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Abstract

New technologies and digital platforms have ushered in a rise of gig, freelance, contract, and other types of independent work. Although independent workers and the gig economy as a whole have received plenty of attention, little research has examined the heterogeneity of work characteristics *among* different independent work opportunities, specifically as it relates to the participation of women in this workforce. Existing data indicate that some digital platforms are more male dominated, whereas others are more female dominated. What accounts for these differences? In this paper, we empirically examine the heterogeneity of work *within* independent work opportunities in relation to female participation by analyzing work characteristics in the United States from the Occupational Information Network (O*Net) database that reflect greater temporal flexibility, which has been shown to vary across occupations and to attract more female workers. Our findings suggest that women in the independent work context do self-select into the types of independent work jobs that reflect greater temporal flexibility, as is the case for women working in traditional employment. However, our findings also reveal that the way in which the existing literature measures temporal flexibility in traditional work settings may not be the same as the way it is measured in the context of independent work. We discuss the implications of our findings for public policy and labor laws.

JEL codes: J01, J08, J16, J4

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1. Introduction

New technologies and digital platforms have ushered in a rise of gig, freelance, contract, and other types of independent work. *Gig work*, *freelancing*, and *contracting* are terms that are often used interchangeably to refer to independent work opportunities that differ from traditional, employment-based work. Following the literature, we use the term *independent work* to refer to all these types of alternative labor arrangements to contrast with standard employer–employee arrangements.[1]

Although independent and gig work have received plenty of attention as a whole, little research has examined the heterogeneity of work characteristics *among* different independent work opportunities, specifically as it relates to the participation of women in this workforce. Current research on women as independent workers measures to what extent women compose this part of the workforce and highlights the survey evidence indicating flexibility as a main driver for women participating in the independent workforce.

We seek to answer the following question: Does temporal flexibility account for differences in digital platform roles that would make some of the independent work more male or female dominated? Most aggregate studies indicate that men constitute a greater share of the independent workforce than do women. However, a large variation exists across different independent work opportunities. For example, between 2014 and 2015, 86 percent of

[1] This approach is consistent with the literature, which also uses gig, freelance, and contract work interchangeably for analysis as various forms of alternative or external labor arrangements.

independent workers on the platform Etsy were female, whereas 19 percent of workers on the platform Uber were female.[2]

We thus seek to more rigorously identify the factors that attract female workers into some independent occupations more than others and to examine whether those factors operate the same way within the context of independent work as they do within the context of traditional work arrangements. Because the literature on female workforce participation and the gender wage gap has suggested that temporal flexibility factors greatly account for women's distinct career and labor market choices, we focus on whether temporal flexibility can also account for why some digital platforms are more male dominated and others more female dominated.

To measure the importance of temporal flexibility factors across occupational roles, we select work characteristics in the United States within the Occupational Information Network (O*Net) database that best represent those roles. Our findings suggest that women in the independent work context do self-select into the types of independent work jobs that reflect greater temporal flexibility, as is the case for women working in traditional employment. However, our findings also reveal that the way in which the existing literature measures temporal flexibility in traditional work settings may not be the same as the way it is measured in the context of independent work. Thus, the diverging work context in independent work arrangements compared with traditional work arrangements may transform how work characteristics affect temporal flexibility.

Our paper thus contributes to existing research on women as independent workers in the gig economy by empirically showing how the heterogeneity of work characteristics within

[2] Etsy, "Building an Etsy Economy: The New Face of Creative Entrepreneurship," Etsy, Brooklyn, NY, 2015, http://extfiles.etsy.com/Press/reports/Etsy_NewFaceofCreativeEntrepreneurship_2015.pdf. Uber, "New Survey: Drivers Choose Uber for Its Flexibility and Convenience," press release, December 7, 2015, https://www.uber.com /newsroom/driver-partner-survey.

independent work arrangements may affect female participation, even in ways that appear contrary to those observed in traditional work arrangements.

Our paper has implications for public policy in the United States. Currently, workers in gig, freelance, and contracting jobs are legally classified as "independent contractors" or "self-employed" (1099 workers), whereas workers in traditional employment jobs are classified as "employees" (W-2 workers).[3] Recent policies such as California's Assembly Bill 5 (AB5) require reclassifying many independent workers as employees. Policies such as AB5 may pose unintended differential consequences for female workers. If certain majority-female digital platforms, such as Etsy and Care.com, provide work opportunities and flexibility for female workers who would otherwise be unable to take on traditional employment, challenges to the legal classification of such workers in particular could disproportionately hinder women's participation in independent work.

The paper proceeds as follows: Section 2 reviews the literature on women as independent workers and the gig economy. Section 3 provides a theoretical framework in the context of women's workforce participation. Section 4 presents the data and results. Section 5 discusses the implications for public policy, and section 6 concludes.

2. Literature Review

New technologies and digital platforms have given prominence to the gig economy and have also attracted a growing number of freelancers and independent contractors. *Gig work* refers to work that is mediated through specific apps or platforms—such as Uber, Lyft, Postmates, Handy, or TaskRabbit—and is often service-based work. *Freelance work* is similar to gig work in that both

[3] *W-2 workers* (employees) and *1099 workers* (contractors) are terms established by the Internal Revenue Service to distinguish between the two classes of workers.

are types of independent work, characterized by short-term contractors who are legally classified as self-employed and independent contractors. But not all freelance work is gig work, as freelancers do not always use an intermediate platform, and freelancers tend to have more control over setting their own rates. Freelancers also tend to be in more knowledge-work professions (such as software developers, researchers, or translators) or creative-work professions (such as musicians, actors, and writers). Upwork, Fiverr, and Freelancer.com are platforms where freelancers might find their market. References to *contract work* may reflect both high-skilled contractors (i.e., consultants) or middle-skilled workers (e.g., electricians, carpenters, or construction workers). *Gig* or *platform-based work*, *freelancing*, and *contracting* are all terms that are often used interchangeably because they are all forms of independent work referred to as "alternative or external labor arrangements" and are contrasted with the standard employer–employee relationship.

The growth in the gig economy has captured public and scholarly attention, but no research consensus exists on the true size and growth of this workforce.[4] As economist Katharine Abraham and coauthors illustrate, household surveys and administrative data point to two different pictures of what is happening with the independent workforce (with surveys indicating

[4] For studies that attempt to measure its size and growth, see Bureau of Labor Statistics, "Contingent and Alternative Employment Arrangements—May 2017," news release no. USDL-18-0942, June 7, 2018, https://www.bls.gov/news.release/pdf/conemp.pdf; Tito Boeri et al., "Solo Self-Employment and Alternative Work Arrangements," *Journal of Economic Perspectives* 34, no. 1 (2020): 170–95; Edelman Intelligence, "Freelancing in America: 2019," study commissioned by Upwork and the Freelancers Union, October 2019, https://www.slideshare.net/upwork/freelancing-in-america-2019/1; Diana Farrell, Fiona Greig, and Amar Hamoudi, *The Online Platform Economy in 2018: Drivers, Workers, Sellers, and Lessors* (New York: JPMorgan Chase Institute, 2018); MBO Partners, *The State of Independence in America* (Herndon, VA: 2016, 2017, 2018, 2019); Lawrence F. Katz and Alan B. Krueger, "The Rise and Nature of Alternative Work Arrangements in the United States, 1995–2015" (NBER Working Paper No. 22667, National Bureau of Economic Research, Cambridge, MA, September 2016); Lawrence F. Katz and Alan B. Krueger, "Understanding Trends in Alternative Work Arrangements in the United States" (NBER Working Paper No. 25425, National Bureau of Economic Research, Cambridge, MA, January 2019); Katharine G. Abraham et al., "The Rise of the Gig Economy: Fact or Fiction?, *AEA Papers and Proceedings* 109 (2019): 357–61; Emilie Jackson, Adam Looney, and Shanthi Ramnath, "The Rise of Alternative Work Arrangements: Evidence and Implications for Tax Filing and Benefit Coverage" (Office of Tax Analysis Working Paper No. 114, US Department of the Treasury, Washington, DC, 2017).

little growth in independent work and administrative data showing considerable growth in independent work).[5]

Research on the gig economy also attempts to unpack the types of platforms (labor or capital platforms and industries), with much attention to transportation industries.[6] Moreover, there is discussion about demographics and composition of the independent workforce—with particular focus on the age and income of participating individuals.[7] Scholars are also interested in examining the presence of women in these independent work opportunities, as we will address in this paper.

Most survey evidence on independent work does point to a unifying theme: independent work opportunities are often desirable because of the flexibility they provide workers. A US Bureau of Labor Statistics survey finds that 79 percent of independent contractors prefer their arrangement over a traditional job, and fewer than 1 in 10 independent contractors would prefer a traditional work arrangement.[8] The study "Freelancing in America 2019" also finds that 71 percent of individuals engaging in freelancing appreciate the increased flexibility of their work, and 46 percent state that freelancing gives them the flexibility they need because personal circumstances do not allow them to work for a traditional company.[9] In a survey of 5,578 individuals across the United States, the United Kingdom, and Italy, the researchers also find that among self-employed with workers and solo self-employed (those without workers), "the degree of flexibility that self-employed work offers seems likely to be the main driver of relatively high levels of satisfaction . . .

[5] Katharine G. Abraham et al., "Measuring the Gig Economy: Current Knowledge and Open Issues" (NBER Working Paper No. 24950, National Bureau of Economic Research, Cambridge, MA, August 2018).
[6] Farrell, Greig, and Hamoudi, *Online Platform Economy in 2018*.
[7] Bureau of Labor Statistics, "Contingent and Alternative Employment"; Boeri et al., "Solo Self-Employment"; Eileen Appelbaum, Arne Kalleberg, and Hye Jin Rho, "Nonstandard Work Arrangements and Older Americans, 2005–2017," Economic Policy Institute, February 28, 2019.
[8] Bureau of Labor Statistics, "Contingent and Alternative Employment."
[9] Edelman Intelligence, "Freelancing in America: 2019."

followed by the possibility to work from home for the solo self-employed."[10] Studies from EY Global, MBO Partners, and McKinsey Global Institute and surveys of workers on platforms such as Uber and Lyft all point to flexibility as the desirable characteristic of their alternative job arrangements.[11] Research also suggests that in addition to the benefit of flexibility, individuals may turn to independent work after losing income or running low on assets.[12]

Other research on independent workers further examines the policy and legal considerations, such as worker classification issues and worker benefits: because independent workers are legally classified as self-employed or independent contractors, they are often out of the purview of labor law and regulations that cover those who are legally classified as employees.[13] Developments surrounding the COVID-19 pandemic have also highlighted the problem of access to benefits among independent workers; for this reason, the federal Coronavirus, Aid, Relief, and Economic Security (CARES) Act of March 2020 included a provision for unemployment insurance benefits for the self-employed and gig economy workers.

Because an important aspect of gig economy work is flexibility and independence, it is natural to connect the gig economy literature to women in the workplace, who often place a greater premium on flexible work.

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[10] Boeri et al., "Solo Self-Employment."
[11] David Storey, Tony Steadman, and Charles Davis, "How the Gig Economy Is Changing the Workforce," EY Global, November 20, 2018, https://www.ey.com/en_gl/tax/how-the-gig-economy-is-changing-the-workforce; MBO Partners, *The State of Independence in America: The New Normal* (Herndon, VA: MBO Partners, 2018); James Manyika et al., *Independent Work: Choice, Necessity, and the Gig Economy* (New York: McKinsey Global Institute, October 2016) .
[12] Dmitri K. Koustas, "What Do Big Data Tell Us about Why People Take Gig Economy Jobs?," *AEA Papers and Proceedings* 109 (2019): 367–71; Andrew Garin et al., "Is New Platform Work Different than Other Freelancing?," *AEA Papers and Proceedings* 110 (2020): 156–61; Dmitri K. Koustas, "Consumption Insurance and Multiple Jobs: Evidence from Rideshare Drivers" (working paper, October 2018), https://uchicago.box.com/v/DKoustas-Ride Smoothing-WP; Lawrence F. Katz and Alan B. Krueger, "The Role of Unemployment in the Rise in Alternative Work Arrangements," *American Economic Review* 107, no. 5 (2017): 388; Boeri et al., "Solo Self-Employment."
[13] See, for example, Seth D. Harris and Alan B. Krueger, "A Proposal for Modernizing Labor Laws for Twenty-First-Century Work: The 'Independent Worker'" (Hamilton Project Policy Brief 2015-10, Brookings Institution, Washington, DC, December 2015); Liya Palagashvili, "Disrupting the Employee and Contractor Laws," *University of Chicago Legal Forum* 15 (2018): 397–408; Seth Oranburg and Liya Palagashvili, "Transaction Cost Economics, Labor Law, and the Gig Economy," *Journal of Legal Studies* (forthcoming).

We thus first review the literature on how various labor market factors influence women's decision to participate in the workplace more generally. Economists Linda Edwards and Elizabeth Field-Hendrey analyze differences among working women in home-based versus on-site work. As with other alternative work arrangements, they find that approximately 60 percent of home-based workers are female.[14] Allan King studies the variability of hours across industries and finds that industries that allow for greater variability in the distribution of work hours allow women to better coordinate work activities with home activities, thereby increasing female labor force participation.[15] This finding is consistent with other findings on the role of flexible forms of work, such as part-time, temporary, and self-employment work.[16]

In two separate journal articles, Guy Standing reports how the technological revolution in the late 20th century led to a wide range of working arrangements that has allowed for greater labor market flexibility and thus greater female labor force participation.[17] Véronique Genre, Ramón Gómez Salvador, and Ana Lamo find that a decline in the strictness of labor market regulations in some European countries significantly increases women's labor force participation. They also find that an increase in the use of flexible forms of work, such as part-time employment, helps explain the developments in female labor force participation between the 1980s and the 1990s in Europe.[18]

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[14] Linda N. Edwards and Elizabeth Field-Hendrey, "Home-Based Work and Women's Labor Force Decisions," *Journal of Labor Economics* 20, no. 1 (2002): 170–200.
[15] Allan King, "Industrial Structure, the Flexibility of Working Hours, and Women's Labor Force Participation," *Review of Economics and Statistics* 60, no. 3 (1978): 399–407.
[16] Wayne J. Howe, "Temporary Help Workers: Who Are They, What Jobs They Hold," *Monthly Labor Review*, April 1986, 45–47; Francine D. Blau, Marianne A. Ferber, and Anne E. Winkler, *The Economics of Women, Men, and Work* (Englewood Cliffs, NJ: Prentice-Hall, 1997); Daniel C. Feldman, Helen I. Doerpinghaus, and William H. Turnley, "Employee Reactions to Temporary Jobs," *Journal of Managerial Issues* 7, no. 2 (1995): 127–39.
[17] Guy Standing, "Global Feminization through Flexible Labor," *World Development* 17, no. 7 (1989): 1077–95; Guy Standing, "Global Feminization through Flexible Labor: A Theme Revisited," *World Development* 27, no. 3 (1999): 583–602.
[18] Véronique Genre, Ramón Gómez Salvador, and Ana Lamo, "European Women: Why Do(n't) They Work?" (Working Paper No. 454, European Central Bank, Frankfurt, Germany, March 2005).

Moreover, studies on the gender wage gap find that the costs of *temporal flexibility* significantly account for women's distinct career and labor market choices.[19] In particular, economist Claudia Goldin's index of temporal flexibility indicates how specific work characteristics may dissuade female workers from entering occupations, such as those that require a significant amount of face-to-face contact with others.[20]

With the growth of platform-based work, new research has also examined the presence of women in these independent work opportunities. Using tax data, Brett Collins and coauthors find that, while independent work is more common among men, the participation in independent contracting since 2000 has grown significantly more among women than among men.[21] This finding is consistent with another study by Katherine Lim and coauthors using the administrative tax data of independent contractors, which finds that between 2000 and 2016, a large increase occurred in the growth of female independent contractors relative to female employees or male contractors.[22] The study by Katherine Lim and coauthors also finds that this growth is concentrated among women whose primary source of labor income is from independent contractor earnings (as opposed to independent contractor earnings being a secondary source of income), who are their households' primary earner, and who are in the bottom of the income distribution. Economists Lawrence Katz and Alan Krueger also find that between 1995 and 2015, the growth in alternative work arrangements was driven primarily by women.[23] A recent

[19] Claudia Goldin, "A Grand Gender Convergence: Its Last Chapter," *American Economic Review* 104, no. 4 (2014): 1091–119; Francine D. Blau and Lawrence M. Kahn, "The Gender Wage Gap: Extent, Trends, and Explanations, *Journal of Economic Literature* 55, no. 3 (2017): 789–865.
[20] Goldin, "Grand Gender Convergence."
[21] Brett Collins et al., "Is Gig Work Replacing Traditional Employment? Evidence from Two Decades of Tax Returns" (working paper, March 25, 2019).
[22] Katherine Lim et al., "Independent Contractors in the U.S.: New Trends from 15 Years of Administrative Tax Data" (working paper, July 2019).
[23] Katz and Krueger, "Rise and Nature of Alternative Work Arrangements." In 2019, Katz and Krueger provided a revised analysis to reconcile with the Bureau of Labor Statistics findings. However, this new paper does not provide

report summarizes several such studies (based on both household surveys and administrative data) and concludes that estimates of the share of independent workers who are women range anywhere from 33 to 55 percent in the United States, 31 to 52 percent in the United Kingdom, and 39 to 52 percent in continental Europe.[24]

Survey research of independent workers finds that women may prefer these types of jobs because of the flexibility associated with them.[25] A 2017 study by HyperWallet reports the results of a survey of 2,000 women who use platform-economy companies for work. The study finds that 96 percent of women indicate that the primary benefit of engaging in platform-economy work is the flexible working hours.[26] Moreover, the study finds that 70 percent of those platform working women are the primary caregivers in their homes. A quarter of those women recently left their full-time employment for platform-based work, and 60 percent of them indicated doing so because they wanted flexibility; needed more time to care for a child, parent, or other relative; or both.

Reports by consulting group MBO Partners published in 2016–2019 similarly find that women prefer platform or gig work, freelancing, or other forms of independent work because those work arrangements allow greater flexibility. For example, in its 2018 report, MBO Partners finds that the primary motivations for women to engage in independent work are flexibility (76 percent) and the ability to control their schedules (71 percent).[27] Contrast that result with the

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revisions on the growth of women in alternative work arrangements. See Katz and Krueger, "Understanding Trends in Alternative Work Arrangements."

[24] Abigail Hunt and Emma Samman, "Gender and the Gig Economy: Critical Steps for Evidence-Based Policy" (ODI Working Paper No. 546, Overseas Development Institute, London, January 2019).

[25] There are also drawbacks for women working in alternative labor arrangements. We do not discuss all of the literature on the drawbacks because we do not intend to provide a cost-benefit analysis in this paper on whether independent work opportunities are better for women. We focus on the aspect of flexibility because previous literature has identified temporal flexibility as a primary factor for women's decision to participate in the workforce.

[26] HyperWallet, "The Future of Gig Work Is Female: A Study on the Behaviors and Career Aspirations of Women in the Gig Economy," 2017.

[27] MBO Partners, *State of Independence in America: The New Normal*, 7.

motivations of men, who state that the primary reason for engaging in independent or freelance work is that they enjoy being their own boss (67 percent) and do not like answering to a boss (64 percent). The 2017 report by MBO Partners finds similar results: "Women were significantly more likely to note that flexibility was a more important motivator for independent work than men (74 percent versus 59 percent)."[28]

Furthermore, James Manyika and coauthors report the results of a 2016 survey of 8,000 independent workers, finding that 42 percent of US women and 48 percent of European women who participate in independent work are also caregivers.[29] In fact, referring to the 17 percent of the total sample in their survey who reported providing care to an elderly dependent, the study authors state that "these caregivers participated in independent work at a significantly higher rate . . . than non-caregivers."[30] Moreover, the study indicates that caregivers engage in independent work for supplemental income rather than primary income (67 percent, compared with 54 percent for noncaregivers). Among their conclusions, the authors say that independent work "provides a way for caregivers [who are disproportionally women] to generate income while fitting their hours around the needs of their families. This type of flexibility can ease the burden on financially stressed households facing logistical challenges."[31]

In another survey, researchers find that about 75 percent of self-identified homemakers or stay-at-home mothers in the United States indicated that they would be likely to return to work if they could have flexible options.[32]

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[28] MBO Partners, *The State of Independence in America: Rising Confidence amid a Maturing Market* (Herndon, VA: MBO Partners, 2017), 5.
[29] Manyika et al., *Independent Work*.
[30] Manyika et al., 76.
[31] Manyika et al., 76.
[32] Liz Hamel, Jamie Firth, and Mollyann Brodie, "Kaiser Family Foundation/New York Times/CBS News Non-Employed Poll," December 2014, 25.

These findings are consistent with previous surveys, published even before the rise of the modern platform economy. For example, in 1995 and 1997, Janet Marler and George Milkovich surveyed women participating in alternative labor arrangements and found that women are particularly attracted to these opportunities because the flexible work schedules allow them to reconcile work outside the home with family commitments.[33]

3. Framework on Temporal Flexibility and Independent Work

Existing literature on women's labor force participation and the gender wage gap predicts that we would observe at least two patterns for women engaged in independent work:

- In general, the distinct characteristics of the independent work opportunities (such as those presented through digital platforms) benefit women more than traditional work arrangements; thus, we would expect to see a higher proportion of women participants as independent workers (holding all else constant).
- Within independent work opportunities, we would expect women to sort themselves as they do in the traditional work sector—toward jobs with more temporal flexibility.

The literature on women's labor force participation and the gender wage gap suggests strongly that the costs of *temporal flexibility* significantly account for women's distinct career and labor market choices.[34] See table 1, presented later in this paper, for a breakdown of the explanatory variables for the gender wage gap.

The costs of temporal flexibility are particularly pronounced in traditional labor arrangements, as the ability to customize one's work life is often low. Consequently, women

[33] Janet H. Marler and George T. Milkovich, "Determinants of Preference for Contingent Employment" (CAHRS Working Paper No. 00-03, Center for Advanced Human Resource Studies, Ithaca, NY, January 2000).
[34] Goldin, "Grand Gender Convergence"; Blau and Kahn, "Gender Wage Gap."

may be more likely to participate in the labor force when it allows for greater flexibility.[35] Scholars in a recent study even argue that the shift toward at-home work during COVID-19 might disproportionately benefit women in the long run (even while the closures of schools and childcare centers hurt them disproportionately in the short run).[36]

Indeed, the study referenced earlier by Farrell, Greig, and Hamoudi shows that women constitute a greater share of platform-economy workers if one omits from the analysis transportation platforms such as ridesharing and delivery.[37] And, as discussed earlier, survey studies in the literature find that women tend to prefer independent work because it is more flexible.[38]

Combing the research on independent work and the gender wage gap raises an important consideration. First, recall that economist Claudia Goldin's work indicates the importance of temporal flexibility for explaining the gender wage gap. She says specifically, "The gender gap in pay would be considerably reduced and might vanish altogether if firms did not have an incentive to disproportionately reward individuals who labored long hours and worked particular hours."[39]

But if temporal flexibility is higher in independent work, why is there still a gender wage gap in digital platforms that facilitate this type work? There are, of course, a few explanations. First, the gap might be smaller in the gig economy because of its flexible characteristics. A recent study, for instance, finds that among Uber drivers in the United States, men earn about 7 percent more per

[35] King, "Industrial Structure"; Edwards and Field-Hendrey, "Home-Based Work"; Marler and Milkovich, "Determinants of Preference"; L. Rachel Ngai and Barbara Petrongolo, "Gender Gaps and the Rise of the Service Economy," *American Economic Journal: Macroeconomics* 9, no. 4 (2017): 1–44. Jérôme Adda, Christian Dustmann, and Katrien Stevens, "The Career Costs of Children," *Journal of Political Economy* 125, no. 2 (2017): 293–337.
[36] Titan M. Alon et al., "The Impact of COVID-19 on Gender Equality" (NBER Working Paper No. 26947, National Bureau of Economic Research, Cambridge, MA, April 2020).
[37] Farrell, Greig, and Hamoudi, *Online Platform Economy in 2018*.
[38] HyperWallet, "Future of Gig Work Is Female"; MBO Partners, *State of Independence in America*, 2016–2019; Manyika et al., *Independent Work*; Marler and Milkovich, "Determinants of Preference"; Hamel, Firth, and Brodie, "Non-Employed Poll," 25.
[39] Goldin, "Grand Gender Convergence," 1091.

hour than women on average.[40] The authors note that their estimates are similar to other measurements of gender earnings gaps that are outside the gig economy but are within specifically defined jobs. They attribute this 7 percent gap to experience on the platform; preferences over where to work (motivated largely by where drivers live and, to a lesser extent, safety); and preferences for driving speed. The authors conclude that "even in the gender-blind, transactional, flexible environment of the gig economy, gender-based preferences . . . can open gender earnings gaps."[41]

Another study also investigates the gender wage gap in the gig economy by examining earnings of individuals in leading online labor markets and supplementing its analysis with a field experiment on Amazon Mechanical Turk.[42] The authors find that women earn about 81.4 percent of the hourly wage of their male counterparts. This difference is partially explained by the fact that women tend to bid later and prefer jobs with a lower budget. They also find through their field experiment on Amazon Mechanical Turk that women are less likely than men to bid for monitoring jobs. Several other scholars have also discussed the presence of the gender wage gap in the gig economy.[43] In sum, while certain characteristics of the gig economy (such as a customizable work schedule) seem to benefit women by their high participation rates, other characteristics (such as safety concerns or risk mitigation) might still contribute to a real (but smaller) gender wage gap.

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[40] Cody Cook et al., "The Gender Earnings Gap in the Gig Economy: Evidence from over a Million Rideshare Drivers" (Working Paper No. 3637, Stanford University Graduate School of Business, Stanford, CA, March 2019).
[41] Cook et al., "Gender Earnings Gap," 28.
[42] Chen Liang et al., "Gender Wage Gap in Online Gig Economy and Gender Differences in Job Preferences" (Working Paper No. 18-03, NET Institute, New York, November 2018).
[43] Sydnee Caldwell and Emily Oehlsen, "Monopsony and the Gender Wage Gap: Experimental Evidence from the Gig Economy" (working paper, November 2018), https://sydneec.github.io/Website/Caldwell_Oehlsen.pdf; Arianne Renan Barzilay, "Discrimination without Discriminating? Learned Gender Inequality in the Labor Market and the Gig Economy," *Cornell Journal of Law and Public Policy* 28 (2019): 545–67; Abi Adams and Janine Marie Berg, "When Home Affects Pay: An Analysis of the Gender Pay Gap among Crowdworkers" (working paper, October 2017); Siân Herbert, "Digital Development and the Digital Gender Gap," UK Department for International Development, December 2017.

Second, how do women choose *between* independent work opportunities? Specifically, with a high level of customization available through digital platform jobs, will we still observe the sorting patterns we find in the broader labor market? Because the selection of women into the gig economy and alternative work arrangements has been well established, we pursue this second trend as our unique contribution to the literature. On the face of it, there is little reason to believe that women would sort themselves within independent work jobs differently from how they sort in the traditional labor markets, which is to say again that temporal flexibility characterizes our guiding bundle of explanatory variables. However, several key features differ between independent work and traditional work that make this question more theoretically ambiguous and thus a good candidate for empirical testing.

Some features of temporal flexibility in particular manifest themselves differently in the independent work context. Independent work is arranged primarily through online platforms, and independent workers do not have "bosses" or "co-workers" in the typical sense. Thus, we would expect some of Claudia Goldin's measures of temporal flexibility to play a different role within independent work than within the traditional employee–employer setting on which she bases her theoretical considerations. For example, Goldin's framework indicates that women would self-select out of jobs that require greater importance for "establishing and maintaining interpersonal relationships" and "high contact with others."[44] In the context of employment within a typical firm, such relationships are important for promotions, for instance. But maintaining interpersonal relationships within the independent work context means something different. Individual contact through a digital platform—scheduled at the individuals' own time and carried out where they choose—is not what Goldin had in mind. We discuss these considerations in more detail in the

[44] Goldin, "Grand Gender Convergence."

context of our results in section 4.2. But in sum, although we echo the literature in predicting that women will choose independent work opportunities with more temporal flexibility, we have reason to believe that temporal flexibility in independent work looks different from that in a traditional job. Therefore, we test individual characteristics empirically to help determine which characteristics within independent work are most significant for women's labor choices.

4. Data and Empirical Analysis

Following economist Claudia Goldin and related literature on job characteristics that tend to attract female workers, we seek to investigate whether majority-female independent work occupations differ in the importance of work characteristics that are considered female-friendly under traditional work arrangements. As discussed earlier, certain work characteristics that would indicate less flexibility in traditional work arrangements, such as greater interpersonal contact, may not necessarily dissuade female workers within the independent work context. A requirement for greater interpersonal contact through a digital platform, for instance, may thus attract women in the independent work context, even as it deters them in the traditional economy.

This empirical test will thus help us to begin to understand whether female-friendly work characteristics that provide temporal flexibility in traditional work arrangements also attract female workers within independent work occupations.

4.1 Independent vs. Nonindependent Work

We use the O*Net database, which is sponsored by the Department of Labor and contains hundreds of job characteristics for more than 900 occupations.

O*Net collects data for each work characteristic through ongoing surveys of workers across more than 900 occupations and supplements those worker surveys in some cases with

surveys of occupation experts. Each work characteristic can take on a value between 0 and 100 and measures the average importance or average level of the work characteristic for each occupation. The average importance and average level of each characteristic are calculated from the participants' responses to survey questions. The questions are designed to measure the importance of a work characteristic for each occupation and the level of a work characteristic required for each occupation.

For oral comprehension, for instance, the survey questions ask, "How important is oral comprehension to the performance of your job?" and "What level of oral comprehension is needed to perform your job?" In occupations where respondents indicated on average greater importance for oral comprehension and a higher level of oral comprehension needed to perform the job, the oral comprehension work characteristic values would be closer to 100. For example, physicians, judges, and magistrates have the highest values for oral comprehension importance (91–100) and level (71), whereas textile workers and vehicle cleaners show the lowest values for oral comprehension importance (38) and level (29–39).

To systematically examine the differences in the importance of these work characteristics between majority-female and majority-male independent work, we first classify occupations as independent or nonindependent work occupations. We create a list of available digital platforms in the United States, including companies such as Uber, Fiverr, Upwork, Etsy, and TaskRabbit, along with any occupational roles offered through those platforms that also appear in the O*Net database. Any O*Net occupation that is available through at least one digital platform is classified as independent work. All other O*Net occupations are classified as nonindependent work. This classification process excludes from the independent work category any alternative labor arrangements that are not currently offered through a digital platform.

Independent workers found in these digital platforms include musicians, actors, ridesharing drivers, maintenance contractors such as electricians and plumbers, and high-skilled contractors such as software developers. Multiple platforms sometimes offer the same occupational role. For instance, Uber, Lyft, and Via drivers are all matched with the O*Net occupation of Taxi Drivers and Chauffeurs, which is classified as independent work. Care.com and UrbanSitter nannies are similarly matched with the O*Net occupation of Nannies.

Appendix A lists all 100 digital platforms.[45] Appendix B lists all 122 occupational roles available through digital platforms, along with their corresponding O*Net occupation. In contrast, appendix C contains a partial list of 50 selected occupations that were classified as nonindependent work.

4.2 Female-Friendly Work Characteristics

We select the five O*Net characteristics used in Goldin's index of temporal flexibility: (a) establishing and maintaining interpersonal relationships, (b) contact with others, (c) freedom to make decisions, (d) structured versus unstructured work (hereafter, *unstructured work*), and (e) time pressure. For each, we summarize the primary reasons provided by Goldin for how each work characteristic may dissuade female workers from entering occupations where it is of high importance. Although existing literature suggests that these work characteristics are important determinants of female participation in traditional work arrangements, we seek to investigate whether they are also important determinants of female participation in independent work arrangements. We supplement Goldin's original five characteristics with "independence to further capture flexibility of work" and "duration of typical workweek" because Goldin's work

[45] These are, to the best of our knowledge, all digital platforms active in the United States as of the time of writing.

and the related literature discuss the importance of weekly hours for female labor force participation.

1. *Establishing and maintaining interpersonal relationships.* To what extent does the job require developing constructive and cooperative working relationships with others and maintaining them over time?

- The more working relationships an employee has, the more workers and clients the employee must be around. Goldin suggests that women may thus self-select out of occupations where establishing and maintaining work relationships are of high importance.

2. *Contact with others.* How much does the job require the worker to be in contact with others (face-to-face, by telephone, or otherwise) in order to perform it?

- More contact means less flexibility. Goldin suggests that women may thus self-select out of occupations where contact with others is of high importance.

3. *Freedom to make decisions.* How much decision-making freedom, without supervision, does the job offer?

- Freedom to make decisions could imply greater flexibility, but Goldin discusses this work characteristic in the context of substitutability of workers. If the worker determines what each client should receive, rather than being given a specific project, that means workers are poorer substitutes for one another. This factor reduces flexibility for any given worker, so women may self-select out of occupations where freedom to make decisions is of high importance.

4. *Unstructured work.* How much freedom does the worker have to determine the tasks, priorities, or goals of the current job?[46]

- If the job is more structured for the worker, then the worker has less freedom to determine his or her own tasks, priorities, and goals. Less structure could thus imply greater flexibility for the worker, but Goldin discusses this work characteristic in the context of worker substitutability. If the job gives more freedom to the worker to determine priorities (i.e., it is more specialized to the individual worker), that worker will have fewer close substitutes, and this reduces flexibility. Women may thus self-select out of occupations where determining the tasks, priorities, or goals of the job are of high importance.

5. *Time pressure.* How often does this job require the worker to meet strict deadlines?

- Goldin describes lower time pressure as meaning the worker does not have to be around at particular times. Women may thus self-select out of occupations with greater time pressure.

6. *Independence.* To what extent does the job require developing one's own ways of doing things, guiding oneself with little or no supervision, and depending on oneself to get things done?

- More independence indicates more flexibility. Women may thus self-select into occupations where independence is of high importance.

7. *Duration of typical workweek.* How many hours are typically worked in one week?

- Longer duration of the workweek reduces flexibility. Women may thus self-select out of occupations with longer typical workweeks.

Table 1 presents descriptive statistics for the seven work characteristics across independent work occupations in the O*Net database.

[46] In O*Net, this work characteristic is named "structured versus unstructured work," with greater values implying less structured work.

Table 1. Summary Statistics of Female-Friendly Work Characteristics in Independent Work Occupations

Work characteristic	Obs.	Mean	Std. dev.	Min.	Max.
Establishing and maintaining interpersonal relationships	122	68.402	12.504	40	96
Contact with others	122	83.344	9.799	44	100
Freedom to make decisions	122	78.631	11.014	38	99
Unstructured work	122	76.025	11.576	36	99
Time pressure	122	72.033	12.938	33	100
Independence	122	72.459	9.191	40	95
Duration of workweek	122	61.279	21.203	4	97

4.3 Majority-Female Occupations

We classify the 122 independent work occupations into majority-female and majority-male categories using data on the share of workers who are female from the Current Population Survey.[47] Occupations with 50 percent or more female workers are classified as majority-female jobs, and the remaining occupations are classified as majority-male jobs. Maids and housekeeping cleaners, for instance, are classified as majority-female jobs because the share of workers who are female is 86.8 percent. Taxi drivers and chauffeurs, on the other hand, are classified as majority-male jobs since the share of workers who are female is 18.9 percent. Majority-female occupations include, for instance, maids and housekeeping cleaners, online merchants, nannies, nutritionists, and data entry keyers. Majority-male occupations include, for instance, taxi drivers and chauffeurs, driver/sales workers, movers, software developers, and web developers. Appendix D provides the share of workers who are female for each of the 122 independent work occupations.

[47] Data on the share of workers who are female by occupation are taken from the May 2017 Current Population Survey. Sarah Flood et al., Integrated Public Use Microdata Series, Current Population Survey: Version 8.0 [dataset] (Minneapolis, MN: IPUMS, 2020), https://doi.org/10.18128/D030.V8.0.

4.4 Results on Women as Independent Workers

We test the differences in average importance of the selected work characteristics between majority-female and majority-male independent work occupations. We use a bivariate ordinary least squares regression with robust standard errors for each of our tests of differences and present the results in table 2. Our results show a statistically significant difference in nearly all female-friendly work characteristics between the majority-female and majority-male independent work occupations. *Freedom to make decisions* is marginally significant at the 10.3 percent level. *Time pressure* is insignificant. Figure 1 provides the average work characteristics scores across majority-female versus majority-male occupations.

Overall, our findings suggest that women working in independent work occupations do self-select into the types of jobs that reflect greater temporal flexibility. Occupations requiring longer workweek duration are less likely to be majority female. Occupations that are less structured for the worker, give the worker more freedom to make decisions, and have greater independence are more likely to be majority female.

Table 2. Differences in Average O*Net Characteristics in Majority-Female Independent Work Occupations

Work characteristic	Female	Std. error	Obs.
Establishing and maintaining interpersonal relationships	7.782***	2.301	119
Contact with others	4.821**	1.921	119
Freedom to make decisions	3.519	2.143	119
Unstructured work	5.069**	2.246	119
Time pressure	−0.401	2.831	119
Independence	5.636***	1.617	119
Duration of workweek	−14.522***	4.073	119

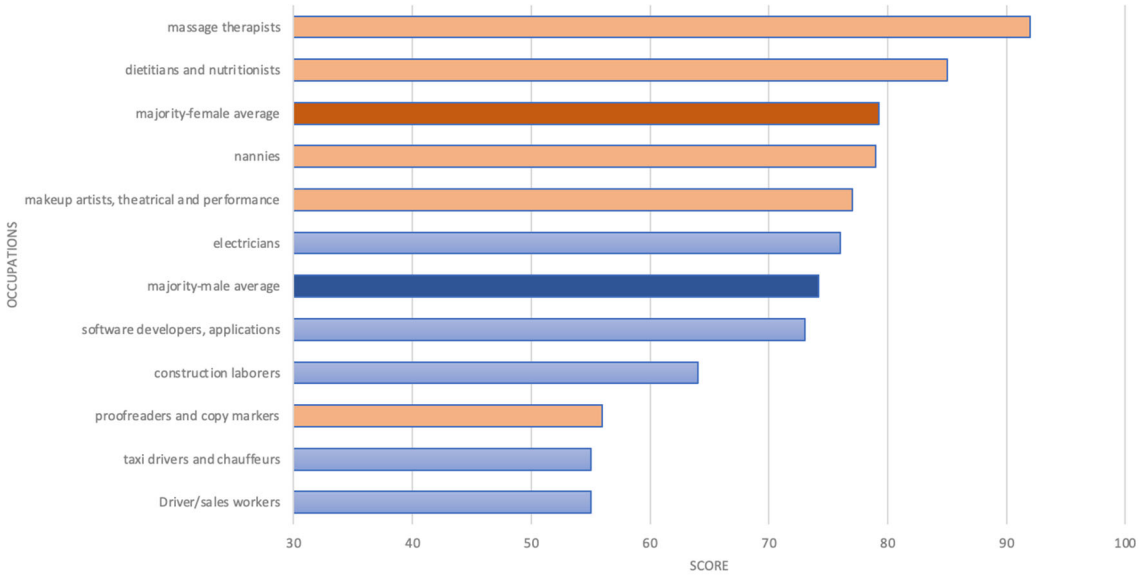
Note: Data on work characteristics are taken from O*Net. Data on share of workers who are female are from Current Population Survey. Ordinary least squares with robust standard errors. Coefficient on binary variable *Female* equal to one if the occupation has at least 50 percent of workers who are female and equal to zero otherwise. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Figure 1. Average Work Characteristic Scores in Majority-Female vs. Majority-Male Occupations

To illustrate the differences in these work characteristics between majority-female and majority-male independent work occupations, figures 2 and 3 depict work characteristics *unstructured work* and *independence*, respectively, across some examples of majority-female (in orange) and majority-male (in blue) independent work occupations. We chose examples from the extremes of the two groups—occupations with a greater than 80 percent share of women or men—and we also included the average of the work characteristics for each group as a reference point.

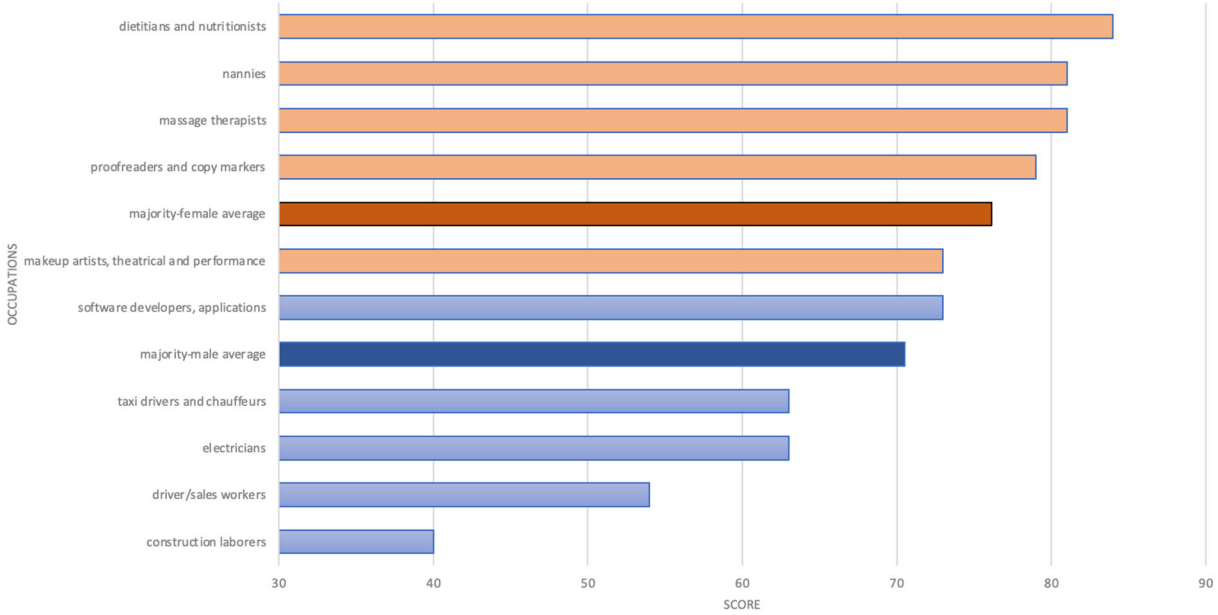
Moreover, our findings also suggest that the diverging work context within independent work compared with traditional work arrangements may transform how work characteristics affect temporal flexibility. Thus, the way in which existing literature measures temporal flexibility for traditional work settings may not be appropriate for measuring it within independent work occupations.

Figure 2. Unstructured Work Characteristic in Selection of Majority-Female and Majority-Male Occupations



Note: blue = majority-male; orange = majority-female.

Figure 3. Independence Work Characteristic in Selection of Majority-Female and Majority-Male Occupations



Note: blue = majority-male; orange = majority-female.

For establishing and maintaining interpersonal relationships, contact with others, unstructured work, and freedom to make decisions, for instance, our coefficients suggest the opposite effect found by Goldin and the existing literature.[48] Goldin's findings suggest that women tend to self-select out of occupations where establishing and maintaining interpersonal relationships, contact with others, less structure on the worker, and freedom to make decisions are of high importance. Our findings suggest the reverse: women who are independent workers may self-select into such occupations.

The divergence in our results from those of Goldin's may reflect precisely that the distinct context under which tasks are carried out in alternative rather than traditional work arrangements can transform how various work characteristics affect temporal flexibility. For example, *freedom to make decisions* in Goldin's model is in the context of a traditional firm. Thus, Goldin predicts that women would select out of occupations with greater freedom to make decisions because it indicates that a worker is less substitutable *from the perspective of the firm*. In the context of independent work, freedom to make decisions is likely to indicate *greater* temporal flexibility rather than less.

Similarly, that high contact with others requires being present for face-to-face time with clients, supervisors, and co-workers, thereby resulting in less flexibility, at least partly depends on an employee–employer relationship within a traditional work arrangement. Goldin indicates that the employee becomes less valuable if he or she is not available for face-to-face contact when it is an important aspect of the job:

> In many workplaces employees meet with clients and accumulate knowledge about them. If an employee is unavailable and communicating the information to another employee is costly, the value of the individual to the firm will decline. Equivalently, employees often gain from interacting with others in meetings or through random exchanges. If an employee is not around that individual will be excluded from the information conveyed

[48] Goldin, "Grand Gender Convergence."

> during these interactions and has lower value unless the information can be fully transferred in a low cost manner.[49]

In the context of alternative work arrangements in general and independent work in particular, Goldin's observation is not applicable. Contact with others in the independent work context may simply require individual contact with clients through a digital platform, scheduled at the individual's own time and carried out where he or she chooses. Furthermore, such contact need not require other team members or a firm. It is also not subject to problems of knowledge transmission to the same extent as an employee's experience.

Online sellers on Etsy, babysitters on Care.com, and maids on Handy, for instance, all have jobs that require high *contact with others* and *establishing and maintaining interpersonal relationships*. These jobs do not, however, require face-to-face contact for every interaction with clients since the workers can, and often must, establish and maintain relationships through a digital platform. Thus, Goldin's prime example of a lawyer within a law firm who is often required to be present for face-to-face discussions with colleagues, to attend group meetings, and to be ready at all times for immediate and time-pressing meetings with clients does not closely represent the typical experience of an independent worker.

Time pressure is another work characteristic that was significant in Goldin's findings but not significant in ours—though it is in the same direction as Goldin's: women tend to self-select out of occupations that have greater time pressure. One reason for the divergence with the significance of *time pressure* is that higher time pressure in the traditional work setting, and as described by Goldin, indicates that the worker has to be around at particular times—thereby reducing time flexibility and dissuading women from those occupations. In the context of independent work and within digitally performed tasks, time pressure may indicate meeting strict

[49] Goldin, 1104.

deadlines, though workers may schedule when to perform the task as they wish. For example, some of the independent workers in our data with high time pressure include copy editors, editors, and graphic designers—all of whom often have to meet strict deadlines but are not often required to be around at particular times—especially in the context of performing tasks through digital platforms. That is, a freelance graphics editor may be required to meet a tight deadline but may not be required to work at particular times or to be physically present to meet that deadline.

Overall, our approach is not definitive; however, our findings suggest that women in the independent work context do self-select into the types of independent work jobs that reflect greater temporal flexibility, as is the case for women working in traditional employment. However, our findings also reveal that the way in which the existing literature measures temporal flexibility in traditional work settings may differ from how it is measured in the context of independent work. Our findings reveal that women may self-select into jobs that exhibit greater independence, allow more freedom to make decisions, are less structured for the worker, and have shorter workweeks. But in the existing literature, greater freedom to make decisions and unstructured work indicate that a worker is less substitutable *from the perspective of the firm* and, thus, may be less flexible. In the context of independent work, freedom to make decisions and unstructured work (freedom to set tasks, priorities, and goals) are likely to indicate *greater* temporal flexibility rather than less. Moreover, we find that independent work where contact with others and establishing and maintaining interpersonal relationships are of high importance will be more likely to attract female workers, whereas these work characteristics in the traditional economy may reflect less flexibility. In this way, our findings suggest that certain work characteristics are transformed in the context of alternative work arrangements in general and independent work in particular.

Our findings, however, also suggest that certain work characteristics are transformed in the context of alternative work arrangements in general and the gig economy in particular. Specifically, independent work where contact with others and establishing and maintaining interpersonal relationships are of high importance will be more likely to attract female workers.

Further research is needed to gain a more complete understanding of the impact of independent work opportunities on women's labor force participation. Future data collection may include estimates of the actual share of female workers in various digital platforms. For instance, Care.com—a platform to connect nannies, personal aides, dog walkers, and pet trainers—had a 95 percent share of women in 2013. That figure is consistent with appendix D, which classifies the occupations of nannies, personal aides, and pet trainers as majority female. Similarly, in 2019, 87 percent of sellers on Etsy were female, whereas 14 percent and 27 percent of Uber and Lyft drivers, respectively, were female. These figures are also consistent with our estimates and groups in appendix D: online merchants are grouped as "majority-female" independent jobs, and taxi drivers and chauffeurs are grouped as "majority-male" independent jobs.

5. Implications for Policy and Labor Law

From a policy standpoint, independent workers pose challenging questions about labor regulations and the distinction of workers as either employees or contractors. Most individuals working through this platform economy are considered *independent contractors* or *1099 workers* or *self-employed* individuals, whereas traditional employees are considered *W-2 workers*.[50] Most labor regulations and most healthcare benefits, retirement plans, and other worker benefits apply to individuals who are legally defined as employees, but not to those who are defined as independent contractors.

[50] These terms come from an Internal Revenue Service distinction that requires those who hire employees to file a W-2 form and those who hire independent contractors to file a 1099 form.

Today, this legal distinction between employees and contractors, as well as the uncertainty surrounding whether independent and gig workers should be classified as contractors or employees, presents a public policy problem and is a subject of debate. This issue has led to hundreds of class-action lawsuits across the country on the grounds of worker misclassification.[51] Recently, the Department of Labor issued a new rule attempting to clarify the standard for employees versus independent contractors under the Fair Labor Standards Act.[52]

California also recently passed AB5, which effectively requires many independent contractors to become employees instead.[53] Although the bill received significant pushback that led to exemptions for 57 types of independent contracting jobs and an exemption for gig economy platforms through the passage of California Proposition 22, many other independent workers did not receive exemptions under this rule. Moreover, other states have indicated that they plan to follow California's AB5 rule.[54]

Our research has several implications regarding policies that attempt to reclassify independent contractors as employees. First and foremost, if independent work extends opportunities for women who would otherwise be unable to take on employment, then such legal challenges could disproportionately affect women's labor force participation.[55] Take, for example, California's AB5, which overlooks policy consequences for independent work opportunities that attract women. Platforms for transportation and delivery apps may be more male dominated and look different from independent work jobs through Etsy and Care.com,

[51] For a list and detailed discussion of the employee–contractor misclassification lawsuits across gig economy platforms, see Palagashvili, "Disrupting the Employee and Contractor Laws."
[52] "U.S. Department of Labor Announces Final Rule to Clarify Independent Contractor Status under the Fair Labor Standards Act," news release, January 6, 2021, https://www.dol.gov/newsroom/releases/whd/whd20210106.
[53] California AB5, https://www.billtrack50.com/BillDetail/996562.
[54] For an overview of these exemptions, see Michael Farren and Trace Mitchell, "Exploring the Consequences of Worker Reclassification Proposals" (Public Interest Comment, Mercatus Center at George Mason University, Arlington, VA, October 27, 2020).
[55] See all the studies we cited earlier on flexibility of women in independent work.

which tend to be female dominated. Yet policies such as AB5 do not acknowledge these differences among platforms and thus do not acknowledge the impact the rule could have on the different types of individuals on their respective platforms. Thus, to the extent that specific platforms such as Etsy and Care.com provide work flexibility for those who need it and extend work opportunities to women who would otherwise be unable to take on traditional employment, challenges to the legal classification of independent workers could disproportionately hinder women's participation on those platforms. In fact, the California state government did not perform a cost-benefit analysis of AB5 that estimates the potential benefits and potential harm to *women* through this policy.

Indeed, as administrative tax data suggest, participation in independent contracting since 2000 has grown more significantly among women than among men, and as Katherine Lim and coauthors find, this relative growth is concentrated among women whose primary source of labor income is from independent contractor earnings (as opposed to a secondary source of income from independent contractor earnings), who are their households' primary earner, and who are in the bottom of the income distribution.[56] Their study therefore concludes, "These patterns suggest that the long-run increases in [independent contracting] labor provide important sources of household income."[57]

Thus, instead of attempting to diminish these work opportunities, solutions could be reframed toward finding a way for these workers to obtain better worker benefits. For example, there have been discussions about creating a new category of workers who would be subject to some labor regulations but not others.[58]

[56] Lim et al., "Independent Contractors in the U.S."
[57] Lim et al., 16.
[58] Harris and Krueger, "Proposal for Modernizing Labor Laws"; Palagashvili, "Disrupting the Employee and Contractor Laws."

Other solutions should look to the broader underlying causes for a lack of benefits for independent contractors. Several scholars have pointed out that one obstacle to gig economy platforms providing health insurance and other benefits is that, if they did so, a legal factor that specifically looks for the presence of "benefits" for gig economy workers would threaten the business model for many of these platforms.[59] That is, if gig economy platforms provided benefits to their contractors, the IRS could use that fact as evidence that those contractors were in fact employees. To minimize risk to their business models, gig economy platforms may decide not to provide benefits. Several research papers now investigate a "middle category" that would address "portable benefits" for independent workers without having them reclassified as employees.

6. Conclusion

In this paper, we examine the heterogeneity of work context within independent work occupations by investigating work characteristics that, under traditional work arrangements, tend to measure temporal flexibility and thus attract female workers to various occupations. Our findings suggest that women working in independent occupations do self-select into the types of jobs that reflect greater temporal flexibility, as is the case for women working in traditional employment. However, our findings also reveal that the way in which the existing literature measures temporal flexibility in traditional work settings may differ from how it is measured in the context of independent work. Thus, the diverging work context in independent work arrangements compared with traditional work arrangements may transform how work characteristics affect temporal flexibility.

[59] Harris and Krueger, "Proposal for Modernizing Labor Laws"; Liya Palagashvili, "Barriers to Portable Benefits Solutions for Gig Economy Workers" (Policy Paper No. 2020.010, Center for Growth and Opportunity at Utah State University, Logan, October 2020); David Rolf, Shelby Clark, and Corrie Watterson Bryant, *Portable Benefits in the 21st Century* (Washington, DC: Aspen Institute Future of Work Initiative, 2016).

Our results are also consistent with some recent findings on the implications of the COVID-19 pandemic for gender equality. In particular, the transition toward a more flexible work setting is likely to benefit mothers while also giving fathers the opportunity to take on more childcare responsibilities.[60] Independent work, however, is different from other jobs that can be done at home. Although 37 percent of US jobs could be performed entirely at home, they account for 46 percent of all US wages and typically require above-average education and experience.[61] Gig economy and other independent work opportunities may be relatively more accessible, thus representing work opportunities for lower-wage and lower-experience workers. Independent work may thus extend opportunities to women and low-income individuals who might typically be at a disadvantage in traditional work settings.

If, as the literature suggests, we may attribute some of the recent rise in female labor force participation to the growth of alternative work arrangements, that may be one promising direction for future research. One way to explore that growth empirically may be to exploit the varied timing of gig economy platforms' entrance into various cities across the United States. Unfortunately, that approach presents the difficulty of isolating the impact of gig economy work opportunities on female labor force participation because, currently, participation in the gig economy as a primary source of income represents a small fraction of total employment in the United States. Aggregate city, state, or national measures of female labor force participation rates may thus mask any potential role of the gig economy. An additional difficulty is the timing of gig economy growth, which coincides for many major platforms with the recovery period after the Great Recession in the United States. Thus, the macroeconomic environment is likely to be a

[60] Alon et al., "Impact of COVID-19 on Gender Equality."
[61] Jonathan I. Dingel and Brent Neiman, "How Many Jobs Can Be Done at Home?" (NBER Working Paper No. 26948, National Bureau of Economic Research, Cambridge, MA, April 2020).

significant underlying cause for changes in female labor force participation, regardless of the impact of growing opportunities in the gig economy. Furthermore, classification and measurements of gig economy platforms that experienced the greatest growth and where the most data exist, such as Uber and Lyft, are also the ones where female workers tend to participate the least.[62] These are difficult challenges that future research examining the role of the gig economy in female labor force participation may seek to address.

Finally, our paper carries broad implications for policy and labor law. First, many digital platforms are currently facing legal challenges for "misclassification" of employees as 1099 contractors. If the gig economy extends work opportunities to women who would otherwise be unable to take on employment, such challenges could disproportionately affect women's labor force participation. Second, the growth of independent workers presents a new challenge to significant portions of labor law because many, if not all, healthcare and retirement plan benefits associated with work are currently provided by employers. We believe further research on portable benefits policies may present a solution to this challenge posed by the growth in independent workers.

[62] HyperWallet, "Future of Gig Work Is Female."

Appendix A: Gig Economy Platforms List

1) Addison Lee
2) Airbnb
3) Airtasker
4) Amazon Flex
5) Amazon Mechanical Turk
6) Andela
7) Bellhop
8) Bird
9) Blacklane
10) BoltBus
11) Care.com
12) Cargomatic
13) Carma
14) Catalant
15) Caviar
16) Couchsurfing
17) Crowdspring
18) Dolly
19) DoorDash
20) Drizly
21) easyCar
22) Easy Taxi
23) EatStreet
24) Etsy
25) Expert360
26) Fancy Hands
27) Farmdrop
28) Favor
29) Feastly
30) Field Agent
31) Field Nation
32) FitnessTrainer.com
33) Fiverr
34) FlipKey
35) Freelancer.com
36) Getaround
37) Gigster
38) goPuff
39) Graphite
40) GreenPal
41) Grubhub
42) Guru
43) Handiss
44) Handy
45) Heal.com
46) HelloTech
47) Helpling
48) HireAChef
49) HomeAdvisor
50) HomeAway
51) HopSkipDrive
52) InnoCentive
53) Instacart
54) Just Eat
55) JustPark
56) Lawn Love

57) Lazada Group
58) LegalZoom
59) Lime
60) Luxe
61) Lyft
62) Munchery
63) 99designs
64) Onefinestay
65) Pager
66) PeoplePerHour
67) Postmates
68) Rocket Lawyer
69) Rover.com
70) Reedsy
71) Shipt
72) Shyp
73) Sittercity.com
74) Soothe
75) Spin
76) Table at Home
77) Takl
78) Talkspace
79) TaskEasy
80) TaskRabbit
81) The Glam App
82) Thumbtack
83) Tongal
84) Topcoder
85) Turo
86) Tutor.com
87) Uber
88) Uber Eats
89) Udemy
90) UpCounsel
91) Upwork
92) UrbanSitter
93) Via
94) VIPKid
95) Vrbo
96) Wag
97) Wingz
98) Workpath
99) YourMechanic
100) Zeel

Appendix B: Digital Gig Platforms and Matched O*Net Occupations

O*Net occupations	Gig economy platforms
Accountants	Airtasker, Catalant, Fiverr, Freelancer.com, Graphite, Guru, Upwork, PeoplePerHour
Acupuncturists	Airtasker, Thumbtack, Thumbtack, Zeel
Actors	Airtasker, Catalant, Fiverr, Freelancer.com, Guru, PeoplePerHour, Upwork
Advertising and promotion manager	Catalant, Fiverr, Graphite, Guru, PeoplePerHour, Upwork
Aerospace engineer	Guru, Handiss, Upwork
Agents and business managers of artists, performers, and athletes	Fiverr, Guru, Upwork
Agricultural engineers	Guru, Handiss, Upwork
Animal trainers	Airtasker, AskforTask, Care.com, Rover, Takl
Architects, except naval	Guru, Handiss, Upwork
Automotive master mechanics	Airtasker, AskforTask, Takl, YourMechanic
Barbers	Fiverr
Cabinetmakers and bench carpenters	Airtasker, Etsy, Fiverr, Takl, TaskRabbit, Thumbtack
Carpenters	Airtasker, Etsy, Fiverr, Takl, TaskRabbit, Thumbtack
Carpet installers	Airtasker, AskforTask, Handy, Takl, TaskRabbit, Thumbtack
Chemical engineers	Guru, Handiss, Upwork
Chiropractors	Fiverr
Civil engineers	Guru, Handiss, Upwork
Computer programmers	Airtasker, Catalant, FancyHands, Fiverr, Freelancer.com, Guru, PeoplePerHour, Topcoder, Upwork
Computer systems engineers and architects	Airtasker, Catalant, Fiverr, Freelancer.com, PeoplePerHour, Topcoder, Upwork

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O*Net occupations	Gig economy platforms
Computer user support specialists	Airtasker, AskforTask, Expert360, Freelancer.com, Fiverr, Graphite, HelloTech, Catalant, PeoplePerHour, Upwork
Community health workers	Airtasker, Heal.com, Pager
Construction laborers	Airtasker, Handiss, Takl
Construction managers	Graphite, Handiss
Couriers and messengers	Airtasker, Fiverr
Cooks, private household	Airtasker, Feastly, Table at Home, Thumbtack
Copy writers	Airtasker, Catalant, CrowdSpring, Expert360, Field Agent, Fiverr, Freelancer.com, Guru, PeoplePerHour, Upwork
Dancers and choreographers	Airtasker, Catalant, Fiverr, Freelancer.com, Guru, PeoplePerHour, Upwork
Data entry keyers	Airtasker, Catalant, FancyHands, Fiverr, Freelancer.com, Guru, PeoplePerHour, Upwork
Database architects	Airtasker, Catalant, Expert360, Fiverr, Freelancer.com, Guru, PeoplePerHour, Topcoder, Upwork
Desktop publishers	Airtasker, Catalant, Guru, PeoplePerHour, Topcoder, Upwork
Dietitians and nutritionists	Airtasker, AskforTask, Thumbtack, Upwork
Drafters	FancyHands, Fiverr, Guru, Upwork
Driver/Sales Workers	Addison Lee, Amazon Flex, Cargomatic, Caviar, DoorDash, Drizly, EasyCar, Easy Taxi, EatStreet, Farmdrop, Favor, GoPuff, Grubhub, HopSkipDrive, Instacart, Just Eat, Munchery, Postmates, Shipt, Takl, Uber Eats
Drywall installers, ceiling tile installers, and tapers	Airtasker, Fiverr, Takl
Editors	Airtasker, Catalant, FancyHands, Fiverr, Freelancer.com, Guru, PeoplePerHour, Reedsy, Upwork
Electrical and electronics engineers	Guru, Handiss, Takl, Upwork
Electricians	

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O*Net occupations	Gig economy platforms
Electronic home entertainment equipment installers and repairers	Airtasker, AskforTask, Field Nation, Handy, HelloTech, Takl, TaskRabbit,Thumbtack
Engineers, all other	Guru, Handiss, Upwork
Environmental engineers	Guru, Handiss, Upwork
Fence erectors	Airtasker, Fiverr, Takl, Thumbtack
Film and video editors	Airtasker, AskforTask, Catalant, Freelancer.com, Fiverr, Guru, PeoplePerHour, Tongal, Upwork
Financial analysts	Catalant, Fiverr, Graphite, Guru, Toptal, Upwork
Fitness trainers and aerobics instructors	Airtasker, AskforTask, FitnessTrainer.com, Thumbtack, Zeel
Floral designers	Airtasker, AskforTask, Thumbtack
Fundraisers	Catalant, Fiverr, Guru, Upwork
Graphic designers	Airtasker, Catalant, Crowdspring, Fiverr, Freelancer.com, Guru, 99Designs, PeoplePerHour, Reedsy, Upwork
Hairdressers, hairstylists, and cosmetologists	Airtasker, Fiverr
Heating and air-conditioning mechanics and installers	Airtasker, AskforTask, Handy, Takl, TaskRabbit, Thumbtack
Hotel, motel, and resort desk clerks	Airbnb, CouchSurfing, FlipKey, HomeAdvisor, HomeAway, One Fine Stay, Vrbo,
Home appliance repairers	Airtasker, AskforTask, Field Nation, Handy, HelloTech, Takl, TaskRabbit, Thumbtack
Industrial engineers, including health and safety	Guru, Handiss, Upwork
Interpreters and translators	Airtasker, Fiverr, Freelancer.com, Guru, PeoplePerHour, Upwork
Jewelers and precious stone and metal workers	Etsy, Freelancer.com, PeoplePerHour
Laborers and freight, stock, and material movers, hand	Airtasker, AskforTask, Bellhop, Dolly, Takl, TaskRabbit, Thumbtack
Landscaping and groundskeeping workers	Airtasker, AskforTask, GreenPal, LawninLove, Takl, TaskEasy, TaskRabbit, Thumbtack
Locksmiths and safe repairs	Airtasker, Freelancer.com, Takl

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O*Net occupations	Gig economy platforms
Maid and housekeeping cleaners	Airtasker, AskforTask, Handy, Helpling, Homejoy, Takl, TaskRabbit, Thumbtack
Makeup artists, theatrical and performance	Airtasker, AskforTask, Guru, TaskRabbit, The Glam App, Thumbtack
Management analysts	Catalant, Graphite, Guru, Upwork
Managers, all other	Catalant, Graphite, Guru, Upwork
Market research analysts and marketing specialists	Catalant, Fiverr, Freelancer.com, Guru, PeoplePerHour, Reedsy, Upwork
Marine engineers and naval architects	Guru, Handiss, Upwork
Marriage and family therapists	Fiverr, Talkspace, Thumbtack, Upwork
Mental health counselors	Airtasker, Fiverr, Talkspace, Thumbtack, Upwork
Massage therapists	Airtasker, Fiverr, Soothe, Thumbtack, Zeel
Materials engineers	Guru, Handiss, Upwork
Mechanical engineers	Guru, Handiss, Upwork
Meeting, convention, and event planners	Fiverr, Guru, Upwork
Mining and geological engineers, including mining safety engineers	Guru, Handiss, Upwork
Miscellaneous construction and related workers	Guru, Handiss, Takl, Upwork
Miscellaneous media and communication workers	Catalant, FancyHands, Fiverr, Guru, PeoplePerHour, Upwork
Miscellaneous personal appearance workers	Airtasker, AskforTask, Fiverr, TaskRabbit, The Glam App, Thumbtack
Miscellaneous vehicle and mobile equipment mechanics, installers, and repairs	Fiverr, Freelancer.com, PeoplePerHour, Takl
Models, demonstrators, and product promoters	Fiverr
Musical instrument repairers and tuners	Airtasker, AskforTask, Thumbtack
Musicians and singers	Airtasker, Catalant, Fiverr, Freelancer.com, Guru, PeoplePerHour, Upwork
Nannies	Airtasker, AskforTask, Care.com, Sittercity.com, UrbanSitter

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O*Net occupations	Gig economy platforms
News analysts, reporters and correspondents	Fiverr, Upwork
Nuclear engineers	Guru, Handiss, Upwork
Operating engineers and other construction equipment operators	Guru, Handiss, Upwork
Online merchants	Carousell, Etsy, Lazada Group
Optometrists	PeoplePerHour, Upwork
Other healthcare practitioners and technical occupations	Airtasker, Freelancer.com, Upwork, Workpath
Other installation, maintenance, and repair work	Airtasker, AskforTask, Freelancer.com, Takl, Thumbtack
Painters, construction and maintenance	Airtasker, Etsy, Fiverr, Takl, Thumbtack
Painting workers	Airtasker, Etsy, Fiverr, Guru, Takl, Thumbtack
Paralegals and legal assistants	Airtasker, Catalant, Expert360, FancyHands, Fiverr, Freelancer.com, Guru, LegalZoom, PeoplePerHour, Rocket Lawyer, Thumbtack, UpCounsel, Upwork
Personal care aides	Airtasker, Care.com, Workpath
Petroleum engineers	Guru, Handiss, Upwork
Personal financial advisers	Catalant, Fiverr, Freelancer.com, Graphite, Guru, PeoplePerHour, Upwork
Phlebotomists	Workpath
Photographers	Airtasker, AskforTask, Fiverr, Freelancer.com, TaskRabbit, Thumbtack, Upwork
Plumbers, pipefitters, and steamfitters	Airtasker, Takl
Poets, lyricists, and creative writers	Airtasker, Freelancer.com, Guru, Tongal, Upwork
Proofreaders and copy markers	Airtasker, Catalant, Fiverr, Freelancer.com, Guru, PeoplePerHour, Reedsy, Upwork
Property, real estate, and community association managers	Catalant, Graphite, Guru, Upwork
Public relations specialists	Catalant, Fiverr, Freelancer.com, Guru, PeoplePerHour, Upwork

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O*Net occupations	Gig economy platforms
Security and fire alarm systems installers	Airtasker, AskforTask, Freelancer.com, Takl, Thumbtack
Septic tank servicers and sewer pipe cleaners	Airtasker, Takl, Thumbtack
Shoe and leather workers and repairs	Airtasker, Etsy, Freelancer.com, PeoplePerHour, Upwork
Small engine mechanics	Airtasker, Freelancer.com, PeoplePerHour, Takl, Upwork
Software developers, applications	Airtasker, Andela, Catalant, Expert360, Gigster, Guru, Fiverr, Freelancer.com, PeoplePerHour, Topcoder, Upwork
Software developers, system software	Airtasker, Andela, Catalant, Gigster, Guru, Fiverr, Freelancer.com, PeoplePerHour, Topcoder, Upwork
Statistical assistants	Airtasker, Catalant, FancyHands, Fiverr, Freelancer.com, Graphite, Guru, PeoplePerHour, Upwork
Survey researchers	FancyHands, Fiverr, Freelancer.com, Guru, PeoplePerHour, Upwork
Tailors, dressmakers, and sewers	Airtasker, Etsy, Freelancer.com, PeoplePerHour
Tax preparers	Airtasker, AskforTask, Fiverr, Freelancer.com, Guru, PeoplePerHour, Upwork
Taxi drivers and chauffeurs	Addison Lee, Amazon Flex, Bridj, Cabify, HopSkipDrive, Lyft, Uber, Via
Television, video, and motion picture camera operations and editors	Guru, Upwork
Technical writers	Airtasker, Catalant, Crowdspring, Fiverr, Freelancer.com, Guru, PeoplePerHour, Upwork
Textile knitting and weaving machine setters, operators, and tenders	Airtasker, Etsy, Freelancer.com
Textile, apparel, and furnishings workers, all other	Airtasker, Etsy, Freelancer.com
Therapists, all other	Upwork
Tutors	Airtasker, AskforTask, Care.com, Tutor.com, Udemy, Upwork, VIPKid
Tour and travel guides	PeoplePerHour, Upwork
Travel agents	PeoplePerHour, Upwork

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O*Net occupations	Gig economy platforms
Transportation workers, all other	Bird, Blacklane, BoltBus, Getaround, JustPark, Lime, Luxe, Spin, Takl, Turo, Via, Wingz
Upholsterers	Airtasker, Etsy, Freelancer.com
Video game designers	Airtasker, Fiverr, Freelancer.com, Guru, PeoplePerHour, Tongal, Upwork
Web administrators	Airtasker, Catalant, Expert360, Fiverr, Freelancer.com, Guru, PeoplePerHour, Upwork
Web developers	Airtasker, Catalant, Expert360, Fiverr, Freelancer.com, Guru, PeoplePerHour, Upwork

Appendix C: Selection of Nonindependent Worker Roles

1) Airline pilots, copilots, and flight engineers
2) Ambulance drivers and attendants, except emergency medical technicians
3) Auditors
4) Billing, cost, and rate clerks
5) Broadcast news analysts
6) Cashiers
7) Chief executives
8) Compensation and benefits managers
9) Compliance managers
10) Concierges
11) Counter and rental clerks
12) Dentists, general
13) Dermatologists
14) Education administrators, elementary and secondary school
15) Elementary schoolteachers, except special education
16) Family and general practitioners
17) Financial managers
18) Flight attendants
19) General and operations managers
20) Hospitalists
21) Hosts, restaurant, lounge, and coffee shop
22) Human resources managers
23) Insurance underwriters
24) Investment fund managers
25) Judges, magistrate judges, and magistrates
26) Librarians
27) Loan counselors
28) Lodging managers
29) Medical secretaries
30) Nurse practitioners
31) Obstetricians and gynecologists
32) Occupational therapists
33) Optometrists
34) Pediatricians, general
35) Pharmacists
36) Physical therapists
37) Police patrol officers
38) Program directors
39) Property, real estate, and community association managers
40) Registered nurses
41) Sales managers
42) Secretaries and administrative assistants, except legal, medical, and executive
43) Social and community service managers
44) Spa managers
45) Surgeons
46) Technical directors or managers
47) Tellers
48) Transit and railroad police
49) Transportation managers
50) Veterinarians

Appendix D: O*Net Independent Work Occupations and Share of Women

O*Net occupations	Share of women (%)
Accountants	63.9104
Actors	40.7726
Acupuncturists	81.8088
Advertising and promotions managers	57.0303
Aerospace engineers	6.0522
Agents and business managers of artists, performers, and athletes	55.7616
Animal trainers	75.7200
Architects, except landscape and naval	25.8495
Architectural drafters	18.3091
Automotive master mechanics	3.4973
Barbers	14.4908
Biochemical engineers	14.4541
Brickmasons and blockmasons	0.0000
Broadcast news analysts	56.7235
Broadcast technicians	9.7490
Cabinetmakers and bench carpenters	4.7566
Camera operators, television, video, and motion picture	11.7754
Carpet installers	3.9955
Chemical engineers	29.8248
Chiropractors	28.8424
Choreographers	68.6340
Civil engineers	16.5029
Computer programmers	24.2035
Computer systems engineers and architects	27.4256
Computer user support specialists	26.5220
Construction carpenters	1.8638

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O*Net occupations	Share of women (%)
Construction laborers	2.0634
Construction managers	8.8966
Cooks, private household	42.4474
Copywriters	61.1666
Couriers and messengers	26.5178
Dancers	68.6340
Database architects	27.4256
Data entry keyers	78.3388
Dietitians and nutritionists	94.0152
Drivers and sales workers	5.9212
Drywall and ceiling tile installers	1.2088
Editors	54.9047
Electrical engineers	10.8736
Electricians	2.7764
Electronic home entertainment equipment installers and repairers	0.5453
Environmental engineers	22.3839
Fence erectors	0.0000
Film and video editors	11.7754
Financial analysts	27.6097
Fitness trainers and aerobics instructors	63.8016
Floral designers	52.1586
Fundraisers	73.5128
Graphic designers	52.1586
Hairdressers, hairstylists, and cosmetologists	91.3500
Heating and air-conditioning mechanics and installers	1.9705
Home appliance repairers	0.0000
Industrial engineers	28.3801
Interpreters and translators	59.3762

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O*Net occupations	Share of women (%)
Jewelers	32.8641
Laborers and freight, stock, and material movers, hand	19.3593
Landscaping and groundskeeping workers	5.9195
Locksmiths and safe repairers	11.1615
Maids and housekeeping cleaners	86.8184
Makeup artists, theatrical, and performance	84.6179
Management analysts	41.3545
Marine architects	0.0000
Marine engineers	0.0000
Market research analysts and marketing specialists	57.7618
Marriage and family therapists	71.8823
Massage therapists	85.9175
Materials engineers	28.5130
Mechanical engineers	10.5055
Meeting, convention, and event planners	80.0867
Mental health counselors	71.8823
Mining and geological engineers, including mining safety engineers	0.0000
Models	82.3506
Motorboat mechanics and service technicians	9.4015
Motorcycle mechanics	9.4015
Musical instrument repairers and tuners	22.2989
Musicians, instrumental	48.3515
Nannies	92.1913
Nonfarm animal caretakers	82.3562
Nuclear engineers	0.0000
Online merchants	55.8584
Operating engineers and other construction equipment operators	1.2931
Optometrists	55.5768

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O*Net occupations	Share of women (%)
Outdoor power equipment and other small engine mechanics	9.4015
Painters, construction and maintenance	9.6949
Painting, coating, and decorating workers	10.1611
Paralegals and legal assistants	87.8486
Personal care aides	85.5176
Personal financial advisers	33.7422
Petroleum engineers	25.6909
Phlebotomists	84.7289
Photographers	39.8624
Poets, lyricists, and creative writers	61.1666
Proofreaders and copy markers	100.0000
Property, real estate, and community association managers	45.4220
Public relations specialists	71.7440
Reporters and correspondents	56.7235
Sales agents, financial services	38.9413
Sales agents, securities and commodities	38.9413
Securities and commodities traders	38.9413
Security and fire alarm systems installers	0.0000
Septic tank servicers and sewer pipe cleaners	0.0000
Shoe and leather workers and repairers	38.4467
Singers	48.3515
Software developers, applications	19.1722
Software developers, systems software	19.1722
Statistical assistants	38.4802
Tailors, dressmakers, and custom sewers	82.1507
Taxi drivers and chauffeurs	18.9163
Tax preparers	51.4488
Technical writers	55.5308

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O*Net occupations	Share of women (%)
Textile knitting and weaving machine setters, operators, and tenders	67.1481
Tour guides and escorts	49.0905
Travel agents	84.5739
Travel guides	49.0905
Tutors	65.1867
Upholsterers	7.3816
Video game designers	27.4256
Web administrators	27.4256
Web developers	31.9943