s when employers used discussion forums to advertise jobs. Over time, specialized websites started to offer platforms for posting job ads and resumes. As

Figure 1. Online traffic on websites that host job boards and resume banks in the US

Source: Author's own based on data from *Weddle's Guides to Employment Web Sites*. Online at: https://www.weddles.com/
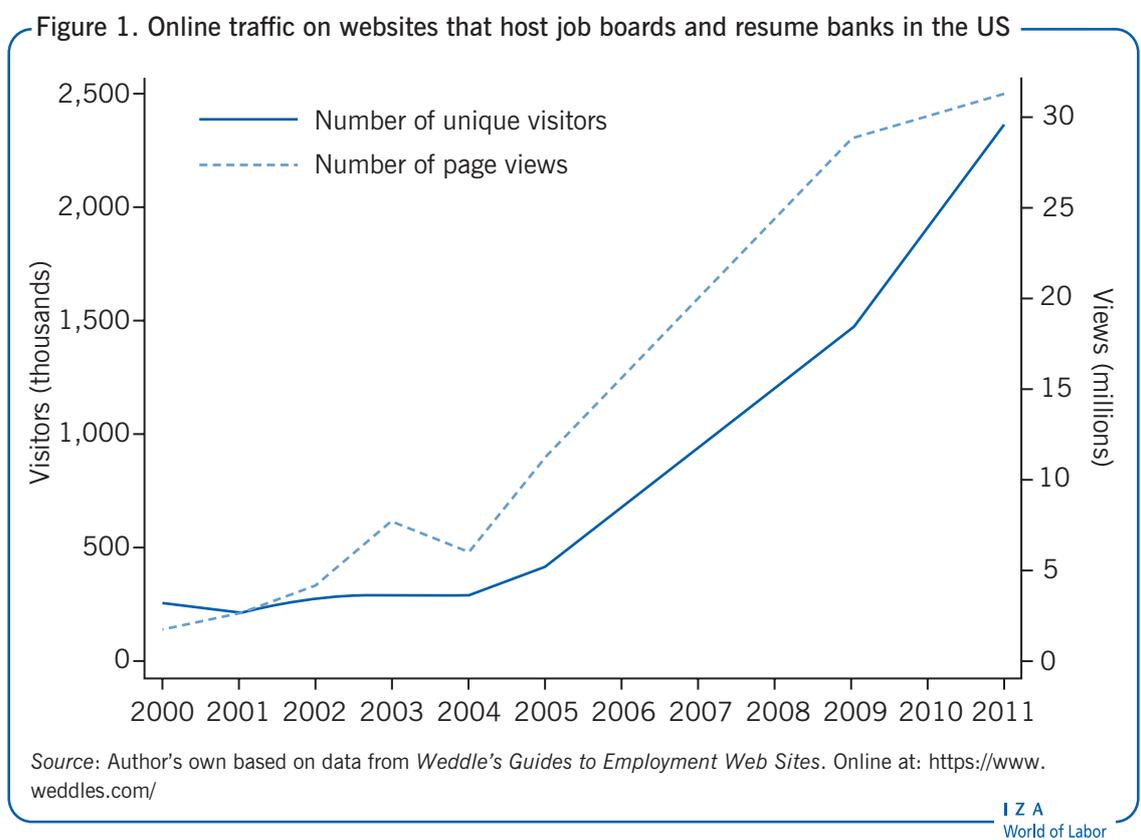
illustrated in Figure 1, employment websites experienced an increase in the number of visitors and page views over time. As tasks that require ICT grew in importance for many jobs, new websites started to offer platforms where jobs could be completed entirely online. These changes created an online market for contract labor. This segment of online recruiting is also becoming increasingly important.

Changes brought on by these websites enhanced employers' ability to disseminate information to a much wider audience and permitted more frequent updating of information about available jobs. The amount of information that employers could share about their jobs (and the workplace) improved as binding restrictions on the length of a job ad were eliminated. These changes meant that employers could disseminate information with more ease, greater speed, and at lower cost, which has led to a significant reduction in search frictions and the potential for a better functioning labor market. Employers' recognition of this potential and the shift toward online dissemination of information about jobs has forced statistical agencies to change the way data on labor demand are collected. Rather than relying on classified ads sections in newspapers, as had been done in the past, some statistical agencies now rely on online job postings to get their measures of available job openings.

The extent to which employment websites offer employers access to information about a larger and more diverse applicant pool compared to offline recruiting tools is most evident from studies that document employers' use of online platforms for contract labor. Several studies in this line of research find that employers in the US draw on a broad pool of job searchers that transcends national borders for jobs that can be completed online [2]. Because these platforms offer detailed information about the workers (e.g. past performance measures, past employers' ratings, experience on the platform as measured by the number of hours worked, and wage history), they can particularly benefit workers with less experience (i.e. new labor market entrants) and workers in less developed countries whose credentials employers often have a harder time evaluating. Two relevant studies demonstrate this, finding that access to more detailed data about workers improves subsequent employment and earnings of new entrants [3] as well as the likelihood of securing an interview, being shortlisted for work, and wage bids for workers from less developed countries [2]. The authors of the latter study, however, find that workers from less developed countries benefited less when access to better on-the-job monitoring was available to employers. This finding affirms that the initial gains to the disadvantaged group of job applicants were due to the online platform succeeding in improving access to information. These gains disappeared once employers could get the relevant information about the workers by using on-the-job monitoring.

Whereas online platforms for contract labor have improved access to information about job searchers, the presence of websites like Glassdoor is providing a space for workers to reveal information about workplaces and employers voluntarily. These platforms provide information about employer quality that would otherwise be harder to observe as job searchers and employers expand their search geographically. Studies have found links between reviews of employers that were posted by workers on Glassdoor and firm performance, job interview experience (i.e. experience was more in line with expectations), and worker turnover.

Ease of access to information: Costs and risks

Employers' reliance on various online platforms to disseminate and gather information has also ushered in new costs and risks. First, because the costs of online dissemination of information have declined, information might not be maintained with regular updates, resulting in phantom vacancies whereby job ads are not removed from an online job board once filled and continue to be advertised. This introduces new search frictions in the labor market as job searchers direct too many of their job applications toward job postings that have only recently been posted on an online job board. While the existing literature has focused on the way stale information about available job openings might frustrate job searchers, this is also likely to be relevant for employers. Such concerns arise if job searchers do not update their resumes once a job is found or new qualifications are acquired. In this case, employers incur a cost of sorting through information that is not up to date. As the Illustration on p. 1 shows, employment websites in the US, on average, increased the length of time that resumes were kept in online resume banks over time. Whereas an average employment website kept a resume in its resume bank for about six months from 1996 until 2003, it kept them on average for 12 months by the end of the sample period in 2011. The incidence with which the websites kept resumes online indefinitely also increased over time. Whereas 20% of the websites kept resumes indefinitely in the early 2000s, 50% did so in 2011. Employment websites, on the other hand, decreased the length of time that job ads were kept posted on online job boards.

The second risk relates to privacy. Legislation in many countries protects job searchers from having to reveal certain information (e.g. religious affiliation, political convictions) to employers during the recruiting process. With the proliferation of social networking sites and a reduction in tracking costs (i.e. costs of collecting information about an individual over time or/and across online sites), it has become easier for employers to use social networking sites to gather information about the job applicants that they cannot legally get during a formal hiring process. Several surveys of employers in Belgium, Canada, the US, Greece, France, and Switzerland confirm that employers pursue these activities. At the same time, several other surveys also find that many job searchers reveal information about themselves online without realizing that the information can be collected by current and prospective employers for uses other than those intended at the time the information was posted online. To get a better sense of these concerns, authors of one study sent employers fictitious resumes [4]. Together with the resumes, which included no information about personal traits, the authors created fictitious Facebook pages that revealed information (i.e. religious affiliation and sexual orientation) linked to the fictitious applicants. The field experiment revealed differences in callback rates. The pattern was consistent with some employers using information about the job applicants' personal traits on Facebook when deciding whom to interview. Another similar field experiment in Belgium revealed that callback rates were higher for candidates whose fictitious Facebook accounts featured a more attractive photo.

The third potential disadvantage relates to access to a larger and more diverse pool of job searchers from different parts of the world that is afforded to employers on many of the online platforms for contract labor. One study, for example, finds that teams consisting of workers from different countries that are formed via online platforms for contract labor are less productive than teams that are nationally more homogenous. This relationship is particularly strong for workers with specialized skills and is caused by difficulties with communication

rather than preferences or expectations [5]. Another study finds that despite access to detailed information about a diverse pool of workers on a website for contract labor (oDesk), diaspora connections continue to play an important role in employers' hiring decisions.

Information analysis using AI: Screening of job applicants

The final stage of recruiting requires the analysis of available information about the job applicants based on which job offers get extended. While internet-backed tools have led to a faster and cheaper dissemination of and access to information, recent applications of AI offer the basis for the analysis of large amounts of data. AI, in a narrow sense, is software that offers predictions and recommendations based on patterns it identifies in data. One example is the use of algorithms to assign job interviews based on information from the applicants' resumes.

The use of AI to support recruiting offers several benefits. The most immediate benefit is that AI allows employers to utilize the large amounts of data that have become available. Another benefit is the ability to conduct non-routine tasks, such as screening job applications. Most of the evidence on the effectiveness of AI as a recruiting tool comes from field experiments conducted in online markets for contract labor. This research tends to focus on evaluating the effects of a recommendation system that alerts employers to the existence of good job applicants. The recommended applicants are typically chosen by an algorithm that identifies overlaps between the applicants' skills and employers' required skills, the applicants' availability, and the applicants' ability.

One such study finds that the introduction of a recommendation system by an online platform for contract labor increased employer-initiated invitations to job searchers to apply for job openings. Whereas employers' hiring success only improved for technical job openings, no effect was found on wages or productivity of new hires [6]. Another study finds that hiring based on algorithms may be less biased than human decision-making as its use tends to benefit minority candidates. Moreover, algorithm-based hiring has been shown to lead to job applicants who are more successful in interviews, are more likely to receive and accept job offers, and are less likely to use outside job offers during salary negotiations [7]. These benefits were larger when hiring candidates with better non-cognitive skills rather than better cognitive skills. Finally, one study finds that while AI-based recommendations affect employers' decisions about which job applicants to review in more detail, they do not affect employers' choices of whom to hire [8]. A related group of studies has revealed that AI-based recommendation systems are used less often for specialized jobs or when experienced workers are sought. Overall, the findings from these studies suggest that the gains from using recommendation systems are varied. It can be said that AI-based hiring disproportionally benefits employers with a vacancy that requires either technical skills, non-cognitive skills, or less experience.

Concerns related to AI-based recruiting

Several potential concerns regarding the use of AI in recruiting have also been identified, though their significance has yet to be documented empirically. First, many recommendation systems use existing data to form their recommendations. In this sense, recommendations can be plagued by biases that might be inherent in the data that are

generated from past (biased) decisions. Past performance measures, for example, that are used by recommendation algorithms might be measured with error for some workers due to the intentional discriminatory practices of their supervisors who were tasked to measure their performance. A related second concern is that only aspects of a job or a worker that are easier to measure and quantify can be incorporated into an algorithm [9].

A third concern is that using performance outcomes of existing workers to inform hiring decisions ignores the performance of those who were not hired [9]. This can potentially lead to unintended outcomes. In instances of past discrimination, for example, only the best performers from discriminated groups get hired. AI would predict hiring in favor of these groups while not considering that their past performance is not representative of the group but rather is an outlier caused by discrimination. While this issue also exists in the absence of AI-backed decision-making, it makes clear that AI cannot resolve all the problems inherent to decision-making.

Fourth, many recommendation systems draw on rules that lead to unintended biases. Even if employers are indifferent about the gender of their target audience, for instance, an algorithm that optimizes cost-effectiveness might result in job ads being shown disproportionally to men if advertising to men is less expensive [10]. One study has found that high-paying jobs are advertised less often to female users than to male users of Google's search engine [11]. Although no direct evidence for the cause of this link is provided, the authors stipulate that one reason might be that male users tend to click on ads for high-paying jobs more often than female users. If an algorithm that underlies Google's search engine is set up to maximize click probability, past gender differences in clicking will prompt the search engine to target users based on gender when advertising high-paying jobs.

Fifth, if the rules that underlie algorithms are known then they can be manipulated. Job searchers might include words in resumes or pursue activities that they know can improve their chance of securing a job interview. Such actions can result in distributional effects if job searchers differ in their ability to use and manipulate the technology. Thus far no evidence has been found that such manipulation is widespread. Two recent developments, however, may make this concern more relevant. Efforts to analyze the job content of online job ads have increased through projects like the pan-European CEDEFOP. Recent calls for better regulation of the use of AI are putting pressure on greater transparency of AI-backed algorithms [12]. Both changes are likely to result in easier access to data and rules that are used in AI-backed algorithms.

The above discussion of concerns makes clear that any adoption of AI must consider potential risks as well as gains. That said, these concerns can be ameliorated with relative ease by making all components transparent to their users.

Aggregate effects on the functioning of the labor market

The existing literature has documented positive and negative implications of ICT use at various stages of recruiting. It is therefore not surprising that evidence about the aggregate effects on the overall functioning of the labor market is scant. One study focuses on the rapid expansion of Craigslist, which provides an online platform for posting job ads, real estate ads, for-sale ads, and ads seeking relationships [13]. The study's authors find that the entry of Craigslist into local labor markets in the US did not decrease the local unemployment rate. This finding suggests that, despite improving dissemination of and

access to information, Craigslist did not improve the aggregate functioning of the labor market. One explanation for this null result might be Craigslist's cannibalization of online search traffic that had, prior to its entry, been taking place on competing employment websites. If this explanation is correct, then it underscores the difficulties of assessing aggregate effects by focusing on a single online platform or a single ICT tool.

LIMITATIONS AND GAPS

The key factor that limits researchers' understanding of the interaction between ICT and recruiting is the sheer complexity of the interaction. In addition, much of the existing evidence is based on recruiting efforts of employers in North America and tends to be restricted to specific segments of the labor market (i.e. a market for hourly work, jobs that require technical skills, and entry-level jobs). Access to data that are not tied to a particular country, industry, occupation, or skill level would allow a better understanding of the overall nature and variety of drawbacks and benefits of employers' reliance on ICT when recruiting. Furthermore, researchers need to better understand the factors that contribute to or hinder employers' adoption of ICT tools. Particularly important seems to be how differences in their adoption contribute to inequities by widening the gap in labor market experiences between those with access to new tools and those without.

SUMMARY AND POLICY ADVICE

Employers are increasingly relying on the internet and other ICT-backed tools to support many of the processes involved in their recruiting practices. These processes include dissemination of information about available job openings, search for information about potential hires, the analysis of job applications, and the initiation of contacts with potential new hires. Such activities can now be done with greater ease, much faster, and at a lower cost than prior to the adoption of ICT.

That said, new costs unique to the use of ICTs have also become apparent. One such cost is related to the large amount of available irrelevant information, which is due to irregular updating. Another cost arises as information gets accessed without the knowledge of those to whom it pertains thereby raising privacy concerns. The use of ICT as embodied by AI-backed recommendation systems can also result in costs due to suboptimal decisions arising from biases inherent in the underlying algorithms and data. Finally, the potential misuse of ICTs by users who lack the appropriate skills can also be costly and introduces new risks.

New policies need to take these costs and benefits into account. The greatest potential lies in policies that seek to enrich recruiters with skills to help them adopt and use ICT effectively. This could be done through subsidies geared toward on-the-job training or by ensuring that such skills are taught in schools. A separate issue that requires regulatory oversight concerns the need for data retention. AI-based recommendations systems require large amounts of data. Some of these data are digital footprints left by job searchers' and employers' activities online. Longer retention of such data could violate users' rights as protected by privacy laws. It may also be problematic if the data's usefulness decays over time as it becomes obsolete. Regulators could require that the details of underlying algorithms and the data be publicly available for review to minimize biases that can be present in AI-backed recruiting [12].

Acknowledgments

Competing interests

REFERENCE LIST

Further reading

Athey, S. "The impact of machine learning on economics." In: Agrawal, A., J. Gans, and A. Goldfarb (eds). *The Economics of Artificial Intelligence: An Agenda*. Chicago: University of Chicago Press, 2018.

Jansen, A. J., L. A. White, E. Dhuey, D. Foster, and M. Perlman. "Training and skills development policy options for the changing world of work." *Canadian Public Policy* 45:4 (2019): 460–482.

Key references

[1]   Hoffman, M., L. B. Kahn, and D. Li. "Discretion in hiring." *Quarterly Journal of Economics* 133:2 (2018): 765–800.

[2]   Agrawal, A., N. Lacetera, and E. Lyons. "Does standardized information in online markets disproportionately benefit job applicants from less developed countries?" *Journal of International Economics* 103 (2016): 1–12.

[3]   Pallais, A. "Inefficient hiring in entry-level labor markets." *American Economic Review* 104:11 (2014): 3565–3599.

[4]   Acquisti, A., and C. Fong. "An experiment in hiring discrimination via online social networks." *Management Science* 66:3 (2020): 1005–1024.

[5]   Lyons, E. "Team production in international labor markets: Experimental evidence from the field." *American Economic Journal: Applied Economics* 9:3 (2017): 70–104.

[6]   Horton, J. "The effects of algorithmic labor market recommendations: Evidence from a field experiment." *Journal of Labor Economics* 35:2 (2017): 345–385.

[7]   Cowgill, B. *Bias and Productivity in Humans and Algorithms: Theory and Evidence from Resume Screening.* Working Paper, 2020.

[8]   Barach, M. A., A. Kaul, M. Leung, and S. Lu. *Small Numbers Bargaining in the Age of Big Data: Evidence from a Two-sided Labor Matching Platform.* Working Paper, 2019.

[9]   Cowgill, B., and C. Tucker. *Algorithmic Fairness and Economics.* Columbia Business School Research Paper, 2020.

[10] Lambrecht, A., and C. Tucker. *Algorithmic Bias? An Empirical Study into Apparent Gender-biased Discrimination in the Display of STEM Career Ads.* Working Paper, 2018.

[11] Datta, A., M. C. Tschantz, and A. Datta. "Automated experiments on ad privacy settings: A tale of opacity, choice, and discrimination." *arXiv* (2014).

[12] Kleinberg, J., J. Ludwig, S. Mullainathan, and C. R. Sunstein. *Discrimination in the Age of Algorithms.* NBER Working Paper No. 25548, 2019.

[13] Kroft, K., and D. G. Pope. "Does online search crowd out traditional search and improve matching efficiency? Evidence from Craigslist." *Journal of Labor Economics* 32:2 (2014): 259–303.

Online extras

The **full reference list** for this article is available from:

https://wol.iza.org/articles/interaction-between-technology-and-recruiting-practices

View the **evidence map** for this article:

https://wol.iza.org/articles/interaction-between-technology-and-recruiting-practices/map