

The Changing Nature of Work

Advances in technology and the adoption of new business models by firms are changing where and how workers perform their tasks and the nature of the employment arrangements between workers and firms. The COVID-19 pandemic appears to have accelerated some of these changes. In recent years, there has been growing interest in understanding the implications of nonstandard employment arrangements, including various contract, independent contractor, informal nonemployee, and digital platform arrangements. At the same time, the emergence of algorithmic management, the introduction of artificial intelligence into the workplace, and the rapid increase in remote work potentially affect those in both standard employee and nonstandard employment arrangements. Such changes also may affect the choices firms and workers make regarding work arrangements. For instance, new technologies and the growing prevalence of remote work may make contract arrangements more appealing to some firms.

Data gaps and measurement challenges, however, impede our understanding of the magnitude of these phenomena and their implications for workers, firms, and the macroeconomy. The research in this volume seeks to fill data and information gaps in several areas pertaining to the changing nature of work. The first four papers examine work from home, which surged during the pandemic and has remained higher than in the pre-pandemic period. The next seven papers examine various types of nonstandard employment arrangements—that is, work that falls outside the “traditional” or “standard” arrangement in which employees perform services for the organization that employs them. Papers cover contract company work and various self-employment arrangements, including independent contractor/freelance, informal, and digital platform work arrangements. The final paper in this volume studies the rise of digital technologies, such as robotics, the internet, and artificial intelligence.

A major contribution of the research in this volume is the development of new data and methodologies to better document the extent to which modes of employment and work arrangements are changing. The research further uses novel data to shed light on variation in business practices in the economy, the implications of new business models and technologies for workers, and the importance of accurately capturing these phenomena in economic analysis.

On-site work vs. work from home

Technology had been making remote work more feasible for many, but the onset of the Covid-19 pandemic in 2020 led to a sudden surge in work from home. In May 2020- at the height of the pandemic – BLS’s Current Population Survey (CPS) estimates indicated 35.4 percent of those employed had teleworked in the prior 4 weeks because of the pandemic. Indicative of this effect, Census Bureau estimates from the American Community Survey showed the proportion of the employed who worked from home more than tripled between 2019 and 2021, increasing from 5.7 percent to 17.9 percent. CPS estimates also revealed that 70.8 percent of those who worked from home in October 2022 had either started or increased the amount they teleworked since February 2020. As the dangers of the pandemic receded, some high-profile companies began requiring their workers to return to work, raising questions about whether the pandemic was a blip or whether the experiences would fundamentally alter the trajectory of where (and how) people work. If the latter is

true, it raises new questions about which workers are the most likely to work from home and what the implications are for businesses and employees.

Four papers in this volume use novel data to provide insights into these issues. Katharine Abraham, Mahammad Ashoori, Aref Darzi, Natalie Gonzalez-Priest, John Haltiwanger, Aliakbar Kabiri, and Erkut Ozbay use location data from mobile devices to determine if people are likely working onsite at different points in time between 2019 and 2022. In one analysis that uses panel data, the authors track changes in onsite work for a set of people who were determined to work onsite in either February 2019 or February 2020. In a separate, cross-sectional analysis, they examine the prevalence of onsite work in the month of September for the years 2019 through 2022. The large sample of location data enables the researchers to examine the prevalence of onsite work at a granular geographic level (Census tract).

Nicole Nestoriak and David Oh exploit data from the Occupational Requirements Survey (ORS), which collects detailed task data along with information about whether working from home on a regular basis was permitted. In the analysis, they map the ORS tasks into ONET work activities to provide a detailed examination of the types of work in which work from home is permissible. Papers by Francesca Foliano, Rebecca Riley, and Lynsey Brown and by José Barrero, Nicholas Bloom, Kathryn Bonney, Cory Breaux, Catherine Buffington, Steven Davis, Lucia Foster, Brian McKenzie, Keith Savage, and Cristina Tello-Trillo draw on data from household and employer surveys, respectively. Foliano, Riley, and Brown analyze data from time use diaries collected by the United Kingdom's Office of National Statistics from April 2020 through March 2025. These data are useful not only for examining trends in work from home in the UK but also for understanding the benefits and costs of work from home for workers. Barrero et al. examine evidence from the Census Bureau's Business Trends and Outlook Survey (BTOS), which surveyed over 150,000 firms in November 2024 and January 2025 on their work from home practices. These data are valuable for examining trends in work from home, constraints businesses face in making the work from home option available to employees, and perceptions among businesses about the benefits and costs of allowing workers such flexibility.

Several key findings emerge from these papers. First, various data sources consistently show that while the prevalence of work from home declined following its peak during the pandemic, it is considerably higher than it was before the pandemic. The analysis in Abraham et al. based on cross-sectional cell phone tracking data suggests that the share of remote work was 25 percentage points higher in September 2020 than in February of that year, and while it had fallen substantially by September 2022, it was still about 10 percentage points higher than just before the pandemic. Using UK time use data, Foliano, Riley, and Brown find that although the prevalence of remote work declined immediately following the pandemic, it has remained stable since 2022, with 30 percent of workers working mainly or partly from home, roughly double the share working from home before the pandemic. Evidence from the BTOS company survey, reported in Barrero et al., further indicates no inclination among businesses to revert to pre-pandemic onsite work requirements in the foreseeable future.

While the share working from home is substantially higher than before the pandemic, the prevalence of remote work varies greatly by occupation and industry. Barrero et al. report that businesses see feasibility as the greatest constraint in adopting work from home practices: to work

from home, employees must be able to perform some or all of their work remotely. Consistent with this, they find that remote work is most common in the information sector, where much of the work is office based, and nearly absent in the food and accommodations sector, where jobs are typically customer-facing or otherwise require onsite presence.

Using data from the ORS mapped into ONET tasks, Nestoriak and Oh provide a more nuanced view of how and why remote work varies. They find that jobs involving physical tasks are negatively associated with being able to work remotely, those primarily involving mental tasks are positively associated with remote work, and interactive tasks depend on the type of interaction required: complex interactive tasks are positively associated with remote work, but tasks that involve interacting with coworkers are negatively associated with it. Interestingly, Nestoriak and Oh further find considerable within-occupation variation, which may be explained by differences in the specific tasks workers must perform.

Relatedly, there is large geographic variation in the prevalence in remote work. With their large sample of cell phone data, Abraham et al. are able to examine how offsite work varies across detailed geographic areas. They find considerable variation within cities and counties that is correlated with industry and occupation mix, household income, and even political affiliation. Nestoriak and Oh find that more centrally located and dense counties have relatively more activities where remote work is permitted and argue that worker demand to reduce commuting time may help explain this pattern.

This hypothesis is supported by analysis in Foliano, Riley, and Brown, who conclude that savings in commuting time is a major benefit to those working from home. The time-use data they analyze indicate that, relative to onsite workers, remote workers spend more time sleeping or resting, engaging in unpaid work, care giving and fitness, and well-being activities. They also find that remote work allows people to better align when they work with their preferred schedules, decreasing the likelihood of people working in the early morning and during the traditional lunch hour and increasing the likelihood of people working in the late afternoon. At the same time, remote workers find their work less enjoyable and, if anything, report being slightly less productive, perhaps because they also are more likely to multi-task by combining work with non-work activities. Thus, their evidence indicates that remote work is not valued because it is more productive or enjoyable per se, but rather because it reduces the amount of time workers spend commuting to work, permits them to work at times of day they find more optimal, and frees up time to engage in activities they value more

Loss of worker productivity often surfaces as a major concern with work from home practices. In the BTOS survey results reported in Barrero et al., businesses' concern over efficiency and productivity is the second most commonly cited factor limiting their use of work from home, although far more businesses cite feasibility as a limitation. While 61 percent of businesses in the BTOS cite that parts or all of the job cannot be performed from home as a limiting factor, about 12 percent cite efficiency or productivity concerns—less than the share of businesses that report that no factors limit work from home (27 percent). Citing other evidence from the survey showing that businesses largely rely on in-person monitoring of employees to improve workforce productivity and that employers have not fully adapted practices to provide comparable monitoring of remote

workers, Barrero et al. argue that that exiting management practices regarding employee monitoring may be important in limiting the adoption of work-from-home practices.

Nonstandard work arrangements: Contract company work and self-employment, including independent contractor and digital platform work arrangements

Most workers are in so-called “traditional” employment arrangements in which they are employees of the organization for whom they provide labor services. Reflecting concerns over the rise of contract company work and freelance or independent contractor work toward the end of the 20th Century, however, the Bureau of Labor Statistics first fielded questions concerning these practices in the Contingent and Alternative Arrangements Supplement (CWS) to the Current Population Survey 1995. In contract company work, an organization provides the labor services of its workers to another organization; often their employees work at the client’s worksite and under the supervision of the client. The dramatic rise in the 1990s of the temporary help industry, which rose from a half a percent of wage and salary employment at the beginning of the decade to two percent by the close, is emblematic of contract company work. Freelancers or independent contractors work for clients but are classified as self-employed and thus lack certain employment protections and benefits afforded employees. Recent years have seen the introduction and rapid rise of digital platform work, sometimes called “gig” platform work, in which apps or websites help place workers into short-term jobs and typically mediate the payment between workers and their customers. Those working through digital platforms usually work as independent contractors.

Despite the media and policy attention these employment arrangements have garnered, data gaps limit our understanding of the size of the workforce in contract company and the various types of self-employment arrangements and the broader implications for workers and labor market analyses of these arrangements. The next seven papers in the volume develop and analyze novel data to help address these issues.

Contract company work

While contract company workers are employees of the business that contracts out their services and so are captured in employer surveys and administrative data, information on the clients for whom these individuals work generally is not collected. In “The Rise of the Contract Workforce in U.S. Manufacturing,” Matthew Dey and Susan Houseman develop a new method for imputing staffing services workers in core manufacturing occupations to manufacturing and other sectors by detailed industry, occupation, and geographic area from 1990 to 2018.

They estimate that the share of contract workers in the manufacturing sector’s core occupations rose from 1.7 percent in 1990 to 5.8 percent in 1997. The contract share continued to grow in the 2000s, even as direct-hire employment in manufacturing declined sharply, peaking at 10.0 percent in 2015 before declining slightly. They estimate that the shift to contract workers can explain more than 22 percent of the employment decline in core manufacturing jobs from 1990 to 2018 and 10 percent of the employment decline from 1997 to 2018. The share of contract use varies considerably across manufacturing industries and metro areas. These new data, which include information on staffing industry use by occupation, industry, and area, may help be useful in future

research to shed light on why firms outsource labor, the implications for workers, and potential biases in some analyses whose labor measures omit contract workers.

Self-employment

The imputations in Dey and Houseman illustrate the potential importance in labor market analyses of tracking where employees of contract companies work. Yet, many workers, including those in contract arrangements, are self-employed. Data for research and policy on the self-employed are less well developed than data on employees. For example, the Longitudinal Employer-Employee Dynamics (LEHD) data, developed by Census, links information on employer businesses with their wage and salary employees. The LEHD data have been the basis for many important insights into U.S. labor markets over the last couple of decades. A major weakness of the LEHD, however, is that it does not include information on the self-employed who comprise a significant minority of the employed.

In “Business Owners and the Self-Employed: Thirty-Three Million and Counting,” Christopher Goetz, Henry Hyatt, Zachary Kroll, Kristin Sandusky, and Martha Stinson document on-going work at Census to fill that gap. Paralleling the structure of the LEHD, the new data infrastructure creates a longitudinal business database for nonemployer businesses (business entities without employees) and the individuals who derive self-employment income from them. These data distinguish among several types of self-employment: sole proprietors (with or without an employer Identification number), partnerships, and S corporations or C corporations. Sole proprietors without an EIN (in which case workers are simply using their social security number for identification) account for over 70% of all nonemployer businesses. Earnings for self-employed workers are derived from tax returns.

The authors illustrate how the new data products from this effort can be used in research to examine phenomena, such as the use of self-employment during the transition from non-employment to employment; transitions between being an employee and various types of self-employment arrangements, the exits and entries of different types of nonemployer businesses; variation in dynamics by the legal form of self-employment businesses; and the prevalence of multiple self-employment job holding. Regarding the last, the data show that a third of the self-employed hold concurrent multiple jobs with nonemployer businesses. The paper includes a detailed discussion of how the data infrastructure is created, which will be a valuable resource for future data users.

Household surveys typically group workers in disparate types of self-employed together. In “Understanding Self-Employment Trajectories over the Life Course in the United States,” Joelle Abramowitz and Andrew Joung develop a novel approach to identify different types of self-employment in existing household surveys. The authors use a large language model to analyze unstructured text data collected as part of the Panel Study of Income Dynamics (PSID) and the Health and Retirement Study (HRS) surveys. In this text, workers describe their jobs, and the model categorizes workers into one of four groups: 1) business owner or president, or owner of family farm; 2) formal self-employed (independent contractor); 3) informal self-employed (works on a non-contract basis); and digital or gig platform worker. Using these data, Abramowitz and Joung demonstrate how the demographic characteristics and education and skills levels of workers vary across self-employment arrangements. For example, they find that Black and Hispanic workers are

disproportionately represented in informal self-employment and that informal self-employed jobs are associated with higher manual skills and lower abstract skills.

Exploiting the longitudinal structure of the PSID and HRS data, Abramowitz and Joung show that movement across different types of self-employment is common—and is far more common than movement into and out of wage and salary employment. Older workers, for example, commonly move from business ownership to informal self-employment, which the authors see as evidence of a transition to retirement. In the future, the methodology pioneered in Abramowitz and Joung may be applied in other contexts to provide a better and more nuanced understanding of self-employment.

Digital platform work

While companies have long subcontracted work to be performed by the employees of other organizations or by self-employed workers, digital platform work—also commonly known as digitally mediated work or gig platform work—is an employment arrangement introduced in the 21st Century. Amazon Mechanical Turk, which facilitates the outsourcing of short, often repetitive tasks to freelance workers, is credited with creating the first digital platform for work in 2005 (Polivka, this volume). Since then, there has been rapid growth in the number and types of digital platforms in the United States and globally. That growth has been accompanied by contentious policy debates. Efforts in California to limit the ability of certain platforms to classify workers as independent contractors—and pushback by the ride sharing and delivery platforms—is emblematic of such policy fights.

Yet, whether and what types of policies are needed in response to the rapid growth of digital platform work depends on how many workers engage in it and how this new employment arrangement affects them. In addition to Abramowitz and Joung, who provide information on digital platform work in the PSID and HRS, this volume includes three papers that tackle measuring the platform workforce and the implications of platform work for workers.

Basic statistics on the number of platform workers are lacking, partly because there is little consensus on what counts as platform work. As Anne Polivka writes in “The What and How of Measuring Digital Platform Work,” broadly defined, digital platform employment involves the use of an app or website that digitally matches a worker to a customer. Polivka argues that how one defines a platform worker may legitimately vary with the reason for developing the measure. She outlines several factors to take into consideration when developing a measure:

1. The mode or location of the work: whether one wants to capture work performed in person, online, or both;
2. Where the work falls on the capital-labor spectrum: Labor often involves the use of capital equipment (e.g. platform delivery drivers typically use their own car), and one must decide whether to include all income-generating services or whether platform work must have a substantial labor component mediated by a platform;
3. The degree of control the platform has over the worker-customer match, over the price the worker charges the customer, and over how the worker uses the platform and conducts their

work: platforms vary considerably on these dimensions, which affect the nature of the employment arrangement;

4. A worker's hours and earnings on the platform and the appropriate reference period (e.g., a week, month, or year): In some cases, it may make sense to limit platform workers to those meeting certain restrictions, such as those whose hours, or earnings, exceed a certain threshold.

Polivka illustrates the various choices made across these dimensions in surveys administered in the United States and other countries and how definitions impact estimates of the size of the platform workforce.

This volume includes two papers that measure the size of the platform workforce in the United States, using different definitions of platform work and different data sources. Each measure has certain strengths. In "The Evolution of Platform Gig Work, 2012-2023," Andrew Garin, Emilie Jackson, Dmitri Koustas, and Alicia Miller use IRS tax data to estimate the growth of platform work over this 11-year period with a special focus on growth between 2019 and 2023. The authors identify the 90 leading platforms and identify platform workers as those receiving 1099s from these companies; they exclude from their definition platforms that facilitate the selling of goods or the renting of property. Corresponding to annual tax filings, their reference period is one year.

Their measure captures platform workers who receive a 1099. Most platform companies issue a 1099-NEC (previously termed 1099-MISC) to those with annual earnings of \$600 or more. Some platforms, however, issue 1099-Ks, which also are issued by credit card companies and other payment processors. Although the platforms issuing 1099-Ks are primarily limited to rideshare companies, the fact that a large number of people drive for rideshare platforms presents some problems for using tax data in measuring the size of and trends in platform work,

A clear strength of a database constructed from administrative tax records is its size and panel structure, which enables granular analysis over time. Analysis in Garin, Jackson, Koustas, and Miller reveals interesting trends. In their measure, transportation and delivery services account for the majority of workers with any platform work, and the number of workers engaging in platform work tripled in the four-year period from 2019 to 2023. That growth is primarily attributable to the explosion in delivery platform work, which began during the pandemic. The authors note that the growth of delivery services expanded platform work outside of metropolitan areas, where rideshare services are concentrated. An estimated 3.2 percent of the tax workforce engaged in platform work in 2021, according to their measure. In contrast, non-platform 1099 work, which makes up the bulk of 1099 freelance work, declined between 2019 and 2023. Consequently, the rise of platform work accounted for all of the increase in 1099 work during this time period.

For the large majority who engage in platform work during the year, platform work is not the major source of their annual earnings. The authors present suggestive evidence in the paper that workers are more likely to take up platform work when they experience a negative shock to their income. Thus, platform work may be an important way in which some workers make ends meet during periods of financial distress.

Rachel Marie Brooks Atkins, Quentin Brumet, and Katie Johnson measure the digital platform workforce using questions on the Entrepreneurship in the Population Survey (EPOP), a household

survey administered by the National Opinion Research Center (NORC). Their measure differs in fundamental ways from that in Garin, Jackson, Koustas, and Miller paper. It includes workers who sell goods or rent property through platforms and captures platform work done during a specified week or over a six-month period, not a year. With this definition, Atkins, Brummet, and Johnson find that 2.2 percent of workers had platform jobs as their main job in the prior week. Findings in Garin, Koustas, Jackson and Miller indicate that among those engaging in platform work over the course of the year, earnings from platforms primarily supplement workers' annual earnings from other jobs. Atkins, Brummet, and Johnson find, however, that, in any given week, platform work is the primary earnings source for most (64 percent) of those with such work. This finding is consistent with evidence in the Garin et al. paper indicating that workers are more likely to take platform jobs when experiencing an adverse shock to their income shock.

An advantage of household survey data over tax data is that these data may include workers not captured in the tax system either because platform workers earn below a tax threshold or are paid under the table. Another advantage is that these data do not rely on lists of platform companies. A major disadvantage of household surveys relative to administrative data is that respondents may be confused by questions about digital platform work; early efforts to measure platform work in the Contingent Worker Supplement (CWS) to the Current Population Survey, for example, encountered such a problem (CPS staff 2018). This problem was mitigated in the EPOP survey by asking respondents for the name of the platform, which enabled the authors to confirm whether those who reported working through a platform understood the question and, for those listing a legitimate platform name, to categorize the type of platform. The authors show that the demographic characteristics of workers differ across the types of platforms.

A methodological contribution of their paper arises from the fact that the EPOP survey was administered to three samples: a probability-based panel maintained by NORC, an address-based sample, and an opt-in panel. The first two are designed to be representative of the population, while the opt-in panel is not. The authors find that (even with weighting to match the demographic profile of the population) the prevalence of platform work is similar in the panel and address-based samples but is considerably higher in the opt-in sample. These findings caution against the use of opt-in samples to derive population estimates.

Workers' understanding of independent contractor/freelance work arrangements

While independent contracting or freelance work is commonly portrayed as providing workers with greater independence and flexibility, unlike employees, workers in these arrangements must cover business expenses out of pocket, fully pay FICA (Social Security) taxes, and do not have income taxes withheld from their paycheck. This, in turn, raises concerns about whether workers understand the tradeoffs inherent in these arrangements.

To answer this question, Edward Freeland, Andrew Garin, and Dmitri Koustas conducted a random assignment experiment within the EPOP survey. Respondents were asked about their expectations of net pay in freelance and traditional employee jobs with the same gross pay; information on business and tax expenses associated with freelance work varied across treatment and control groups. The authors find that workers in freelance arrangements report having greater control over when, where, and how they work compared to employees. At the same time, they find that, unless

provided with detailed information on costs, survey respondents tended to greatly underestimate business and tax expenses associated with freelance work and overestimate the net pay of freelance compared to traditional employee work. This pattern was observed regardless of whether respondents were in an employee or self-employment job at the time of the survey. The findings suggest that people in or considering freelance work may not understand the expenses and point to the need for more transparency about the costs and tax burdens of freelance work.

Implications of New Digital Technologies for Work

Since the First Industrial Revolution in the 18th Century, waves of major technological innovations have raised fears about the impacts their adoption will have on workers. With the rapid emergence of new digital technologies including the internet, robotics, and, most recently, artificial intelligence, concerns about technology and its implications for the future of work have risen to prominence again.

Ekaterina Prytkova and Fabien Petit examine this issue in “The Employment Impact of Emerging Digital Technologies: Evidence from US Labor Markets.” Prytkova and Petit apply a methodology they developed for the European context to study the effects that new digital technologies are having on employment and earnings in the United States. To do so, they construct measures of workers’ exposure to 40 distinct types of new digital technologies at the detailed occupation and industry level. In their approach, they use natural language processing to assess the semantic similarity between patents for each technology and descriptions of industries and occupations. The measure is designed to capture potential exposure to a specific type of technology, which they use as a proxy for actual exposure in estimating the effects of digital technologies on employment and earnings. Using data from the ACS for the period 2012 to 2019, they categorize workers into occupation by industry at the commuting zone level and employ a shift-share approach to estimate employment and earnings effects for the U.S. Their analysis is notable in that it looks at overall effects of digital technologies on employment and earnings and not just the effects in the exposed occupations and industries.

They find that, during the period studied, exposure to digital technologies increases U.S. employment overall, though the effects vary by demographic group. Technology exposure negatively impacts employment for prime age individuals and those with very low educational attainment (no high school degree) but raises employment among young and older individuals and those with a college degree. The estimated effect of exposure to new technology on earnings is positive overall, although those lacking a high school degree do not benefit.

A methodological contribution of this paper is the development of a new open-access database that quantifies the exposure of industries and occupations to 40 emerging digital technologies within the US context. These exposure scores are provided at a granular level, specifically for 4-digit NAICS 2007 industries and 8-digit O*NET-SOC 2010 occupations, enabling detailed analyses when combined with U.S. labor market data.

Collectively, the research in this volume provides novel evidence on the changing nature of work as well as new data products and methodologies that will facilitate the study of these phenomena in the future.

Reference

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