The Law and Political Economy of Workplace Technological Change

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This Article explores how labor and employment laws shape workplace technological change. It focuses on emerging data-driven technologies such as machine learning, the branch of artificial intelligence that has sparked widespread concern about the future of work. The Article argues that labor and employment laws shape employers' technological choices in two ways. First, those laws help to facilitate technological development by granting employers broad rights to gather workplace data, to develop new technologies using that data, and to implement those technologies into the workplace, typically regardless of workers' preferences. Second, those laws channel technological development in certain directions, in particular by encouraging companies to use technologies to exert power over workers and therefore cut labor costs. This analysis has policy implications. Among other things, it suggests that ensuring a decent future of work may require reforms to guarantee workers a voice in the development and deployment of workplace technologies. The Article also argues that automation, while a real and important phenomenon, is not the most important challenge facing workers now or in the foreseeable future.

Table of Contents

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INTRODUCTION

This Article explores how labor and employment laws shape workplace technological change. That relationship is a matter of public importance today, since employers are using data-driven technologies to restructure work. More and more jobs are now performed in the shadow of data-gathering devices such as mobile phones, handheld scanners, GPS and other location trackers, and of course computers, which often feed data straight into corporate intranets. As a result, companies have more usable data about workers' performance and about workplace processes than ever before. Companies also have new tools to interpret that data, including machine learning and other sorts of artificial intelligence ("AI"), which they are using both to automate certain tasks, and to monitor and manage workers in new ways.[1] These developments have already transformed the ride-hailing sector, where gig economy companies have grown rapidly in many major cities,[2] and are now altering other large low-wage sectors including fast food, retail, hotels and hospitality, and warehousing.[3] These developments have also sparked extensive debate about the future of work, and widespread concern that we face a looming automation wave.[4]

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[1] *See* discussion *infra* Parts II and III.

[2] *See generally* ALEX ROSENBLAT, UBERLAND: HOW ALGORITHMS ARE REWRITING THE RULES OF WORK (2018); Brishen Rogers, *The Social Costs of Uber*, 81 U. CHI. L. REV. DIALOGUE 85 (2015); Alex Rosenblat & Luke Stark, *Algorithmic Labor and Information Asymmetries: A Case Study of Uber's Drivers*, 10 INT'L. J. COMM. 3758 (2016).

[3] *See* discussion *infra* Part III.

[4] *See* Cynthia Estlund, *What Should We Do After Work? Automation and Employment Law*, 128 YALE L.J. 254, 254 (2018) (arguing that policymakers should prepare for the possibility of a world with much less work, even if the scope of the automation threat isn't clear); Carl Benedikt Frey & Michael A. Osborne, *The Future of Employment: How Susceptible Are Jobs to Computerisation?*, 114 TECHNOLOGICAL FORECASTING AND SOCIAL CHANGE 254, 254 (2017) (arguing that automation is a major threat to work in the near future); MARTIN FORD, RISE OF THE ROBOTS: TECHNOLOGY AND THE THREAT OF A JOBLESS FUTURE xiv–xvi (2015)

Yet existing scholarship and public debates have not fully grasped the relationship between labor and employment laws and workplace technological change.[5] One reason is that debates around technology and work have focused on conflicts between new technologies and employment regulations. For example, gig economy representatives and some scholars have argued that modern worker protections may restrict companies' abilities to innovate, potentially thwarting technological progress.[6] Worker advocates and other scholars have responded that companies are using new technologies to avoid legal obligations toward workers.[7] Both arguments have merit, since novel technologies often put pressure on existing legal categories.[8]

But as legal realists and their intellectual descendants have emphasized, law in modern societies does more than *regulate* economic behavior. Law also helps *constitute* economic and social relations in the first place.[9] Law

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(furthering the claim that automation is a major threat to work in the near future); ANDY STERN WITH LEE KRAVITZ, RAISING THE FLOOR: HOW A UNIVERSAL BASIC INCOME CAN RENEW OUR ECONOMY AND REBUILD THE AMERICAN DREAM 51–73 (2016) (making the same claim that automation is a major threat to work in the near future).

[5] Other labor and employment law scholars have begun to analyze these issues in ways that overlap with my own. Several articles on point will be published in a symposium issue of the COMPARATIVE LABOR LAW & POLICY JOURNAL in 2020. *See, e.g.*, Valerio De Stefano, *"Negotiating the Algorithm": Automation, Artificial Intelligence and Labour Protection*, 41 COMP. LAB. L. &. POL'Y. J. 15, 16 (2020) (explaining that, in addition to automating some tasks, new technologies "also increase the possibility of management to increasingly monitor working activities in a way that is not desirable for the worker"); Jeremias Adams-Prassl, *What if Your Boss Was an Algorithm: Economic Incentives, Legal Challenges, and the Rise of Artificial Intelligence at Work*, 41 COMP. LAB. L. &. POL'Y. J. 123, 124 (2020) ("Instead of taking away workers' jobs . . . advances in AI-driven decision-making will first and foremost change their managers' daily routines . . . . [W]e are witnessing the rise of the 'algorithmic boss.'").

[6] *See, e.g.*, John Myers, *Uber, Lyft, DoorDash Launch a $90-Million Fight Against California Labor Law*, L.A. TIMES (Oct. 29, 2019), https://www.latimes.com/california/story/2019-10-29/uber-lyft-doordash-fight-california-labor-law-ab5, *archived at* https://perma.cc/WY84-S2AY; *see generally* Seth D. Harris & Alan B. Krueger, *A Proposal for Modernizing Labor Laws for Twenty-First-Century Work: The "Independent Worker"* 2 (Hamilton Project, Discussion Paper No. 2015-10, 2015) (arguing that there is a tension between gig economy work relationships and existing laws around employment classification).

[7] This has been alleged in several major lawsuits. *See, e.g.*, Cotter v. Lyft, Inc., 60 F. Supp. 3d 1067 (N.D. Cal. 2015) (denying defendant's motion for summary judgment on employment status of Lyft drivers); O'Connor v. Uber Techs., Inc., 82 F.Supp.3d 1133 (N.D. Cal 2015); *see generally* Brishen Rogers, *Employment Rights in the Platform Economy: Getting Back to Basics*, 10 HARV. LAW & POL'Y REV. 479 (2016) (arguing that existing definitions of employment are broad enough to cover Uber and Lyft drivers).

[8] *See generally* Gary E. Marchant, *The Growing Gap Between Emerging Technologies and the Law*, *in* THE GROWING GAP BETWEEN EMERGING TECHNOLOGIES AND LEGAL-ETHICAL OVERSIGHT: THE PACING PROBLEM 19, 22–23 (Gary E. Marchant et al. eds., 2011) (arguing that law lags behind technology both because legal regulations "are based on static rather than a dynamic view of society and technology" and because legal institutions take significant time to revise); Simon Deakin & Christopher Markou, *The Law-Technology Cycle and the Future of Work* 1 (Univ. of Cambridge Faculty of Law Legal Studies Research Paper Series, Paper No. 32/2018, May 22, 2018), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3183061, *archived at* https://perma.cc/BBB7-QZTQ.

[9] *See, e.g.*, JULIE E. COHEN, BETWEEN TRUTH AND POWER: THE LEGAL CONSTRUCTIONS OF INFORMATIONAL CAPITALISM 4 (2019) (discussing the contemporary relationship among legal institutions, development of networked information technologies, and changes in the political economy); Simon Deakin et al., *Legal Institutionalism: Capitalism and the Constitutive Role*

does this by establishing parties' entitlements to particular resources, and by setting the background rules of economic cooperation. For example, labor and employment laws regulate work by forbidding employers to pay employees less than the minimum wage or to terminate them for seeking to unionize. But those laws also constitute employment as a legal relationship that carries certain rights and duties, and they grant employers most decisionmaking powers within employment relationships, including powers to develop and deploy productive technologies.[10] Some labor and employment doctrines therefore help facilitate the development of novel technologies like machine learning, even as others may slow down technological progress.[11] An accurate picture of the relationship among law, technology, and work must account for this constitutive role of law.

Debates around the future of work have also been limited in another respect: commentators have tended to view technological development as an apolitical process that is driven by advances in science and engineering.[12] Yet a wealth of historical and contemporary evidence suggests that social and political factors influence the course of technological development, sometimes in profound ways. Canonical works in science and technology studies, for example, have demonstrated that actors often choose technologies strategically to advance their own interests.[13] Labor sociologists and historians, meanwhile, have shown that employers have often favored technologies that limit workers' shop-floor power—sometimes even at the expense of efficiency or productivity.[14] Law and technology scholars, finally, have built on those insights and on the legacies of legal realism to illuminate the relationship between law, contemporary information technologies, and the distribution of power in society.[15]

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of Law, 45 J. COMP. ECON. 188, 189 (2017) (discussing how contemporary legal institutions help to constitute capitalist markets); Robert L. Hale, *Coercion and Distribution in a Supposedly Non-Coercive State*, 38 POL. SCI. Q. 470, 471 (1923) (explaining how law helps to constitute economic relations); *see also* sources cited *infra* note 39.

[10] *See* discussion *infra* Part I.B.

[11] *See id.*

[12] *See* discussion *infra* Part II.A; *see generally* Yochai Benkler, A Political Economy of Oligarchy: Winner-Take-All Ideology, Superstar Norms, and the Rise of the 1% 2–4 (Sept. 2017) (unpublished manuscript) ["Benkler, *Oligarchy*"], http://www.benkler.org/Political%20economy%20of%20oligarchy%2001.pdf, *archived at* https://perma.cc/XF9N-44LX (arguing that most public debate around technology and work assumes that technological progress drives economic and political developments).

[13] *See* LEWIS MUMFORD, TECHNICS AND CIVILIZATION 6 (1934) (arguing that "technics . . . exists as an element in human culture and it promises well or ill as the social groups that exploit it promise well or ill."); *see generally* Langdon Winner, *Do Artifacts Have Politics?*, 109 DAEDALUS 121 (1980).

[14] *See* discussion *infra* Part I.A.

[15] *See* discussion *infra* Part I.A; *see generally* Yochai Benkler, *Power and Productivity: Institutions, Ideology, and Technology in Political Economy* in POLITICAL ECONOMY AND JUSTICE, (Allen, D., Benkler, Y., and Henderson, R eds., forthcoming 2021) [hereinafter Benkler, *Power and Productivity*]; COHEN, *supra* note 9; *see also id.*, at 30–33 (sketching some of the ways that companies have used networked information technologies to alter work relationships and managerial practices, and highlighting how changes to legal doctrines have facilitated that process).

Together, these bodies of scholarship suggest that employers' technological choices are embedded in workplace power relations, which are themselves structured at every level by labor and employment laws. Technology should therefore evolve in response to labor and employment laws, as employers develop or choose particular technologies subject to the privileges and constraints those laws establish.[16] Hence this Article's title: It argues that the path of workplace technological change is shaped in profound ways by the law and political economy of work.[17]

To build out this argument, the Article shows that employers are developing two new sorts of technological means today, which they are using for two distinct ends.[18] The new means are (1) automation, or the use of machines to perform tasks previously performed by line-level workers, and (2) "algorithmic management,"[19] or the use of data and algorithms to hire, direct, monitor, schedule, or discipline workers.[20] The ends are (1) to enhance labor productivity, by enabling workers to increase output while holding input constant, and (2) to augment employers' power vis-à-vis workers and therefore limit labor costs.[21] Productivity enhancement is generally desirable and should be encouraged, since it enables rising labor standards.[22] Power-exertion by employers is often undesirable, since it can erode labor stan-

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[16] *See* Deakin & Markou, *supra* note 8, at 1 ("We should . . . expect law to lag behind technology at times of rapid innovation, but also understand that law does more than simply respond belatedly to technological change. Technology's evolution is shaped by its legal environment.").

[17] *See* Benkler, *Oligarchy*, *supra* note 12, at 4 (defining "political economy" as "the study of how power shapes production and distribution in society."); David Singh Grewal, Amy Kapczynski & Jedediah Purdy, *Law and Political Economy: Toward a Manifesto*, LPEBlog (Nov. 6, 2017), https://lpeblog.org/2017/11/06/law-and-political-economy-toward-a-manifesto/, *archived at* https://perma.cc/47G3-WTG5 (proposing new field of study, "law and political economy," which seeks to understand how law "gives shape to the relations between politics and the economy at every point.").

[18] New technologies are often developed or sold to companies by suppliers or vendors, of course. The Article will nevertheless refer to "employers" as the parties developing technologies for ease of exposition.

[19] The term "algorithmic management" is not my own. It seems to have become popular due to a working paper by several Carnegie Mellon researchers. *See* Min Kyung Lee et al., *Working with Machines: The Impact of Algorithmic and Data-Driven Management on Human Workers* 1603 (CHI '15: Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems, Working Paper, 2015), https://dl.acm.org/citation.cfm?doid=2702123.2702548, *archived at* https://perma.cc/92CD-TXG4.

[20] *See* discussion *infra* Part II (discussing automation) and Part III (discussing algorithmic management).

[21] The Article's distinction between power-enhancing and productivity-augmenting technologies is indebted to similar distinctions in Benkler, *Power and Productivity*, *supra* note 15 and Samuel Bowles, *Social Institutions and Technical Change*, *in* Technological and Social Factors in Long-Term Fluctuations 68 (De Matteo et al. eds., 1989).

[22] However, labor and employment laws, and other institutions, help determine whether productivity increases translate into wage increases. *See generally* Bruce E. Kaufman, *Economic Analysis of Labor Markets and Labor Law: An Institutional/Industrial Relations Perspective*, *in* Research Handbook on the Economics of Labor and Employment Law (Cynthia L. Estlund & Michael L. Wachter eds., 2012).

dards.[23] Importantly, either means can be used for either end. Employers can automate work tasks that involve drudgery—or they can automate tasks that were performed by skilled workers with some labor market power. Employers can use algorithms to make job searches cheaper and easier—or they can use algorithms to surveil workers more closely and undermine their autonomy.

Our labor and employment laws shape this process in two distinct ways, both of which have been referenced above. Those laws facilitate the development of new technological means by establishing and enforcing employers' rights to gather, process, and control workplace data, and to install workplace technologies, typically without regard to workers' preferences.[24] Those laws, and the broader political economy of work that they help sustain, also encourage employers to use new technologies to exert power over workers.[25] Indeed, comparative evidence suggests that U.S. employers use technologies for power augmentation more often than their counterparts in nations with stronger worker protections.[26] Employers may exert power over workers to ensure that managers and investors capture a significant share of profits. Or employers may do so to maintain a competitive position in economic sectors dominated by low-wage, low-productivity production strategies.[27] Either way, the effect is typically to reduce wages and to erode the quality of work. Employers' technological choices, as shaped by labor and employment laws, therefore impact the distribution of both income and political-economic power over time.[28]

This analysis has several implications for today's debates around technology and the future of work. For example, it suggests that lawmakers have substantial room to ensure decent work today and in the future. Enhanced worker protections can still encourage higher wages and a better quality of work; such protections may also encourage employers to invest more in productivity-enhancing technologies. This analysis also suggests that ensuring a decent future of work may require giving workers rights to consult or bargain over workplace technologies.[29] Along the way, the Article argues

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[23] The Article adopts Weber's definition of "power" as one party or group's ability to "realize their own will in a communal action against the resistance of others." FROM MAX WEBER: ESSAYS IN SOCIOLOGY 180 (H.H. Gerth & C. Wright Mills eds., 1946) (translating MAX WEBER, WIRSTSCHAFT UND GESELLSCHAFT (ECONOMY AND SOCIETY) 631–40 (1922)).

[24] *See* discussion *infra* Part I.B.

[25] As explained below, employers almost always use new technologies for some combination of productivity enhancement and power augmentation. Law affects employers' choices regarding the balance between those uses of technology at the margin. *See* discussion *infra* Part I.A.

[26] *See* discussion *infra* Part IV.A.

[27] *See* discussion *infra* Part IV. Those markets have co-evolved with our legal regimes that grant employers near-plenary power in the workplace, just as other nations' markets and characteristic uses of technology have co-evolved with their own institutions. *See* discussion *infra* Part IV.A (regarding comparative evidence on uses of technology in other nations).

[28] *See* discussion *infra* Parts I.A and IV.A.

[29] *See* discussion *infra* Part IV.B.

that automation is not now a world-historic threat, and likely will not be soon.[30]

Part I outlines the Article's basic theory of the law and political economy of workplace technology. Part I.A introduces the Article's methodology, which draws from various fields that focus on the relationship among institutions (including law), labor politics, and economic outcomes, and discusses the history of workplace conflict around technology. Part I.B then summarizes key labor and employment law doctrines that enable companies to gather work-related information, quantify it as usable data, and use it to reshape production. The most important of these doctrines include background rules of the employment relationship, such as employment at will, the default rule of individual contracting, the absence of extensive employee privacy rights, and narrow legal definitions of employment. Certain legal norms are also quite important, including commitments to freedom of contract and a deeply rooted assumption that employers "own" the workplace in a manner familiar from classical property law.

The next two Parts examine how employers are actually using new data-driven technologies today. Part II discusses automation. Part II.A summarizes labor market data suggesting that automation is a real and important phenomenon but not a world-historic threat. It also sketches the current occupational structure, which is heavily weighted toward jobs that are difficult to automate using currently available technologies. Part II.B then surveys the promise and limits of machine learning, the subfield of artificial intelligence that has generated widespread concern about the future of work. Doing so helps illustrate the likely scope of automation in the near future, as well as how machine learning could enhance algorithmic management processes. Part II.C then discusses a few recent automation successes. Those suggest that companies do not typically automate entire jobs at once; rather, they automate particular tasks and may focus on tasks that give workers some labor market power. What's more, after automating such tasks, companies often alter production processes in ways that limit workers' discretion and autonomy. As a result, automation can enhance employer power as well as productivity.

Part III then discusses algorithmic management—which, like automation, can be used both to enhance productivity and to exert power over workers. Part III.A examines algorithmic hiring and scheduling. Those processes could benefit workers in some cases: they could enable easier job searches and could make employer decisions more legible to regulators. But they can also undermine labor standards and encourage illicit discrimination. Part III.B discusses algorithmic monitoring, which may reward especially diligent workers, but seems likely to put downward pressure on wages and working conditions in the aggregate. Part III.C discusses what the Article calls "data-driven fissuring," or the use of new technologies to monitor

[30] *See infra* Part II.

work that has been shunted outside company boundaries through subcontracting, franchising, and related strategies.[31] Fissuring is not problematic *per se*, but it often erodes standards in the low-wage labor market.

Part IV then draws out some broader lessons. Part IV.A brings in historical and comparative evidence to suggest that a different allocation of rights in workplace technology could encourage a different balance between productivity-enhancing and power-augmenting strategies—and even a more equal distribution of income and wealth. Part IV.B then outlines policy responses that would democratize the governance of workplace technology by giving workers a voice in technological decisions. Those reforms would be most effective if bolstered by changes in industrial policy and other means of enhancing worker voice.

This Article has several limitations that are worth noting at the outset. It focuses largely on the low-wage labor force. This is because the low-wage labor market is more homogenous in terms of job classifications than the mid-wage and high-wage markets, which makes it easier to trace general trends; there are also large numbers of low-wage workers today, which make their concerns economically significant.[32] The Article also focuses on economic terms of employment, including wages, hours, and collective bargaining rights, and says less about how new data practices interact with workplace civil rights, in part because scholars have already begun to address those issues in detail.[33] That being said, the low-wage labor markets

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[31] *See generally* DAVID WEIL, THE FISSURED WORKPLACE: WHY WORK BECAME SO BAD FOR SO MANY AND WHAT CAN BE DONE TO IMPROVE IT (2014).

[32] According to the U.S. Bureau of Labor Statistics ("BLS"), there are around 12.9 million manufacturing workers in the United States, with a unionization rate just over 10%, and median wages of around $22 an hour. *Industries at a Glance – Manufacturing: NAICS 31–33*, U.S. BUREAU OF LABOR STATISTICS, https://www.bls.gov/iag/tgs/iag31-33.htm, *archived at* https://perma.cc/M27R-DV82. There are far more low-wage service workers, many of whom work for major corporations. For example, there are now over thirteen million nonsupervisory retail workers, *Industries at a Glance – Retail Trade: NAICS 44–45*, U.S. BUREAU OF LABOR STATISTICS, https://www.bls.gov/iag/tgs/iag44-45.htm, *archived at* https://perma.cc/J232-C8NC; eleven million food service workers, *Industries at a Glance – Food Services and Drinking Places: NAICS 722*, U.S. BUREAU OF LABOR STATISTICS, https://www.bls.gov/iag/tgs/iag722.htm, *archived at* https://perma.cc/JA98-UDHH; 4.2 million hand laborers, which includes warehouse workers, *Hand Laborers and Material Movers*, U.S. BUREAU OF LABOR STATISTICS, https://www.bls.gov/ooh/transportation-and-material-moving/hand-laborers-and-material-movers.htm, *archived at* https://perma.cc/2DGS-XAAR; and 3.2 million home health aides and personal care aides, *Home Health Aids and Personal Care Aids*, U.S. BUREAU OF LABOR STATISTICS, https://www.bls.gov/ooh/healthcare/home-health-aides-and-personal-care-aides.htm, *archived at* https://perma.cc/57P8-DFPY. The median wage for each of those groups is under $15 an hour, with the exception of hotel workers, where the median is just over $15 an hour. *Industries at a Glance – Leisure and Hospitality*, U.S. BUREAU OF LABOR STATISTICS, https://www.bls.gov/iag/tgs/iag70.htm, *archived at* https://perma.cc/5PM4-5632.

[33] *See, e.g.*, Ifeoma Ajunwa, *Age Discrimination by Platforms*, 40 BERKELEY J. EMP. & LAB. L. 1 (2019); Ifeoma Ajunwa, Kate Crawford & Jason Schultz, *Limitless Worker Surveillance*, 105 CALIF. L. REV. 735 (2017); Solon Barocas & Andrew D. Selbst, *Big Data's Disparate Impact*, 104 CALIF. L. REV. 671 (2016); Pauline T. Kim, *Data-Driven Discrimination at Work*, 58 WM. & MARY L. REV. 857 (2017). On the relationship between contemporary surveillance practices and processes of racial differentiation more generally, *see* Simone Browne,

the Article discusses are disproportionately populated by women and other members of historically disenfranchised groups, including African Americans, Latinx individuals, and immigrants.[34] As a result, virtually *all* of the practices discussed below have a disproportionately negative impact on such groups, even before illicit discrimination comes into the picture. In that regard, this analysis may also contribute to our understanding of the intersection of race, class, and other power structures in today's political economy.

I. The Law and Political Economy of Workplace Technology: An Overview

This Part outlines the Article's theory of the relationship among law, political economy, and workplace technologies. Part I.A summarizes past scholarship demonstrating that both the labor contract and companies' choices of technologies are shaped by workplace and social power dynamics. Part I.B then summarizes the key labor and employment law rules that shape the political economy of work, and therefore facilitate and channel workplace technological change.

A. The Political Economy of Workplace Technology

Labor is a peculiar commodity, quite different from tangible commodities like soybeans.[35] Because labor is always performed by a human being, it cannot be separated from workers and stored for future use. Moreover, workers' interests and employers' interests both overlap and diverge. They share an interest in profitability, but companies have an incentive to reduce labor costs while increasing output, while workers have an incentive to increase their wages and benefits while not working too hard. Workers also develop normative understandings of fairness at work, and often take collective action to advance their interests within the workplace. Their ability to do so, however, is shaped at every level by the legal regimes constituting and governing employment.

Understanding the labor contract, and the role of technology within it, thus requires attention not just to supply and demand but also to the *law and political economy of work*: how power shapes economic behavior,[36] and how

Race and Surveillance, *in* Routledge Handbook of Surveillance Studies (Kirstie Ball et al. eds., 2012).

[34] Irene Tung, Yannet Lathrop & Paul Sonn, *The Growing Movement for $15*, Nat'l Emp't Law Project 1 (Nov. 2015) (summarizing data on demographic characteristics of low-wage workers).

[35] The argument in this paragraph draws generally on Robert M. Solow, The Labor Market as a Social Institution (1990); Kaufman, *supra* note 22; Claus Offe & Helmut Wiesenthal, *Two Logics of Collective Action: Theoretical Notes on Social Class and Organizational Form*, 1 Pol. Power & Soc. Theory 67 (1980); Joseph E. Stiglitz, *Information and the Change in the Paradigm in Economics*, 92 Am. Econ. Rev. 460 (2002).

[36] *See* Benkler, *Oligarchy*, *supra* note 12, at 4 (defining political economy in similar terms). *See also* Wolfgang Streeck, *Taking Capitalism Seriously: Toward an Institutionalist*

economic behavior co-evolves with the broader legal and institutional structure.[37] For present purposes, the most important laws are labor and employment laws, and the most important institutions are industrial relations systems and other mechanisms of workplace governance, which differ substantially across nations. This Article therefore draws from various disciplines that shed light on the law and political economy of workplace technology and labor contracts.[38]

For example, legal realists and their descendants in critical approaches to law have long argued that markets are constituted in part through law, and that the law both reflects extant power relations and provides subordinate groups with tools for resistance.[39] Heterodox economists and "old" institutional economists have also focused on the legal and social constitution of the labor market,[40] arguing, for example, that supply and demand should be understood as broad bands rather than discrete curves, within which political

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Approach to Contemporary Political Economy 3 (Max-Planck-Institut für Gesellschaftsforschung, Köln, MPIfG Discussion Paper No. 10/15, 2010), https://www.econstor.eu/bitstream/10419/43282/1/640705758.pdf, *archived at* https://perma.cc/RE69-S6GW ("Political economy looks at the interrelations between collective action in general and collective rule-making in particular, and the economy; it extends from economic and social policy-making to the way in which economic interests and constraints influence policy, politics and social life as a whole.").

[37] By "institutions" and "institutional structures," I mean the complex of collective practices that typically co-evolve with the law in modern economies, but which are not reducible to law, and which structure economic behavior. That definition is close to Douglass North's definition of institutions as "humanly devised constraints that structure political, economic and social interaction." Douglass C. North, *Institutions*, 5 J. ECON. PERSP. 97, 97 (1991). But while North and many social scientists treat law as one among many institutions, I treat it as a separate category to focus on how law shapes other institutions and vice versa.

[38] Regarding human behavior, the article operates within a modified rational choice framework. Specifically, it assumes boundedly rational firms and workers with capacities for both self-interested and solidaristic strategic behavior, who are often more interested in their relative than their absolute position in the distribution of income and social esteem, and who tend to satisfice rather than maximize. At scale, individual (boundedly) rational decisions can therefore lead to aggregate patterns of behavior and production that diverge from neoclassical predictions and instead exhibit substantial power-seeking or rent-seeking behavior. For a parallel approach to such questions, see Benkler, *Power and Productivity*, *supra* note 15. *See also* ADAM PRZEWORSKI, CAPITALISM AND SOCIAL DEMOCRACY (1986) (bringing elements of rational choice theory to the study of class power relationships and political economy).

[39] Classics of legal realism include, *e.g.*, Hale, *supra* note 9, and Morris R. Cohen, *Property and Sovereignty*, 13 CORNELL L. REV. 8, 17–19 (1927) [hereinafter Cohen, *Property and Sovereignty*]. Prominent critical approaches to labor law include Karl E. Klare, *Labor Law as Ideology: Toward a New Historiography of Collective Bargaining Law*, 4 INDUS. REL. L.J. 450 (1981) and Katherine Van Wezel Stone, *The Post-War Paradigm in American Labor Law*, 90 YALE L.J. 1509 (1981). Recent scholarship on the legal constitution of capitalist markets includes KATHARINA PISTOR, THE CODE OF CAPITAL: HOW LAW CREATES WEALTH AND INEQUALITY (2019) (discussing how the law creates modern financial instruments) and COHEN, *supra* note 9 (discussing legal constitution of modern networked information technologies in context of contemporary political economy).

[40] *See*, *e.g.*, Kaufman, *supra* note 22, at 78 (explaining "institutional economics/industrial relations" perspective on labor economics that emphasizes legal and social constitution of labor markets); *see also* SOLOW, *supra* note 35; Samuel Bowles & Herbert Gintis, *Contested Exchange: New Microfoundations for the Political Economy of Capitalism*, 18 POL. & SOC'Y 165 (1990) (giving a prominent account of labor contract by heterodox economists).

and social factors can influence wages and other working conditions.[41] Law and technology scholars, and scholars within social studies of technology, have shown that technology itself can be a means of social control, and that actors, including employers, may select and deploy technologies to advance their own particular interests.[42] These bodies of scholarship differ in various important ways, but they collectively show that technology, including workplace technology, is partially endogenous to social relationships, and that the ability to design and choose technology is an important source of social and economic power, with potentially significant distributive effects.

Indeed, in the literature on the politics of technology, some of the leading examples involve the workplace. In a canonical article, Langdon Winner highlighted the nineteenth-century industrialist Cyrus McCormick's adoption of pneumatic molding machines that were both more expensive and less precise than those considered to be state of the art.[43] Doing so was more costly in the short term, but it enabled him to prevent unionization of his plant.[44] Control over technology was also central to the transition from craft to industrial production.[45] Through "Taylorism," or the system of "scientific management" developed by Fredrick Winslow Taylor,[46] companies captured craft workers' tacit knowledge and used it to break production "into discrete, rationalized, low-skill tasks" that could be performed by workers with little specialized training.[47] As discussed in Parts II and III, employers often use modern data-gathering and processing technologies in the same way.[48]

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[41] *See* Kaufman, *supra* note 22, at 83.

[42] *See* COHEN, *supra* note 9, at 3; Benkler, *Power and Productivity*, *supra* note 15; Lawrence Lessig, *Code is Law: On Liberty in Cyberspace*, HARV. MAG. (Jan. 1, 2000), https://harvardmagazine.com/2000/01/code-is-law-html, *archived at* https://perma.cc/7AZQ-R7X8 (arguing that whoever controls the code on which the internet runs "sets the terms on which cyberspace is experienced," helping determine whether users can remain anonymous, for example, and whether and how governments can regulate online speech).

[43] *See* Winner, *supra* note 13, at 124–25.

[44] *See id.* at 125.

[45] *See generally* HARRY BRAVERMAN, LABOR AND MONOPOLY CAPITAL (1974); MICHAEL BURAWOY, MANUFACTURING CONSENT: CHANGES IN THE LABOR PROCESS UNDER MONOPOLY CAPITALISM (1982); DAVID MONTGOMERY, WORKERS' CONTROL IN AMERICA: STUDIES IN THE HISTORY OF WORK, TECHNOLOGY, AND LABOR STRUGGLES (1979); MICHAEL PIORE & CHARLES SABEL, THE SECOND INDUSTRIAL DIVIDE: POSSIBILITIES FOR PROSPERITY (1986); Katherine Stone, *The Origins of Job Structures in the Steel Industry*, 6 REV. OF RADICAL POL. ECON. 113, 116 (1974); *see also* Bowles, *supra* note 21, at 72–73.

[46] *See, e.g.*, FREDERICK WINSLOW TAYLOR, THE PRINCIPLES OF SCIENTIFIC MANAGEMENT 37 (1911) (explaining that scientific management is "directly antagonistic to the old idea that each workman can best regulate his own way of doing the work").

[47] Karen Levy, *The Contexts of Control: Information, Power, and Truck-Driving Work*, 31 INFO. SOC'Y 160, 161 (2015); *see also* BRAVERMAN, *supra* note 45, at 76–83 (arguing that Taylor sought to reorganize machine tool production for the purpose of disempowering workers); *see generally* Craig R. Littler, *Understanding Taylorism*, 29 BRITISH J. SOC. 185 (1978).

[48] Employers' efforts to replicate workers' tacit knowledge parallel efforts by tech companies to gather user data and use it to produce new forms of artificial intelligence and other technologies outside the workplace context. Julie Cohen has argued that such efforts are often legitimated through analogy to the public domain in intellectual property law, such that users' data is understood as "a repository of raw materials that are there for the taking." Employers, like tech giants, have successfully cast these efforts as natural and unobjectionable despite

Building on this record, economist Samuel Bowles has argued that modern employers use technologies for three distinct purposes: to enhance efficiency or productivity, to "homogenize" work by enabling less-skilled workers to perform it, and to monitor work more closely and therefore project a credible threat that underperforming workers will be identified and terminated.[49] This Article classifies both of the latter uses of technology as power-augmenting.[50] Individual technologies can serve multiple purposes, of course: The Fordist assembly line did not just homogenize work and enhance productivity through specialized machinery but also enabled foremen to easily discern which workers were falling behind pace.[51]

Employers' choices of technology at the micro (firm) level can also, over time, influence the distribution of power at the macro level. In particular, as employers adopt technologies that alter the occupational structure over time, workers' capacities for collective action may be bolstered or undermined,[52] as will their capacities to establish and enforce legal regimes that protect their interests.[53] This can lead to feedback effects, as employers' decisions to use technology in one manner or another—and workers' abilities to

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their distributive effects. Julie E. Cohen, *The Biopolitical Public Domain: The Legal Construction of the Surveillance Economy*, 31 PHIL. & TECH. 213, 213 (2018); *see also* Nick Couldry & Ulises A. Mejias, *Data Colonialism: Rethinking Big Data's Relation to the Contemporary Subject*, 20 TELEVISION & NEW MEDIA 336, 336 (2019). The cost of granting exclusive rights in knowledge that was previously part of a public domain is a theme in intellectual property scholarship. *See, e.g.*, James Boyle, *The Second Enclosure Movement and the Construction of the Public Domain*, 66 L. & CONTEMP. PROBS. 33, 37 (2003).

[49] Bowles, *supra* note 21, at 78; *see also id.* at 70 (arguing that employers may favor inefficient technologies where doing so helps them contain workers' power and capture a higher share of profits).

[50] In using the term "productivity" I do not endorse a particular method for measuring productivity. I use the term simply to mean generating more output per unit of input. Purchasing a die press that is stronger and faster than an existing die press will enhance productivity in that sense; requiring assembly line workers to use the old die press at a faster pace will not. On some of the challenges of measuring productivity today, see Zia Qureshi, *A More Productive Debate About Productivity*, GEO. J. INT'L AFF. (Dec. 22, 2016), https://www.georgetownjournalofinternationalaffairs.org/online-edition/a-more-productive-debate-about-productivity, *archived at* https://perma.cc/GQP6-EAAG. For the most part, the discussion below also brackets the contribution of human capital to productivity, but that issue is discussed in brief in Parts II.C (discussing upskilling and down-skilling that accompanies automation) and IV.B (summarizing comparative evidence on employers' investments in upskilling).

[51] *See* Bowles, *supra* note 21, at 80.

[52] For example, the shift from craft to industrial production reduced workers' skills but also created opportunities for them to organize en masse within factories. *See*, *e.g.*, Chiara Benassi et al., *Explaining Divergent Bargaining Outcomes for Agency Workers: The Role of Labour Divides and Labour Market Reforms*, 25 EUR. J. INDUS. REL. 163, 165 (2018) (discussing different sources of worker power within contemporary production relationships, including skills, capacities for collective action, and legal or institutional protections).

[53] This analysis reflects, in part, Karl Polanyi's theory of the state (and therefore law), in which "the exercise of state power fundamentally shapes the relative strength of different social actors." *See* Fred Block, *Polanyi's Double Movement and the Reconstruction of Critical Theory*, 38 PAPERS POL. ECON. 1, 2 (2008); *see generally* KARL POLANYI, THE GREAT TRANSFORMATION (1944). It also reflects Marc Galanter's classic insight that the U.S. legal system systematically favors the "haves," who have the capacity to fight for rules as well as outcomes in litigation. Marc Galanter, *Why the 'Haves' Come Out Ahead: Speculations on the Limits of Legal Change*, 9 LAW & SOC'Y REV. 95, 100 (1974).

resist—are then shaped by the institutional context in which both operate.[54] For example, scholars in comparative political economy have argued that firms' technological choices are shaped by patterns of economic coordination. In some economies with more centralized collective bargaining, employers have maintained profitability by pursuing high value-added production strategies requiring specialized capital investment and extensive worker training.[55]

This understanding of workplace technology as a source of power in itself, and as embedded in a thick institutional context, is distinct from mainstream treatments of the issue. Neoclassical labor economics, for example, tends to disregard power differentials emerging from either technology or social factors, on the theory that competitive markets will eliminate them.[56] Theories of skill-biased technological change similarly assume that technological change is productivity-enhancing,[57] tacitly disregarding power-augmenting uses of technology, and de-emphasize employer strategies at both the micro- and macro-level to reduce worker power, unionization rates, and the real value of the minimum wage.[58] To be clear, firms are not mere takers

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[54] Employers in low-wage services may have especially powerful incentives to limit workers' power through technological and legal strategies, since it is more difficult to achieve steady productivity gains through capital investment in services than in manufacturing. *See generally* William J. Baumol, *Macroeconomics of Unbalanced Growth: The Anatomy of Urban Crisis*, 57 AM. ECON. REV. 415 (1967) (arguing that relative cost of services will increase over time as productivity growth lowers the cost of manufactured goods); Aaron Benanav, *Automation and the Future of Work—2*, 120 NEW LEFT REV. 117, 126–28 (2019) (noting relevance of Baumol's analysis in today's economy); Torben Iversen & Anne Wren, *Equality, Employment and Budgetary Restraint: The Trilemma of the Service Economy*, 50 WORLD POL. 507, 508–09 (1998) (outlining economic challenges faced by modern service economies). The growing size and power of the financial sector has also increased pressure on companies to limit labor costs today. *See* EILEEN APPELBAUM & ROSEMARY BATT, PRIVATE EQUITY AT WORK: WHEN WALL STREET MANAGES MAIN STREET 90 (2014).

[55] *See* Peter A. Hall & David Soskice, *An Introduction to Varieties of Capitalism*, *in* VARIETIES OF CAPITALISM: THE INSTITUTIONAL FOUNDATIONS OF COMPARATIVE ADVANTAGE 1, 38–39 (Peter A. Hall & David Soskice eds., 2001); *see also* KATHLEEN THELEN, VARIETIES OF LIBERALIZATION AND THE NEW POLITICS OF SOCIAL SOLIDARITY i (2014) (refining varieties of capitalism framework to understand different patterns of market liberalization in advanced economies). *But see* Streeck, *supra* note 36, at 23–25 (implicitly criticizing varieties of capitalism framework for its inattention to conflicts within capitalist societies).

[56] *See* Michael L. Wachter, *Neoclassical Labor Economics: Its Implications for Labor and Employment Law, in* RESEARCH HANDBOOK ON THE ECONOMICS OF LABOR AND EMPLOYMENT LAW 20, 21–24 (Cynthia L. Estlund & Michael L. Wachter eds., 2012) (summarizing "textbook" example of competitive labor market in which no party has power).

[57] *See, e.g.*, David H. Autor & David Dorn, *The Growth of Low-Skill Service Jobs and the Polarization of the US Labor Market*, 103 AM. ECON. REV. 1553, 1553 (2013) ("Technology in the canonical model [of skill-biased technological change] is assumed to take a factor-augmenting form, meaning that it complements either high- or low-skill workers."); *id.* at 1559 (revising canonical model to account for automation as "computers substitute[ ] for low-skill workers performing routine tasks—such as bookkeeping, clerical work, and repetitive production and monitoring activities").

[58] The canonical Autor & Dorn analysis, for example, assumes that skill levels and wages correspond. *See id.* at 1554, 1557. This disregards cases where low wages are a result of formal or functional exclusion from labor and employment laws. For example, agricultural and domestic workers are among the lowest paid in the country, but both are excluded from protec-

of technology in such accounts—rather, they (or their suppliers) develop technologies to solve challenges they encounter during production. But because labor and product markets allocate factors of production more-or-less efficiently, firms that do not maximize productivity will suffer or even fail.[59] In contrast, the various studies of law and political economy noted above, and the analysis that follows in this article, suggest that companies use power-augmenting technologies often enough, and at such a scale, to have significant political-economic effects.[60]

B. Employment Laws, Employment Structures, and Technological Change

Employment and labor laws shape this process by establishing and enforcing employers' and workers' rights with regard to workplace technology.[61] While the overall doctrine here is complex, its basic thrust is clear: Employers can typically gather data on workers' performance and workplace processes, and can use that data to develop new workplace technologies and to reshape production processes, regardless of workers' desires. This section discusses several such laws and complexes of laws.

Employment at will and the persistence of the common law: By far the most important U.S. labor and employment law doctrine is the employment-

tions under the National Labor Relations Act. 29 U.S.C. § 152(3) (2018). Many other workers lack real protections due to the "fissuring" of employment, discussed in Part III.B. *See also* Daron Acemoglu, *Technical Change, Inequality, and the Labor Market*, 40 J. ECON. LITERATURE 7, 10 (2002) (arguing that institutional changes may contribute to inequality, but also that institutional changes themselves are driven by technological changes).

[59] *See* Benkler, *Oligarchy*, *supra* note 12, at 12–13 (unpacking and criticizing foundational assumptions of skill-biased technological change ("SBTC") theories); *see also* David Card & John E. DiNardo, *Skill-Biased Technological Change and Rising Wage Inequality: Some Problems and Puzzles*, 20 J. LAB. ECON. 733, 735 (2002) (arguing that labor market data does not support SBTC theories); Paul Krugman, *Liberals and Wages*, N.Y. TIMES (July 17, 2015), https://www.nytimes.com/2015/07/17/opinion/paul-krugman-liberals-and-wages.html, *archived at* https://perma.cc/GB4Q-QT2S (arguing that "the case for 'skill-biased technological change' as the main driver of wage stagnation has largely fallen apart").

[60] Employers' abilities to choose technologies are not limitless. Laws, norms of fair treatment, workers' responses, and product markets present real constraints. That said, product and labor market constraints may not be as acute as is often assumed. Innovation may require a degree of monopoly power, which may mitigate product market pressures. *See, e.g.*, Paul M. Romer, *Endogenous Technological Change*, 98 J. POL. ECON. S71, S78 (1990). There is also growing evidence that monopsony is prevalent in contemporary labor markets, which limits workers' ability to move among jobs. For a recent summary of the data and surrounding policy debate, see Ioana Marinescu & Eric A. Posner, *A Proposal to Enhance Antitrust Protection Against Labor Market Monopsony* (Roosevelt Institute, Working Paper, 2018), https://rooseveltinstitute.org/wp-content/uploads/2019/01/RI_ProposalToEnhanceAntitrustProtection_workingpaper_11419-1.pdf, *archived at* https://perma.cc/YWH5-97WN.

[61] For ease of exposition, this Article will use the term "rights" to refer to the full spectrum of Hohfeldian entitlements, including "claims," "privileges," "powers," and "immunities." *See generally* Wesley N. Hohfeld, *Some Fundamental Legal Conceptions as Applied in Judicial Reasoning*, 23 YALE L.J. 16 (1913).

at-will rule.[62] Under employment at will, either party to an employment contract can terminate it at any time, for any reason (even a malicious one), so long as doing so is not otherwise unlawful. While this doctrine is no longer as robust as it once was,[63] it still shapes basic workplace power relations. For example, while employment at will grants the employer and employee formally equal entitlements to end an employment contract, those rights benefit employers in the run of cases since they engage in many employment contracts while workers typically engage in only one.[64]

Employment at will also reflects a deeply rooted sense that the employer *owns* the enterprise and enjoys sovereignty over it, in a manner familiar from classical property law, and encourages courts to view the employment relationship as based on freedom of contract and consent.[65] For example, it serves as a sort of "business judgment rule" for employment decisions: Unless there is evidence of other wrongdoing such as fraud or a statutory violation, the employment-at-will rule deters courts from second-guessing companies' decisions to terminate workers.[66] And when employers can terminate employment contracts at will, they can often revise those contracts at will in ways that limit their employees' rights.[67] Employment at will also means that workers who complain about employer actions that are not otherwise unlawful—including, for example, the implementation of new

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[62] *See* Clyde W. Summers, *Employment At Will in the United States: The Divine Right of Employers*, U. PA. J. LAB. & EMPL. L. 65, 65 (2000) (arguing that the employment-at-will doctrine "has been, and still is, a basic premise undergirding American labor law," and that the doctrine "gives American labor law much of its distinctive character").

[63] For example, there are various exceptions to and limitations on employment at will that have been developed via statute and under contract and tort doctrine. *See* Cynthia Estlund, *Rethinking Autocracy at Work*, 131 HARV. L. REV. 795, 803–05 (2018) (reviewing ELIZABETH ANDERSON, PRIVATE GOVERNMENT: HOW EMPLOYERS RULE OUR LIVES (AND WHY WE DON'T TALK ABOUT IT) (2017)).

[64] Bowles and Gintis deem this "short-side power." Bowles & Gintis, *supra* note 40, at 184.

[65] *See* Cohen, *Property and Sovereignty*, *supra* note 39, at 12; *see also* De Stefano, *supra* note 5, at 31–35 (discussing importance of "managerial prerogatives" to assign tasks and organize production, and tracing the intentional legal constitution of those prerogatives over time by courts and legislatures in various nations).

[66] *See* Wachter, *supra* note 56, at 43; *see also* Richard Michael Fischl, *'A Domain Into Which the King's Writ Does Not Seek to Run': Workplace Justice in the Shadow of Employment-at-Will*, *in* LABOUR LAW IN AN ERA OF GLOBALIZATION: TRANSFORMATIVE PRACTICES AND POSSIBILITIES 253, 261–63 (Joanne Conaghan, Richard Michael Fischl & Karl Klare eds., 2004).

[67] *E.g.*, Asmus v. Pacific Bell, 999 P.2d 71, 76 (Cal. 2000) (holding that employees' decision to continue work after employer's unilateral change to employee policies was consideration for employer's revised promises, such that new policies were binding on employees); Lucht's Concrete Pumping, Inc. v. Horner, 255 P.3d 1058, 1059–60 (Colo. 2011) (holding that continued employment can constitute consideration that binds employee to covenant not to compete promulgated by employer); Soto-Fonalledas v. Ritz-Carlton San Juan Hotel Spa & Casino, 640 F.3d 471, 475 (1st Cir. 2011) (holding that bilateral promises to arbitrate constitute adequate consideration for arbitration clause promulgated by employer).

monitoring systems or other new technologies—can often be disciplined or terminated without remedy.[68]

Closely related to employment at will is the default rule of individual contracting rather than collective bargaining. This means that terms and conditions of employment are set through individual negotiations between employer and employee, unless and until workers unionize.[69] By contrast, in other countries, workers often enjoy some collective workplace representation regardless of whether they have unionized. German works councils, for example, are enterprise-level bodies with rights to be consulted around some management decisions, and rights to bargain over scheduling, reductions in work, and technological changes that increase the employer's monitoring capacity.[70] The European Union has also mandated works councils at large multinational enterprises, though they only have consultative rights.[71] Such bodies can encourage employers to use technologies in different ways, as discussed in Part IV. But they are typically unlawful in nonunionized workplaces in the United States.[72]

Collective bargaining and workplace technology: The National Labor Relations Act ("NLRA"),[73] which governs union organizing and collective bargaining in the private sector, modifies these background rules in certain ways. For example, in a nonunion workplace, a collective protest against a new workplace technology such as new machinery or a monitoring device that would lead the employer to increase the pace of work may be protected against employer retaliation.[74] This is an exception to employment at will, but it applies only in cases where the workers act collectively around a matter that affects terms and conditions of employment. In practice, nonunionized worker protests around technological change appear to be rare, or at least those protests have only rarely led to National Labor Relations Board ("NLRB") cases.[75] That may be because the employer could lawfully termi-

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[68] If workers do so collectively, they are protected against retaliation under the National Labor Relations Act. *See infra* note 74 and accompanying text.

[69] *See* Benjamin I. Sachs, *Enabling Employee Choice: A Structural Approach to the Rules of Union Organizing*, 123 HARV. L. REV. 655, 660 (2010).

[70] *See* Matthew Dimick, *Productive Unionism*, 4 U.C. IRVINE L. REV. 679, 688 n.49 (2014); *see generally* WORKS COUNCILS: CONSULTATION, REPRESENTATION, AND COOPERATION IN INDUSTRIAL RELATIONS (Joel Rogers & Wolfgang Streeck eds., 1995).

[71] *See* Directive 2009/38/EC of the European Parliament and of the Council of 6 May 2009 on the Establishment of a European Works Council or a procedure in Community-scale undertakings and Community-scale groups of undertakings for the purposes of informing and consulting employees.

[72] *See* 29 U.S.C. § 158(a)(2) (2018); *see also* Electromation, Inc., 309 N.L.R.B. 990, 998 (1992) (holding that employer violated NLRA by unilaterally establishing "action committees" of workers and management to address employee complaints).

[73] 29 U.S.C. §§ 151–169 (2018).

[74] *See* NLRB v. Wash. Aluminum Co., 370 U.S. 9, 14 (1962) (holding that Section 7 of NLRA, 29 U.S.C. § 157, prohibits employer from disciplining workers who engaged in collective protest around working conditions, even if the workers had no intention of unionizing).

[75] *But see* Legacy Charter, 2018 N.L.R.B. LEXIS 338 at *2 (Aug. 16, 2018) (holding that non-union teacher's complaints about higher workload resulting from employers' request that teachers utilize new technologies are protected).

nate workers if their jobs have become redundant due to technological change under the employment-at-will rule, even if it were prohibited from retaliating against them for such protests under the NLRA.

Once employees have unionized, employers have a duty to bargain with them in good faith over wages, hours, benefits, disciplinary policies, and other terms and conditions of employment.[76] This does limit employers' power to use new technologies in various ways. For example, unionized employers cannot begin to use new monitoring devices that would alter disciplinary practices without first bargaining with their employees' union.[77] Nor can a unionized employer evade collective bargaining obligations by moving operations to a new and more technologically advanced plant.[78]

But employers are only obligated to bargain over decisions to adopt technological innovations that would displace workers (as opposed to altering disciplinary or supervisory practices) "if the benefit, for labor-management relations and the collective-bargaining process, outweighs the burden placed on the conduct of the business."[79] The Supreme Court developed that employer-friendly standard in a case considering whether an employer had to bargain over decisions to outsource work.[80] The standard does not balance workers' interests, which may explain why there is little caselaw addressing the duty to bargain over labor-displacing innovations.[81] Employers must nevertheless bargain over the *effects* of such technological changes, which can ensure that they pay severance or put displaced workers into other facilities.[82] In practice, though, the duty to bargain mostly means that the employer must meet and confer with the workers' union in good faith.[83] If the parties do not reach an agreement the workers can strike—but in doing so, they risk permanent replacement.[84]

The rules around technological bargaining reflect general trends in our labor law, which often protects employers' common law prerogatives, again reflecting a classical conception of the workplace as the employer's prop-

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[76] *See* 29 U.S.C. § 158(a)(5) (2018); 29 U.S.C. § 158(d) (2018).

[77] *See* Colgate-Palmolive Co., 323 N.L.R.B. 515, 515 (1997).

[78] *See* Leach Corp. v. NLRB, 54 F.3d 802, 809 (D.C. Cir. 1995).

[79] First Nat'l Maintenance Corp. v. NLRB, 452 U.S. 666, 679 (1981); *see also id.* at 686 n.22 (holding that whether employers must bargain over decisions to automate work must be decided on a case-by-case basis).

[80] *See id.* at 677.

[81] *See* ROBERT A. GORMAN & MATTHEW W. FINKIN, LABOR LAW: ANALYSIS AND ADVOCACY, § 21.6 at 806 (2013) (noting that there are few court or NLRB opinions addressing the duty to bargain over automation decisions).

[82] *See First Nat'l Maintenance*, 452 U.S. at 681.

[83] *See* 29 U.S.C. § 158(d) (2018) (specifying that the duty to bargain requires employers and unions to "meet at reasonable times and confer in good faith" but that it "does not compel either party to agree to a proposal or require the making of a concession").

[84] *See* NLRB v. Mackay Radio & Tel. Co., 304 U.S. 333, 345 (1938) (holding that it is not an unfair labor practice to permanently replace economic strikers).

erty.[85] For example, while the NLRA protects the right to strike, the NLRB and Supreme Court have outlawed some of the most effective sorts of strikes, including sit-downs and intermittent strikes, often on the grounds that they interfere with employers' rights to control the workplace.[86] In a case with direct relevance to the uses of technology discussed below, the NLRB held that workers had no right to slow down their pace of work in protest of employer efforts to alter work processes.[87] Such a slowdown, the NLRB reasoned, "constituted a refusal on [the workers'] part to accept the terms of employment set by their employer," and instead involved an effort "to work on their own terms," which was *per se* unlawful.[88] The opinion cited another case that reasoned if workers were able to limit their own hours through collective action, "it would follow that a similar right existed by which they could prescribe all conditions and regulations affecting their employment."[89] In this legal context, limiting workers' rights vis-à-vis technological innovation seems only natural, since technology is the employer's physical or intellectual property.

These rules resulted from historical battles over the scope of workers' rights, including their rights to a voice in productive technology. For example, in the late 19th and early 20th centuries, U.S. employers building the modern factory system wrested control over the pace and technical content of production from skilled craft workers. As Charles Sabel has argued, the triumph of Fordist production techniques was not inevitable, and craft production remained sustainable in other jurisdictions, including parts of Italy, until the present.[90] Employers gained still more power over the workplace under the 1947 Taft-Hartley Act, in which Congress restricted rights to strike, made union organizing more difficult, and narrowed the scope of employment.[91] Political scientists have argued that Taft-Hartley shaped the postwar political economy by stunting unions' growth, which in turn encouraged unions to focus on improving conditions in individual workplaces and firms rather than achieving a voice in business decisions, and discouraged sector-wide mobilization and social democratic politics.[92]

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[85] *See generally* Klare, *supra* note 39; Karl E. Klare, *Judicial Deradicalization of the Wagner Act and the Origins of Modern Legal Consciousness, 1937–1941*, 62 MINN. L. REV. 265 (1978).

[86] *See* NLRB v. Fansteel Metallurgical Corp., 306 U.S. 240, 255 (1939) (outlawing sit-down strikes); Auto. Workers v. Wis. Emp. Rel. Bd. (Briggs & Stratton), 336 U.S. 254, 254 (1949) (allowing states to outlaw intermittent strikes).

[87] Elk Lumber Co., 91 N.L.R.B. 333, 337 (1950).

[88] *Id.*

[89] *Id.* (citing C. G. Conn, Ltd. v. NLRB, 108 F.2d 390 (7th Cir. 1939)).

[90] *See* CHARLES F. SABEL, WORK AND POLITICS: THE DIVISION OF LABOR IN INDUSTRY, 220–227 (1982) (discussing high-technology cottage industries in central and northeastern Italy).

[91] *See generally* KATE ANDRIAS & BRISHEN ROGERS, ROOSEVELT INST., REBUILDING WORKER VOICE IN TODAY'S ECONOMY 12 (2018).

[92] *See* Sean Farhang & Ira Katznelson, *The Southern Imposition: Congress and Labor in the New Deal and Fair Deal*, 19 STUD. AM. POL. DEV. 1, 7 (2005). Over time, the Taft-Hartley Act's limitations on workers' power encouraged unions to focus on winning a share of produc-

The scope of employment: Another foundational rule is the legal definition of employment. That definition is essential to modern regulations, which typically levy duties only upon entities legally defined as employers, and typically allocate rights only to individuals legally defined as employees. Most statutes borrow the legal definition of employment from the common law of agency, which was developed to determine whether a worker or the company they work for is responsible when a tort by the worker injures a third party; if the company enjoys the right to control the worker's performance, then the company is liable.[93] Indeed, the common law employment relationship was central to Ronald Coase's theory of the firm as a means of minimizing the transaction costs associated with market contracting.[94] As Coase put it, "it is the fact of direction which is the essence of the legal concept of 'employer and employee,' just as it was in the economic concept" of the firm.[95] In contrast, a classic independent contracting relationship arises when a company or individual hires an independent business that brings specialized skills to the table, and by virtue of those skills is best positioned to prevent harms to third parties.

The definition of employment under most statutes limits workers' power in two ways. First, though agency law's control test is a sensible means of allocating responsibility for harms to third parties, that test does not reflect the statutory purposes of employment regulations, which are to protect workers against social harms, such as low wages, unsafe working conditions, and discrimination.[96] Thus, it is arguably unduly limiting. Second, the scope of employment is often too narrow in operation. In part, this is because many work relationships do not fall neatly into either category (employee or independent contractor) and the doctrine is malleable. For example, the NLRB uses a multifactor test derived largely from agency law to determine employment status, but the precise factors that the Board and the

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tivity gains, rather than a voice in production strategies themselves. That balance of authority was formalized in the so-called "Treaty of Detroit," the landmark 150 UAW-GM contract in which GM "regained control over one of the crucial management functions . . . long range scheduling of production, model changes, and tool and plant investment," in exchange for a guaranteed share in productivity, and generous private benefits. NELSON LICHTENSTEIN, THE MOST DANGEROUS MAN IN DETROIT: WALTER REUTHER AND THE FATE OF AMERICAN LABOR 280–81 (1995) (internal quotations omitted).

[93] *See* RESTATEMENT (SECOND) OF AGENCY § 220(2) (AM. LAW INST.1958) (listing factors that should be used to determine whether a relationship constitutes employment). For an historical account of the evolution of the difference between employment and independent contracting within employment and labor law, see V. B. Dubal, *Wage Slave or Entrepreneur?: Contesting the Dualism of Legal Worker Identities*, 105 CALIF. L. REV. 101 (2017).

[94] *See* R. H. Coase, *The Nature of the Firm*, 4 ECONOMICA 386, 403–04 (1937).

[95] *Id.* at 404.

[96] *See, e.g.*, Noah Zatz, *Beyond Misclassification: Tackling the Independent Contractor Problem Without Redefining Employment*, 26 A.B.A. J. LAB. & EMP. L. 279, 282–83 (2011); *see also* Sec'y of Labor v. Lauritzen, 835 F.2d 1529, 1544 (7th Cir. 1987) (Easterbrook, J., concurring) ("The reasons for blocking vicarious liability at a particular point have nothing to do with the functions of the [Fair Labor Standards Act].").

courts emphasize can vary from case to case.[97] This leads to uncertainty and raises the costs of proving a violation, inviting a degree of arbitrage.

Those enforcement challenges, and the scope of employment itself, influence employers' technological decisions. Subcontracted workers and other nonemployees have few if any rights to protest new uses of technology, since they have few collective bargaining rights against the firms that utilize their labor. Yet, as discussed in Part III.C, new data-driven monitoring techniques can enable employers to keep a close watch on workers' performance even if they are far away from its physical plant, and irrespective of their employment status.[98] This creates incentives for companies to formalize and standardize production processes and inputs in order to enable easier outsourcing and monitoring.

Workplace privacy laws: In theory, workplace privacy laws could serve as an important site for negotiations around control of workplace data and workplace technology. After all, many of today's workplace innovations involve monitoring workers more closely, which may violate social norms of privacy.

But workplace privacy laws give workers relatively few rights to prevent their employer from gathering information about their conduct in the workplace, and even fewer rights to prevent their employer from monitoring their work.[99] Public sector workers enjoy greater protections than their private sector counterparts because, as state employees, they have Fourth Amendment rights in the workplace.[100] Yet public sector workers typically have no reasonable expectation of privacy in open areas of the workplace, and public sector employers can often utilize video surveillance in those areas.[101] The common law tort of intrusion upon seclusion is probably the most important generally applicable protection in the private sector, but it

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[97] *See* Lancaster Symphony Orchestra, 357 N.L.R.B. 1761, 1763 (2011) (listing ten factors the NLRB uses to determine whether an employment relationship exists, but noting that "the same set of factors that was decisive in one case may be unpersuasive when balanced against a different set of opposing factors in another case").

[98] *See* discussion *infra* Part III.C.

[99] One reason for this is that our privacy laws are a patchwork. *See*, *e.g.*, MATTHEW W. FINKIN, PRIVACY IN EMPLOYMENT LAW xxxiv, xxxv (5th ed. 2018) (observing that in the United States privacy "legislation has been enacted piecemeal" and that "most often, issues of privacy remain unspoken to by the law").

[100] City of Ontario v. Quon, 560 U.S. 746, 756 (2010) (noting that "individuals do not lose Fourth Amendment rights merely because they work for the government instead of a private employer") (internal citations omitted).

[101] *See*, *e.g.*, Vega-Rodriguez v. Puerto Rico Tel. Co., 110 F.3d 174, 180 (1st Cir. 1997) ("It is simply implausible to suggest that society would recognize as reasonable an employee's expectation of privacy against being viewed while toiling in the [employer's] open and undifferentiated work area."). Courts often draw from constitutional privacy doctrine in common law privacy cases. *See*, *e.g.*, O'Bryan v. KTIV Television, 868 F. Supp. 1146, 1158 (N.D. Iowa 1994) (finding that an employer can search employee's desk area for work-related documents without violating employee's reasonable expectations of privacy, and therefore rejecting employee's intrusion upon seclusion claim); *see generally* Pauline T. Kim, *Data Mining and the Challenges of Protecting Employee Privacy Under U.S. Law*, 40 COMP. LAB. L. & POL'Y J. 405, 413–15 (2019).

sets an even higher bar to recovery, requiring employees to show that a search was "highly offensive to a reasonable person."[102] Notably, while employers' right to monitor the performance of work is now well-established under law and generally accepted as a norm, workers in the past often resisted such monitoring, sometimes even refusing to work if supervisors were present.[103]

Legislatures have protected workers' privacy in various ways. Most notably, California adopted a general privacy statute in 2018 that restricts companies' ability to gather and keep individuals' personal information,[104] but the law does not yet apply to employment relationships.[105] Other employment privacy statutes are aimed at particular harms and practices. For example, the Federal Stored Communications Act protects workers' privacy in their personal email accounts,[106] but not in employer-provided email accounts.[107] Various states require employees' notice and consent before monitoring of telephone or electronic communications,[108] though employees may be unable realistically to refuse consent.[109] Health information is also protected under provisions of the Health Insurance Portability and Accountability Act and the Americans with Disabilities Act.[110] Finally, the NLRA protects employees' privacy in some circumstances, prohibiting employers from surveilling

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[102] RESTATEMENT (SECOND) OF TORTS § 652B (AM. LAW INST. 1977); *see also* K-Mart Corp. Store No. 7441 v. Trotti, 677 S.W.2d 632, 636–37 (Tex. App. 1984).

[103] MONTGOMERY, *supra* note 45, at 13 (discussing ethical code of nineteenth century craft workers, which led them to refuse to work while being watched); *see also id.*, at 115 (discussing workers' refusal to work while being monitored by industrial engineers in early twentieth century).

[104] Dodd. Cal. Consumer Privacy Act of 2018, S.B. 1121 (Cal. 2018) (enacted).

[105] Chau. Cal. Consumer Privacy Act of 2018, Cal. A.B. 25 (Cal. 2019) (enacted) (exempting employment relationships from California Consumer Privacy Act of 2018 until Jan 1, 2021).

[106] 18 U.S.C. § 2701 *et seq.* (2018).

[107] 18 U.S.C. § 2701(c)(1).

[108] *See* FINKIN, PRIVACY IN EMPLOYMENT *supra* note 99, Ch. 5.III.D.1-2 (discussing state statutes regulating the interception of telephone and electronic communications). Various states also forbid employers from gathering biometric data on employees. *See, e.g.*, Biometric Information Privacy Act, 740 ILL. COMP. STAT. 14 (2018); TEX. BUS. & COM. CODE ANN. § 503 (2017); BUS. REG. CODE § 19.375 (2018). Others forbid employers to request employees' social media passwords. LITTLER MENDELSON, P.C., THE BIG MOVE TOWARD BIG DATA IN EMPLOYMENT 14 (Aug. 2015) (showing that 22 states passed such laws by 2015).

[109] *See* Matthew Finkin, *The Kenneth M. Piper Lecture: Employee Privacy, American Values, and the Law*, 72 CHI.-KENT L. REV. 221, 255–56 (1996) (observing that once a majority of employers adopt a practice that invades employee privacy, "consent" to the practice "cannot be said to be free").

[110] *See* HIPAA Privacy Rule, 45 CFR § 160 (2018); *see also* U.S. EQUAL EMPLOYMENT OPPORTUNITY COMM'N, ENFORCEMENT GUIDANCE ON DISABILITY-RELATED INQUIRIES AND MEDICAL EXAMINATIONS OF EMPLOYEES UNDER THE AMERICANS WITH DISABILITIES ACT (ADA), (July 26, 2000), https://www.eeoc.gov/policy/docs/guidance-inquiries.html, *archived at* https://perma.cc/M46D-3VAK. The Fair Credit Reporting Act also limits employers' rights to gather data about employees and potential employees. 15 U.S.C. § 1681(b) (2018). *But see* E.E.O.C. v. Freeman, 778 F.3d 463, 466–67 (4th Cir. 2015) (upholding summary judgment for defendant in disparate impact claim based on background checks that gathered financial data in part because it deemed EEOC's expert testimony on the matter unreliable).

or monitoring workers for the purpose of preventing unionization or other lawful concerted action.[111] Again, however, these are exceptions to the general rule, and none of them touch everyday monitoring of work.

Intellectual property rights: While a full treatment of their influence is beyond the scope of this Article, intellectual property doctrines also affect the course of workplace technological development. For example, Walmart recently patented a device that would monitor conversations near check-out counters to help supervise cashiers and to determine whether customers are becoming frustrated.[112] It is not clear from the patent application, but machine learning that enables natural language processing may be essential to that device's performance, for reasons discussed in Part II.B. Uber, meanwhile, has patented aspects of its business processes that match riders with drivers,[113] as well as aspects of its autonomous vehicle technology,[114] both of which draw on data generated by drivers. Other aspects of production processes may be protected as trade secrets, whether or not they are patentable. Those include algorithms used to optimize internal processes, including machine learning programs and the databases of information on workers' performance that they utilize,[115] and algorithms used in hiring efforts.[116] As Orly Lobel has demonstrated, companies today are using intellectual property and related doctrines, including covenants not to compete and non-solicitation clauses, to claim property rights in what was previously workers' own "cognitive property."[117] While Lobel focused on highly skilled workers, a similar process seems underway for less-skilled workers, as discussed in Parts II and III, as companies extract and formalize workers' tacit knowledge and then utilize it in production.[118]

In sum, this complex of rules illustrates the continuing influence of classical property rights and notions of freedom of contract on employment relationships. The "bundle of rights" includes employer rights to monitor nearly all work-related activities, to glean data from that monitoring, to develop new technologies and implement them into the workplace, and to dis-

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[111] *See, e.g.*, Local Joint Exec. Bd. of Las Vegas v. N.L.R.B., 515 F.3d 942, 945–47 (9th Cir. 2008) (summarizing test for unlawful surveillance under NLRA).

[112] *Listening to the Front End*, U.S. Patent No. 10,020,004 (filed Apr. 21, 2016) (issued July 10, 2018).

[113] *See, e.g.*, *Real-time Resource Management for On-Demand Services*, U.S. Patent 10,460,411 (filed Aug. 30, 2016) (issued Oct. 29, 2019).

[114] *Neural Network System for Autonomous Vehicle Control*, U.S. Patent 10,452,068 (filed Oct. 17, 2016) (issued Oct. 22, 2019).

[115] *See* Jeanne C. Fromer, *Machines as the New Oompa-Loompas: Trade Secrecy, The Cloud, Machine Learning, and Automation*, 94 N.Y.U. L. Rev. 706, 721–24 (2019) (arguing that machine learning algorithms and the datasets they utilize are often protectable as trade secrets).

[116] *See* Jamillah Bowman Williams, *Diversity as a Trade Secret*, 107 Geo. L.J. 1684, 1702, 1707 (2019).

[117] *See generally* Orly Lobel, *The New Cognitive Property: Human Capital Law and the Reach of Intellectual Property*, 93 Tex. L. Rev. 789 (2015).

[118] *See* discussion *infra* Parts II and III. Non-compete agreements are often unenforceable against low-wage workers, but they may still deter workers from taking jobs with competitors.

cipline or terminate workers who object. Workers retain important rights too, but the overall tilt of the doctrine is clear. The next two Parts examine how workplace technology is evolving in the shadow of these legal regimes and workplace power dynamics.

II. Automation and Digital Taylorism

Public debates around the impact of technology on work have focused on automation, or the use of technology to perform tasks previously undertaken by human beings, and the possibility of a wave of technological unemployment. This Part develops a more nuanced account of automation today—one that reflects the limits of existing technologies and unpacks how workplace power dynamics influence companies' automation decisions. Part II.A summarizes a prominent framework developed by a labor economist to understand which work tasks are susceptible to automation, and summarizes economic data indicating that automation is not a world-historical threat today. Part II.B then explores the promise and limits of machine learning, the branch of AI that has sparked extensive debate around automation. While this requires a brief detour from the Article's major argument, it should help dispel worries about a looming automation wave, and also sets up Part III's argument that AI may transform management practices. Part II.C then unpacks how the law and political economy of work affect companies' decisions around which tasks to automate, and how to reorganize production after automation.

A. Automation: Tasks versus Jobs

Companies do not typically automate entire jobs at once. Rather, most jobs are made up of many distinct tasks, and companies automate some of those tasks while leaving others untouched. The labor economist David Autor and coauthors have developed a fairly intuitive division of such tasks into three categories, based on those tasks' susceptibility to automation. The categories are "routine," "abstract," and "manual."[119] "Routine" tasks "follow an exhaustive set of rules and hence are readily amenable" to automation.[120] Those can be physical tasks, such as putting a bolt into an automobile chassis or moving a shelf in a warehouse, or cognitive tasks, such as spell-checking, multiplication, or data entry. Jobs primarily made up of such tasks, particularly in clerical fields, administrative support, and industrial produc-

[119] *See generally* David H. Autor, *Polanyi's Paradox and the Shape of Employment Growth*, *in* Federal Reserve Bank of St. Louis: Economic Policy Proceedings, Reevaluating Labor Market Dynamics (2015); *see also* David H. Autor, *Why Are There Still So Many Jobs? The History and Future of Workplace Automation*, 29 J. Econ. Persp. 3, 5 (2015) ("[E]ven expert commentators tend to overstate the extent of machine substitution for human labor and ignore the strong complementarities between automation and labor that increase productivity, raise earnings, and augment demand for labor.").

[120] Autor, *Polanyi's Paradox*, *supra* note 119, at 135.

tion, have already been hit hard by automation.[121] Indeed, industrial automation is a major reason for the steady decline in manufacturing jobs in the United States since 1979, a decline that has left the bulk of less-skilled and mid-skilled workers in service positions.[122]

The other two categories of tasks—"abstract" tasks and "manual" tasks—have proven stubbornly resistant to automation. Abstract tasks "require problem-solving capabilities, intuition, creativity and persuasion."[123] Many high-wage professional, managerial, and technical jobs are primarily made up of abstract tasks. Such jobs often consist of making high-level situational judgments that others eventually implement. Those judgments require some knowledge of human behavior, norms, or other social factors that existing technologies cannot replicate, for reasons discussed below. Those difficulties have led three University of Toronto Business School professors to argue that, for the foreseeable future, new forms of artificial intelligence will often be used to enhance professionals' judgment capabilities by generating predictions about the likely effects of particular decisions, but that those technologies will not replace professionals en masse.[124]

Manual tasks, finally, involve "situational adaptability, visual and language recognition, and in-person interactions."[125] This category includes "food preparation and serving jobs, cleaning and janitorial work, grounds cleaning and maintenance, in-person health assistance by home health aides, and numerous jobs in security and protective services."[126] It also includes many jobs in retail, where shelf stocking, assisting customers, and checking out customers all require similar skills. And it likely includes work for "platform economy" firms such as Uber and Lyft and delivery services such as Deliveroo and Instacart. A world-historic wave of automation would require robotics to replace huge numbers of workers whose jobs consist largely of such "manual" tasks. To replicate the manual dexterity, situational judgments, and language skills required to work as a barista, waiter, cook, delivery driver, or home care worker would require that artificial intelligence approach, or reach, human levels of intelligence *and* that artificially intelligent systems could be integrated into highly advanced robotics. Neither seems likely soon, for reasons discussed in Part II.B.

Before doing so, it is worth noting that labor market data largely supports Autor's analysis.[127] For example, while it is challenging to determine changes in the rate of automation historically, in part because automation

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[121] *Id.*

[122] *Id.* at 140.

[123] *Id.* at 138.

[124] *See* AJAY AGRAWAL ET AL., PREDICTION MACHINES: THE SIMPLE ECONOMICS OF ARTIFICIAL INTELLIGENCE 53–69 (2018).

[125] Autor, *Polanyi's Paradox*, *supra* note 119, at 138.

[126] *Id.*

[127] Autor's model also matches what the BLS is projecting for the decade to come. News Release, U.S. Bureau of Labor Statistics, *Employment Projections — 2018–2028* (Sept. 4, 2019), https://www.bls.gov/news.release/pdf/ecopro.pdf, *archived at* https://perma.cc/LF83-

can take many different forms, recent productivity statistics suggest it is not occurring at a high rate today. If companies were installing robotics in historically high numbers, we would likely see significant increases in productivity growth, as firms were able to substantially increase output with fewer workers. Instead, productivity growth has recently been as slow as at any time since World War II.[128] Productivity growth in the manufacturing sector—where automation has historically been easiest—has been especially tepid lately, at 0.4% annually for the last decade.[129] Levels of "occupational churn," or the net creation of jobs in growing occupations and loss of jobs in declining occupations, are also low today.[130]

Nor does it appear likely that companies are generally gearing up to install new technologies. If they expected artificial intelligence and highly advanced robotics to be a major source of productivity growth in the near future, they would presumably be investing heavily in information technology. They are not. Computers and software constituted 13.5% of the value of companies' investments from 2000 to 2007, as the internet was coming into wide use.[131] Over the last decade that rate declined to 4.8%.[132] Meanwhile, prior to the COVID-19 crisis, unemployment had not jumped in the United States,[133] despite legislation raising minimum wages in many states.[134] Some European countries are even facing labor shortages, including in manufac-

FCNT (projecting 0.5% contraction in manufacturing and some clerical tasks but expansion in health care, leisure and hospitality, and educational services).

[128] Productivity growth averaged 2.8% annually from 1945 to 1970 and 2.2% annually during the 1990s dot-com boom, but it has hovered around 1.3% annually for the last decade. U.S. Bureau of Labor Statistics, Labor Productivity and Costs, https://www.bls.gov/lpc/prodybar.htm, *archived at* https://perma.cc/WJK9-AHGH; *see also* Jason Furman et al, Artificial Intelligence, Automation, and the Economy, Executive Office of the President 9–10 (Dec. 2016) (noting slowdown in both labor productivity growth generally and in total factor productivity growth, which measures the portion of productivity growth attributable to technological change). The slowdown is not limited to the U.S.; productivity growth slowed in thirty of thirty-one advanced economies from 2005–2015. *Id.* at 10; *see also* Aaron Benanav, *Automation and the Future of Work—1*, 119 New Left Rev. 5, 19 (2019); Benanav, *supra* note 54, at 117 (attributing slowdown in economic growth to global industrial overcapacity).

[129] U.S. Bureau of Labor Statistics, *supra* note 128.

[130] Robert D. Atkinson & John Wu, *False Alarmism: Technological Disruption and the U.S. Labor Market, 1850–2015*, *in* Info. Tech. & Innovation Found. 20 (May 2017).

[131] US Bureau of Labor Statistics, Economic News Release, Multifactor Productivity Trends – 2017 (Mar. 21, 2018), https://www.bls.gov/news.release/archives/prod3_03212018.htm, *archived at* https://perma.cc/BQD7-989P.

[132] *Id.*

[133] *See* U.S. Bureau of Labor Statistics, Labor Force Statistics from the Current Population Survey, https://data.bls.gov/timeseries/LNS14000000, *archived at* https://perma.cc/MGW6-CCNK (showing unemployment rate falling under 4% beginning in April of 2018).

[134] *See* Raise the Minimum Wage, Minimum Wage By State, Nat'l Empl. Law Proj., https://raisetheminimumwage.com/minimum-wage-state/?mode=state&active_dataset=approved%20minimum%20wage&view_table=true, *archived at* https://perma.cc/QHC5-KZ32 (listing current minimum wage rates by states and noting when states had most recently raised their minimum wage).

turing, despite having higher labor costs.[135] While it is possible that those data reflect a lag between the development of new technologies and their implementation, it seems more likely to reflect the limits of the technologies themselves, for reasons discussed immediately below.

B. The Limits of Contemporary Automation

Contemporary automation fears have largely pivoted off developments in the subfield of AI known as machine learning. While machine learning is not new, several papers in the early 2010s demonstrated how the technique could be used for purposes of image recognition.[136] That sparked extensive investment by tech companies.[137] This section first sketches how machine-learning works, and then argues that it is unlikely to lead to massive automation.

1. The Promise and Limits of Machine Learning

Machine learning is "essentially a statistical technique for classifying patterns, based on sample data."[138] For example, a relatively simple system can determine whether a particular picture is of a dog or a cat.[139] Programmers would "train" it by uploading thousands of pictures of dogs and cats (the training data), appropriately labeled, into the machine. The machine would then develop statistical correlations between the pixels in images labeled "dog" or "cat" and the outcomes "dog" and "cat," and programmers would adjust its analyses until it was able to recognize dogs and cats accurately. Where the datasets are large enough and standardized, the results can be remarkably precise. Distinguishing cats from dogs is trivial, but machine learning may be able to help determine whether particular moles are cancerous and to help interpret radiological scans.[140] Machine learning has also proven useful in other fields. Google uses a deep neural network known as

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[135] Liz Alderman, *Danish Companies Seek to Hire, but Everyone's Already Working*, N.Y. TIMES (Feb. 28, 2017).

[136] *See, e.g.*, Alex Krizhevsky et al., *ImageNet Classification with Deep Convolutional Neural Networks*, 60 COMMS. ACM 84 (June 2017); Dan Ciresan et al., *Multi-Column Deep Neural Networks for Image Classification*, IDSIA Technical Report No. IDSIA-04-12 (Feb. 2012), https://arxiv.org/abs/1202.2745, *archived at* https://perma.cc/6SJ3-42SN.

[137] *See generally* Gary Marcus, *Deep Learning: A Critical Appraisal* 1, 2 (Jan 2, 2018), https://arxiv.org/abs/1801.00631, *archived at* https://perma.cc/92TX-Z4XH.

[138] *Id.* at 3.

[139] *See, e.g.*, Sandipan Dey, *Dogs vs. Cats: Image Classification with Deep Learning Using TensorFlow in Python*, DATA SCIENCE CENTRAL (Aug. 14, 2017), https://www.datasciencecentral.com/profiles/blogs/dogs-vs-cats-image-classification-with-deep-learning-using, *archived at* https://perma.cc/B8RW-AEGW.

[140] Stanford Machine Learning Group, *MURA: Bone X-Ray Deep Learning Competition*, https://stanfordmlgroup.github.io/competitions/mura/, *archived at* https://perma.cc/A5PB-GQA2.

RankBrain to help in search responses,[141] another to play games such as Go,[142] and yet another to develop fairly precise language recognition and translation.[143]

Starting in the mid-2010s, various commentators extrapolated from these developments to predict a looming automation wave.[144] They reasoned that the inputs to machine learning and some other forms of AI—good data and processing power—are both becoming cheaper over time.[145] Those developments will clearly enable ongoing task substitution, displacing some number of workers.[146] But some commentators insist that more profound changes are afoot which will enable a massive automation wave. They argue that algorithms are becoming exponentially more powerful today, that they will eventually pass a threshold into "artificial general intelligence" as capable as any human brain, and that they will continue to improve exponentially after crossing that threshold.[147]

For better or for worse, it appears that machine learning is simply not a path to artificial general intelligence.[148] The underlying problem, as one jour-

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[141] Cade Metz, *AI Is Transforming Google Search. The Rest of the Web Is Next*, WIRED (Feb. 4, 2016), https://www.wired.com/2016/02/ai-is-changing-the-technology-behind-google-searches/, *archived at* https://perma.cc/HL54-NN3E.

[142] DeepMind, *AlphaGo*, https://deepmind.com/research/alphago/, *archived at* https://perma.cc/9EA6-5367.

[143] Quoc V. Le & Mike Schuster, *A Neural Network for Machine Translation, at Production Scale*, GOOGLE AI BLOG (Sept. 27, 2016), https://ai.googleblog.com/2016/09/a-neural-network-for-machine.html, *archived at* https://perma.cc/3MQG-HTFR.

[144] *See*, *e.g.*, ERIK BRYNJOLFFSON & ANDREW MCAFEE, THE SECOND MACHINE AGE, 40–56 (2016); STERN WITH KRAVITZ, *supra* note 4, at 51–73; PEDRO DOMINGOS, THE MASTER ALGORITHM: HOW THE QUEST FOR THE ULTIMATE LEARNING MACHINE WILL REMAKE OUR WORLD 276–79 (2015); FORD *supra* note 4, at 1–27, 229–48.

[145] Progress in processing power is explained by "Moore's law," or the pattern that processing speed tends to double roughly every eighteen months. *Moore's Law*, Wikipedia, https://en.wikipedia.org/wiki/Moore%27s_law, *archived at* https://perma.cc/A82S-ECTJ. *But see* Tom Simonite, *Moore's Law Is Dead. Now What?*, MIT TECH. REV. (May 13, 2016) (arguing that progress in chip speed has reached hard physical limits).

[146] *See* discussion, *supra* Part II.A; *see also* ERIK BRYNJOLFSSON & KRISTINA MCELHERRAN, U.S. CENSUS BUREAU, CENTER FOR ECONOMIC STUDIES, DATA IN ACTION: DATA-DRIVEN DECISION MAKING IN U.S. MANUFACTURING 5 (2016) (observing that "the act of collecting data serves to codify information, which makes it more explicit and less tacit," thus enabling automation and other changes to production processes).

[147] *See, e.g.,* NICK BOSTROM, SUPERINTELLIGENCE: PATHS, DANGERS, STRATEGIES 26–62 (2014) (discussing possible paths to such "superintelligence"); *see also* BRYNJOLFFSON & MCAFEE, *supra* note 144, at 14–37 (discussing accelerating technological change); *id.* at 40–56 (discussing possibility of exponential technological change); DOMINGOS *supra* note 144, at 43 (asserting that as artificial intelligence becomes more powerful, "[t]echnological progress will noticeably speed up, not just in computer science but in many different fields").

[148] Steve LeVine, *Artificial Intelligence Pioneer Says We Need to Start Over*, AXIOS (Sep. 15, 2017), https://www.axios.com/artificial-intelligence-pioneer-says-we-need-to-start-over-1513305524-f619efbd-9db0-4947-a9b2-7a4c310a28fe.html, *archived at* https://perma.cc/SB3F-FQLK (stating that the programmer who developed "back-propagation" method that is at the heart of machine learning now believes it is a dead end); *see also* Rodney Brooks, *The Origins of Artificial Intelligence*, RODNEY BROOKS (Apr. 27, 2018), https://rodneybrooks.com/forai-the-origins-of-artificial-intelligence/, *archived at* https://perma.cc/33KL-4P8Y (noting that recent academic publications in the field of "artificial general intelligence" are modest and theoretical, and do not indicate significant progress toward the goal of developing artificial

nalist put it, is that machine learning systems are "greedy, brittle, opaque, and shallow."[149] They are "greedy" in that they require enormous processing power and human oversight to develop, which limits their scalability.[150] They are "brittle" in that they are robust with regard to their training data — but only that data. It remains difficult to transfer a machine-learning algorithm's findings into another domain. They are "opaque" in the sense that their operations are often inscrutable to programmers, which makes it difficult to reverse-engineer them and replicate their success. Most importantly, they are "shallow" because they "possess no common sense about the world or human psychology."[151] As a result, minor changes in the input layer can lead systems to fail. For example, image recognition algorithms may misidentify an object if programmers change a single pixel in the underlying image,[152] and machine learning programs trained on even numbers may be baffled by odd numbers.[153] Due to such challenges, machine learning algorithms often struggle to replicate human judgments, limiting their capacity to displace human workers.

2. The Challenges of Contemporary Automation

The challenges of using machine learning to replace humans quickly compound once algorithm-powered machines such as partially autonomous vehicles encounter the physical world. Most such vehicles "employ a 'sense-plan-act' design," in which a suite of sensors gathers information about the environment such as lane markings, obstacles, and other vehicles, and then algorithms interpret that information and respond.[154] That strategy has enabled engineers to automate many of the subtasks involved in performing an operation. For example, it now seems technologically feasible to automate

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general intelligence); GARY MARCUS & ERNEST DAVIS, REBOOTING AI: BUILDING ARTIFICIAL INTELLIGENCE WE CAN TRUST (2019) (elaborating argument that machine learning is not a path to artificial general intelligence). *But see id.* at 203–06 (predicting that once artificial general intelligence is developed, using tools other than machine learning which are not yet available, it will displace a substantial number of workers).

[149] Jason Pontin, *Greedy, Brittle, Opaque, and Shallow: The Downsides to Deep Learning*, WIRED (Feb. 2, 2018), https://www.wired.com/story/greedy-brittle-opaque-and-shallow-the-downsides-to-deep-learning/, *archived at* https://perma.cc/HHD6-VH8T.

[150] *See* Rodney Brooks, *Machine Learning Explained*, RODNEY BROOKS (Aug. 28, 2017), http://rodneybrooks.com/forai-machine-learning-explained, *archived at* https://perma.cc/6SGG-6EG6. The need to hand-code data has limited IBM's progress in using machine learning for medical diagnostics. Casey Ross & Ike Swetlitz, *IBM Pitched its Watson Supercomputer as a Revolution in Cancer Care. It's Nowhere Close*, STAT (Sept. 5, 2017), https://www.statnews.com/2017/09/05/watson-ibm-cancer, *archived at* https://perma.cc/U9VA-UQK5.

[151] Pontin, *supra* note 149.

[152] Aharon Azulay & Yair Weiss, *Why Do Deep Convolutional Networks Generalize So Poorly to Small Image Transformations?*, 20 J. MACHINE LEARNING RES. 1, 3 (Nov. 2019), https://arxiv.org/pdf/1805.12177.pdf, *archived at* https://perma.cc/NS9H-BXRV.

[153] Marcus, *supra* note 137, at 16.

[154] JAMES M. ANDERSON ET AL., RAND CORPORATION, AUTONOMOUS VEHICLE TECHNOLOGY: A GUIDE FOR POLICYMAKERS 58–59 (2016).

the tasks of plotting a course, accelerating, steering, braking, and sensing other vehicles under many circumstances.

But companies cannot yet take a human with situational judgment out of the picture entirely, because unexpected things happen on roads all the time, including extreme weather, intoxicated people running into the road, items flying off of other cars, or police redirecting traffic to go the wrong way in a lane. In such cases, it is insufficient to make a statistical inference from a dataset of past occurrences, since the situation being confronted does not appear in the training data.[155] A glitch of this sort helped cause one of Uber's self-driving cars to hit and kill a pedestrian in 2018, as the image-recognition devices misidentified the pedestrian and therefore did not respond in time.[156] While human judgments are also flawed, a human driver in that situation would likely have had little difficulty recognizing the cyclist or at least would have slowed while deciding what to do. Due to these and related limitations, companies in the autonomous vehicle sector have sought to lower investors' expectations over the past year.[157]

There are also major technical challenges to the full displacement of manual workers rooted in the limits of contemporary robotics.[158] Some of these involve limits of machine learning, while others involve technical limi-

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[155] MARCUS & DAVIS, *supra* note 148.

[156] Filip Piekniewski, *AI Winter Is Well on Its Way*, PIEKNIEWSKI'S BLOG (May 28, 2018), https://blog.piekniewski.info/2018/05/28/ai-winter-is-well-on-its-way/, *archived at* https://perma.cc/47LS-M4M5; *see also* Amir Efrati, *Waymo's Big Ambitions Slowed by Tech Trouble*, THE INFORMATION (Aug. 28, 2018), https://www.theinformation.com/articles/waymos-big-ambitions-slowed-by-tech-trouble, *archived at* https://perma.cc/57CN-VNHR (noting that autonomous vehicles being tested in Phoenix were often unable to turn left, or stopped suddenly, irritating other drivers).

[157] *See, e.g.*, Cory Weinberg, *At CES, New Questions Emerge as Self-Driving Ambitions Narrow*, THE INFORMATION (Jan. 11, 2019), https://www.theinformation.com/articles/at-ces-new-questions-emerge-as-self-driving-ambitions-narrow, *archived at* https://perma.cc/F4SS-YSZC; Neal E. Boudette, *Despite High Hopes, Self-Driving Cars Are 'Way in the Future'*, N.Y. TIMES (July 17, 2019), https://www.nytimes.com/2019/07/17/business/self-driving-autonomous-cars.html, *archived at* https://perma.cc/ZX8P-A7YB.

[158] There is remarkably little hard data on the impact of automation on work, particularly given the prominence of automation fears in public debates. One recent study by Daron Acemoglu and Pascual Restrepo found that the introduction of robots had led to net employment losses and declines in wages in local labor markets between 1990 and 2007. Daron Acemoglu & Pascual Restrepo, *Robots and Jobs: Evidence from U.S. Labor Markets*, 4–5 (Nat'l Bureau of Econ. Research, Working Paper No. 23285, 2017), https://www.nber.org/papers/w23285.pdf, *archived at* https://perma.cc/2JSD-Y6M4. The net findings were nevertheless relatively modest: In manufacturing, each robot per thousand workers eliminated between three and six jobs within the local labor market, and reduced wages by between 0.25 and 0.5%. *Id*. A review of the data by the Economic Policy Institute pointed out that the paper found that forms of automation other than industrial robotics had neutral or even positive effects on employment, and argued that the paper had not adequately accounted for job creation within other labor markets during the same period. Lawrence Mishel & Josh Bivens, *The Zombie Robot Apocalypse Argument Lurches On*, ECON. POLICY INST. (May 24, 2017), https://www.epi.org/publication/the-zombie-robot-argument-lurches-on-there-is-no-evidence-that-automation-leads-to-joblessness-or-inequality, *archived at* https://perma.cA9DX-7Z8Y.

tations in the design and strength of robotic devices.[159] Promotional videos by the robotics company Boston Dynamics show humanoid and dog-like robots walking through forests unattended, opening doors so they can escape buildings, and even performing backflips.[160] But the robots are not actually autonomous: The company has admitted that they are remotely controlled by humans.[161] Until robots can move autonomously, and have substantial manual dexterity,[162] they cannot replace human workers in jobs that require navigating highly irregular and unpredictable physical and social environments, such as package delivery.[163] Landscaping, housekeeping, and home care are very likely in the same category. Even industrial automation isn't nearly as simple in contemporary factories as it was for some tasks in heavy industrial production. For example, the Taiwanese electronics giant Foxconn, which assembles many Apple products, has slowed a planned automation of its factories because it has found it difficult to reprogram robots quickly enough to manufacture goods on the short timeframes required in modern consumer product markets.[164]

C. The Political Economy of Automation

These technical limits have implications for the political economy of work. A fully automated factory or fleet of vehicles would avoid labor politics entirely—no strikes, no protests, and no need to cater to community norms. But when employers cannot automate entire jobs, they must determine which tasks to automate and how to reorganize production processes afterward. That involves reassigning groups of workers and reshaping their jobs, which can bring labor conflict back into the picture.

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[159] *See, e.g.*, Steve Crowe, *Inside the Rethink Robotics Shutdown*, THE ROBOT REPORT, Nov. 13, 2018, https://www.therobotreport.com/rethink-robotics-shutdown/, *archived at* https://perma.cc/3EXZ-HCKC (reporting that a leading co-bot company had shut down due to low sales, and challenges that arose trying to balance a tension between two goals: keeping the co-bots safe to work alongside, and engineering them to be strong and accurate enough to perform the tasks required).

[160] Many of the videos are on Boston Dynamics' YouTube channel. *See, e.g.*, Boston Dynamics, *More Parkour Atlas*, YOUTUBE (Sept. 24, 2019) https://www.youtube.com/watch?v=_sBBaNYex3E, *archived at* https://perma.cc/CP9X-484V.

[161] Cade Metz, *These Robots Run, Dance and Flip. But Are They a Business?*, N.Y. TIMES (Sept. 22, 2018), https://www.nytimes.com/2018/09/22/technology/boston-dynamics-robots.html, *archived at* https://perma.cc/RUC5-4D9B.

[162] That requires progress in robotic hands, which has been slow due to the physical complexity of human hands. Sean Captain, *Why It's So Hard For Robots to Get A Grip*, FAST COMPANY (Jan. 12, 2017), https://www.fastcompany.com/3066863/why-its-so-hard-for-robots-to-get-a-grip, *archived at* https://perma.cc/SC7J-6GK5.

[163] Matt Beane, *In Automation, the 'Last Motion' Will Come Before the Last Mile*, WIRED (Apr. 23, 2019), https://www.wired.com/story/automation-last-motion-last-mile/, *archived at* https://perma.cc/J8ZW-BVGM.

[164] He Huifeng, *Foxconn Hits Bumps in Road to Full Automation*, SOUTH CHINA MORNING POST (July 29, 2016), https://www.scmp.com/business/companies/article/1996639/foxconn-hits-bumps-road-full-automation, *archived at* https://perma.cc/W22H-AL23.

Amazon's incorporation of robotics into its warehouses is illustrative. Due to the limits of robotic hands and of humanoid robots generally, it isn't possible for robots to roam a warehouse's shelves to grab items.[165] Amazon has instead developed an army of robots to carry shelves from a storage area to human "pickers" who then find the appropriate goods, grab them, and put them into plastic bins.[166] The effects of these automation efforts on workers are complex. Some of the job growth in Amazon's warehouses has been among higher-skilled workers that the company trained to manage robots.[167] But many of the remaining jobs have become more repetitive. As a recent *New York Times* piece put it, "Unlike pickers in manual warehouses," who walk among shelves to find goods, "the pickers [at a semiautomated warehouse] have almost no relief from plucking goods off shelves, other than their breaks."[168] In some warehouses, the particular bin on a shelf where goods can be found even lights up.[169] This means that the job of a picker requires little training and little firm-specific or warehouse-specific knowledge, which should put downward pressure on wages by enabling almost anyone to do the job.

Another example comes from Uber's operations, though it does not involve physical automation. Uber has long sought to develop fully autonomous vehicles, in part so that it could dispense with drivers, who are the company's dominant expense.[170] Uber slowed that program down following the fatal crash noted above,[171] but some of the technologies involved are also fueling its existing app. For example, it has integrated GPS-powered navigation into the drivers' side of its app and may be able to continuously improve

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[165] Nick Statt, *Amazon Says Fully Automated Shipping Warehouses Are At Least a Decade Away*, THE VERGE (May 1, 2019), https://www.theverge.com/2019/5/1/18526092/amazon-warehouse-robotics-automation-ai-10-years-away, *archived at* https://perma.cc/FA6L-DW4M.

[166] *See* Will Knight, *Inside Amazon's Warehouse, Human-Robot Symbiosis*, MIT TECH. REV. (July 7, 2015), https://www.technologyreview.com/s/538601/inside-amazons-warehouse-human-robot-symbiosis/, *archived at* https://perma.cc/X9JE-S5WK; Nick Wingfield, *As Amazon Pushes Forward with Robotics, Workers Find New Roles*, N.Y. TIMES (Sept. 10, 2017), https://www.nytimes.com/2017/09/10/technology/amazon-robots-workers.html, *archived at* https://perma.cc/WME7-5GB8.

[167] Wingfield, *supra* note 166; Ben Casselman & Adam Satariano, *Amazon's Latest Experiment: Retraining Its Work Force*, N.Y. TIMES (July 11, 2019), https://www.nytimes.com/2019/07/11/technology/amazon-workers-retraining-automation.html, *archived at* https://perma.cc/WME7-5GB8.

[168] Noam Scheiber, *Inside an Amazon Warehouse, Robots' Ways Rub Off on Humans*, N.Y. TIMES (July 3, 2019), https://www.nytimes.com/2019/07/03/business/economy/amazon-warehouse-labor-robots.html, *archived at* https://perma.cc/DV3V-MUVM.

[169] *Id.*

[170] *See* Aarian Marshall, *A Bet on Uber is a Bet on Self-Driving*, WIRED (May 10, 2019), https://www.wired.com/story/bet-uber-bet-self-driving/, *archived at* https://perma.cc/E25N-7NUT.

[171] *See* Michael Laris, *Nine Months After Deadly Crash, Uber is Testing Self-Driving Cars Again in Pittsburgh*, WASH. POST (Dec. 20, 2018), https://www.washingtonpost.com/transportation/2018/12/20/nine-months-after-deadly-crash-uber-is-testing-self-driving-cars-again-pittsburgh-starting-today/, *archived at* https://perma.cc/UG6Q-EMMS (noting that the company ceased tests for nine months following the accident).

it using data from past rides.[172] But this is also a form of deskilling, or job "homogenization" in Bowles's terms,[173] since taxi drivers' specialized knowledge of how to navigate a crowded city was historically a source of labor market power.[174] In essence, Uber has captured or replicated some of taxi drivers' tacit knowledge and craft skills, which it now leases to drivers.[175] Similar to Amazon, this means that almost anyone can do the job, putting downward pressure on wages.

These examples suggest that companies today have incentives to selectively automate tasks that give workers some labor market power, just as they have in the past.[176] They also highlight that employers may couple task automation with other process changes, such as algorithmic management, and that the basic rules governing employment facilitate this process.

III. Algorithmic Management (Including Fissuring)

When automation of physical tasks is not possible, firms can also use machine learning and other data-driven technologies that enhance productivity or reduce worker power. Researchers at Carnegie Mellon have used the term "algorithmic management" to describe contemporary companies' use of data-driven algorithms to "manag[e] distributed human workers at a large scale."[177] This Article borrows that term to refer to the full set of ways in which major companies use data, fed into powerful algorithms, to manage workers today. While Uber, Lyft, and other on-demand companies are the most prominent examples of this phenomenon, they are far from alone. As this Part illustrates, major retailers, fast food companies, and delivery companies are already using forms of algorithmic management, often at scale.

The underlying technologies here vary greatly.[178] They include sensors that determine where drivers are and whether they are speeding, as well as bar code scanners and inventory control devices of all sorts. They also include natural-language processing, which companies can use to monitor employees' speech and emails or to scan resumés. They include other sorts of machine learning and data analytics, which analyze the data from those de-

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[172] *See* Rosenblat *supra* note 2, at 133–37.

[173] Bowles, *supra* note 21, at 74.

[174] In London, cab drivers even needed to pass a test showing that they knew the names and locations of all streets in the area, so that they could get to and from any location without a map. Transport For London, The 'Knowledge of London' Examination System 2 (Mar. 2014), https://www.whatdotheyknow.com/request/214973/response/529251/attach/2/Knowledge%20Examinations%20System%20March%202014.pdf, *archived at* https://perma.cc/S9B8-3JNK.

[175] *See also* Cohen, *Biopolitical Public Domain*, *supra* note 48, at 1–2 (discussing similar extraction of data from consumers).

[176] *See generally* Braverman, *supra* note 45; Bowles, *supra* note 21.

[177] Lee et al., *supra* note 19, at 1603.

[178] *See, e.g.*, Ajunwa, Crawford & Schultz, *supra* note 33; Matthew T. Bodie, Miriam Cherry, Marcia L. McCormick & Jintong Tang, *The Law and Policy of People Analytics*, 88 U. Colo. L. Rev. 961 (2017); Elizabeth Tippett, Charlotte Alexander & Zev Eigen, *When Timekeeping Undermines Compliance*, 19 Yale J. L. & Tech. 1 (2017) (examining various timekeeping and scheduling platforms in current use).

vices to make inferences about how workers are performing. And they include classic information technologies, such as mainframe computers and intranets, which can be used to communicate information between worksites and centralized servers. What unite the activities treated here are (a) gathering data to quantify aspects of work processes; (b) processing that data through machine learning or other algorithmic technologies; and (c) making managerial decisions on the basis of those algorithms' analyses.

Algorithmic management efforts are less attention-grabbing than full-job automation, since they often involve iterative changes to management processes and to workers' jobs. To be clear, in many instances they *do* involve task automation, though the tasks being automated—screening of resumés, inventory tracking and ordering, scheduling, workflow organization, oversight, payroll processing, etc.—were formerly carried out by managers rather than line-level workers and are largely cognitive rather than physical. But algorithmic management may prove more consequential than automation in the near term—and perhaps even in the long term. Few or no changes to physical workplaces are required, which makes such technologies cheaper to deploy than robotics. Ongoing progress in machine learning, especially when combined with employers' ready access to data on workplace processes, should also make algorithmic management more powerful over time.

The overall effects of algorithmic management techniques on workers under current law are complex but often negative. Algorithmic management techniques that enable workers to find jobs that better match their skills and preferences will often enhance productivity, as will tasking programs that reduce waste in complex operations; such changes can benefit workers as long as wages track productivity increases. High-performing workers may also benefit from greater quantification of management processes, since it may make their contributions more visible to management. But such techniques can also enable managers to centralize control of operations and to homogenize work.[179] Line-level workers as a class may then end up with less workplace autonomy, lower wages, and a faster pace of work, and irregular or unpredictable schedules.

Below, Part III.A discusses the use of algorithms to hire and schedule workers, and Part III.B discusses algorithmic monitoring and discipline strategies. Part III.C discusses how such techniques can be used to monitor work across firm boundaries, encouraging what the Article calls "data-driven fissuring."

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[179] *See* Laura Tyson & Michael Spence, *Exploring the Effects of Technology on Income and Wealth Inequality*, in AFTER PIKETTY 182–83 (Heather Boushey et al. eds., 2017).

A. Algorithmic Hiring and Scheduling

Algorithms are already being used at scale to assist in hiring processes and to schedule workers for shifts. This section treats these uses of algorithms together because their net effects on workers are likely ambiguous: They may enable significant productivity gains or otherwise benefit workers in some cases, though in other cases they may lead to declines in job quality.

Algorithmic hiring: The theory behind algorithmic hiring is that advanced data analyses may identify aspects of applicants' experience or aptitudes that correlate with success in particular positions. This is superficially plausible, especially since candidates often submit resumés and other data to recruitment websites, and companies often perform background checks that generate some data on skills and work experiences.[180] The field has already evolved rapidly. Various early efforts to automate recruitment using machine learning largely failed, but subsequent efforts to bring machine learning and data analytics into the process in a more limited fashion seem at least moderately successful.[181] For example, Ideal, a Toronto-based startup, has helped various large retailers with hiring by screening resumés, gathering information from applicants regarding their shift availability and skills via chatbot, and recommending qualified candidates.[182] Many McDonald's franchisees use a centralized candidate screening system that the company hired a contractor to develop, which makes some algorithmic assessments of workers before their applications are ever reviewed by a manager.[183]

Such efforts can benefit workers. Job searches are costly for both parties,[184] and if algorithms enable easier and better matching of potential workers with jobs, both employers and workers may be better off. But in the low-wage labor market algorithmic hiring may undermine labor standards. When employers bear the costs of hiring new workers, they may pay above-market wages to reduce turnover and limit recruitment costs.[185] If technology can

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[180] *See* Matt Richtel, *How Big Data is Playing Recruiter for Specialized Workers*, N.Y. TIMES (Apr. 27, 2013), https://www.nytimes.com/2013/04/28/technology/how-big-data-is-playing-recruiter-for-specialized-workers.html *archived at* https://perma.cc/EKJ7-46GM.

[181] Michelle Rafter, *Why Robots Won't Take Over HR Recruiting Any Time Soon*, PC MAGAZINE (Apr. 20, 2016), https://www.pcmag.com/news/why-robots-wont-take-over-hr-recruiting-any-time-soon, *archived at* https://perma.cc/XYE3-WSS2 (quoting CEO of hiring startup Ideal: "A lot of people think recruiting can be totally automated and it's not possible . . . . We tried to develop the system thinking we could and we can't.").

[182] *See, e.g.*, Ideal, *Chatbot and Candidate Messaging Software*, https://ideal.com/product/recruiting-chatbot/, *archived at* https://perma.cc/67RM-DQZW.

[183] Charging Parties' Post-Hearing Brief in Opposition to Proposed Settlement Agreements at 15–16, *McDonald's USA LLC et al. and Fast Food Workers Committee and SEIU et al.*, National Labor Relations Board Cases 02-CA-093893 et al., & 04-CA-125567 et al. (Apr. 27, 2018).

[184] *See generally* Richard Rogerson et al., *Search-Theoretic Models of the Labor Market: A Survey* (NBER Working Paper 10655 Aug. 2004), http://www.nber.org/papers/w10655, *archived at* https://perma.cc/NJG5-UQXC.

[185] Joseph E. Stiglitz, *Alternative Theories of Wage Determination and Unemployment in LDC's: The Labor Turnover Model*, 88 Q. J. ECON. 194, 198 (1974).

reduce recruitment costs, labor markets may behave more like classic commodity markets, likely driving down wages. And if companies utilize task automation to reshape production processes in ways that require fewer skilled workers but more workers without specialized skills, there may be lower returns to finding the best candidates. The more pressing need in such cases simply may be to get a sufficient number of candidates in the door to staff existing processes.

Moreover, automated searches are only as good as their underlying data and programming and can reproduce various forms of bias within labor markets, as past scholars have documented.[186] For example, an algorithm that finds that workers tend to stay in jobs longer if they live near the worksite may exclude African American workers at a disproportionate rate depending on patterns of housing segregation.[187] Indeed, Amazon actually shut down a machine-learning-powered hiring tool after realizing that it tended to correlate success in more technical positions with being male.[188]

Algorithmic timekeeping and scheduling: Many major companies use timekeeping software that tracks when workers sign in and out of work, determines their net hours during each pay period, and interfaces with payroll-processing services.[189] Many also use algorithms to schedule workers for their shifts. Those algorithms predict consumer demand based on past sales as well as factors such as weather reports, and schedule workers accordingly in an effort to ensure that worksites are neither over- nor understaffed.[190] This involves partial automation, though the tasks being automated are managerial.

As with hiring, algorithmic scheduling can benefit workers. When workers can specify times that they would ideally like to work, and an algorithm can figure out how to optimize the schedule for a manager, this can

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[186] *See generally* Ajunwa, *supra* note 33; Barocas & Selbst, *supra* note 33; Kim, *supra* note 33.

[187] *See generally* Kim *supra* note 33, at 873 (noting that algorithmic hiring processes may encourage racial discrimination if, for example, they correlate likelihood of job success with residence in a particular neighborhood, given patterns of housing segregation).

[188] Jeffrey Dastin, *Amazon Scraps Secret AI Recruiting Tool that Showed Bias Against Women*, REUTERS (Oct. 9, 2018), https://www.reuters.com/article/us-amazon-com-jobs-automation-insight/amazon-scraps-secret-ai-recruiting-tool-that-showed-bias-against-women-idUSKCN1MK08G, *archived at* https://perma.cc/HRR4-25ST. *But see* Bo Cowgill & Catherine Tucker, *Algorithmic Bias: A Counterfactual Perspective* (Working Paper: NSF Trustworthy Algorithms, Dec. 2017), http://trustworthy-algorithms.org/whitepapers/Bo%20Cowgill.pdf, *archived at* https://perma.cc/Y8WG-FEXT (noting that "[i]n many practical settings, the alternative to a biased algorithm is not an unbiased one, but another decision method such as another algorithm or human discretion" which may itself be biased).

[189] *See generally* Tippett et al., *supra* note 178; Jodi Kantor, *Working Anything but 9 to 5*, N.Y. TIMES (Aug. 13, 2014), https://www.nytimes.com/interactive/2014/08/13/us/starbucks-workers-scheduling-hours.html, *archived at* https://perma.cc/RY5E-6H8A (describing use of scheduling software by "virtually every major retail and restaurant chain").

[190] Kantor, *supra* note 189.

reduce a company's costs and also help ensure worker satisfaction.[191] And while fixed schedules are highly desirable in most instances, many workers would like some flexibility, and workers may well prefer to be able to request a different shift via an app rather than in person with a manager. Automated scheduling may also help ensure compliance with wage/hour laws,[192] or could help workers prove that they suffered discrimination if, for example, women or African American workers are frequently assigned less-desirable shifts.

That said, automated scheduling is again only as good as its underlying data. An algorithm may assign African American workers to less desirable shifts if they have received those shifts in the past due to discrimination. Likewise, if a company does not accurately predict consumer demand, then it may end up scheduling too leanly, leading to a frantic pace of work. Employers may also program algorithms in ways that disregard workers' needs, especially for workers with multiple jobs or caregiving responsibilities. The issue came to public attention with Starbucks' practice of "clopening[s]," where workers were required to close the store one night and then open it the next day, making it nearly impossible for them to sleep.[193] In the wake of media attention, the company promised more regular and predictable schedules in the future.[194] Notably, Starbucks' decision was not required under federal wage and hour laws, which do not guarantee steady hours, or minimum or maximum hours.[195] There is also evidence that timekeeping software can affirmatively undermine compliance. Three legal scholars reviewed common timekeeping software programs and found that their default settings would often undercount hours, and that the programs enabled employers to edit down hours worked.[196]

Part of what is at stake here is who pays for unused labor power. The norm that firms hired employees and required them to stay onsite for eight hours at a time provided firms with an incentive to give employees sufficient work for that period, but also meant that companies bore the risk that workers would not be busy the entire time. Today those norms have eroded due to various political-economic factors, including the decline of collective bargaining and the shift to a service economy, which have increased pressure on firms to limit costs. As a result, workers typically have no formal voice in scheduling policies. This is another illustration of how uses of technologies

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[191] Kronos, *Hannaford Uses Kronos Optimized Scheduling and Navigator to Streamline Workforce Management*, https://www.kronos.com/customers/hannaford-supermarkets, *archived at* https://perma.cc/6HLV-9SQ6.

[192] *Id.*

[193] Kantor, *supra* note 189.

[194] Jodi Kantor, *Starbucks to Revise Policies to End Irregular Schedules for Its 130,000 Baristas*, N.Y. Times (Aug. 15, 2014), https://www.nytimes.com/2014/08/15/us/starbucks-to-revise-work-scheduling-policies.html, *archived at* https://perma.cc/AP85-9QUY.

[195] *See* 29 U.S.C. § 207 (2018) (mandating maximum hours provision of FLSA, requiring overtime for work over 40 hours in a week, but not requiring regular or reasonable hours).

[196] Tippett et al., *supra* note 178, at 3.

are embedded in political-economic context: With a different set of background entitlements, norms and practices, employers might use algorithmic scheduling programs in ways that serve workers' needs to a greater degree.

B. Algorithmic Monitoring and Tasking

Algorithmic monitoring and tasking may prove to be the most consequential new use of data-driven technologies. They may enable productivity gains, but may also impact the pace of work, wages, and workers' autonomy. The latter effects may arise because employers' difficulties in monitoring work have often affected wage-setting in the past.[197] From the employer's perspective, workers who have been asked to perform a set of tasks may do so more or less diligently, but the employer may not be able to detect which workers are over- or under-performing. Such monitoring costs are at the heart of some variants of "efficiency wage" theory, which arose to explain a phenomenon that puzzled neoclassical economists: why do labor markets rarely "clear," with wages dropping to the point that unemployment approaches zero?[198] Per such theories, employers who cannot monitor workers' performance easily may pay above-market wages to increase the costs of unemployment to workers or to induce worker loyalty.[199] Importantly, however, this theory assumes that employers are unable to cheaply observe workers' effort or output levels.[200] Conversely, if employers can monitor work at low cost, they should have less incentive to pay above-market wages.[201]

Data-driven technologies may dramatically enhance employers' monitoring capacities. For example, employers have long monitored telephone communications and email and have utilized keystroke-monitoring programs

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[197] The argument in this paragraph draws on Stiglitz, *supra* note 35; Robert Gibbons, *Piece-Rate Incentive Schemes*, 5 J. LAB. ECON. 413, 416 (1987); Carl Shapiro & Joseph E. Stiglitz, *Equilibrium Unemployment as a Worker Discipline Device*, 74 AM. ECON. REV. 433, 433 (1984).

[198] Stiglitz, *supra* note 35, at 473.

[199] Shapiro & Stiglitz, *supra* note 197, at 433; *see also* Janet L. Yellen, *Efficiency Wage Models of Unemployment*, 74 AM. ECON. REV. 200, 203 (1984) (examining efficiency wages as a means of selecting for high-performing workers); George A. Akerlof, *Labor Contracts as Partial Gift Exchange*, 97 Q. J. ECON. 543, 549 (1982) (arguing that efficiency wages arise due to norms of fair treatment within the firm or workplace).

[200] Jeremy I. Bulow & Lawrence H. Summers, *A Theory of Dual Labor Markets with Application to Industrial Policy, Discrimination, and Keynesian Unemployment* 2 (Nat'l Bureau of Econ. Research, Working Paper No. 1666, 1985); *see also* Yellen, *supra* note 199, at 201 (arguing that efficiency wages may also be less important "in the secondary sector, where the wage-productivity relationship is weak or nonexistent").

[201] Efficiency wage theories do *not* predict that wage increases amount to a free lunch of sorts, for example by increasing productivity. Rather, as noted in the body text, they arose to explain persistent unemployment. Alex Tabarrok, *The False Prophets of Efficiency Wages*, MARGINAL REVOLUTION (Apr. 28, 2015), https://marginalrevolution.com/marginalrevolution/2015/04/the-false-prophets-of-efficiency-wages.html, *archived at* https://perma.cc/CWG4-WEDM.

to estimate workers' productivity.[202] Advanced technologies have increased their powers to do so. The company Crossover offers a tool called WorkSmart to monitor remote workers; the tool takes a photo of workers every ten minutes through their computer's webcam, which it combines with "other data—including app use and keystrokes—to come up with a 'focus score' and an 'intensity score' that can be used to assess the value of freelancers."[203] Though peer-reviewed research on how such efforts affect wages is rare, one study found that when the platform Freelancer put into practice a monitoring system that tracked keystrokes and the like, clients' preferences "for bidders with a high effort-related reputation in time-based projects" fell; new users on the platform were able to find clients more easily, but the equilibrium price for time-based projects dropped by almost 7%.[204]

Companies also have numerous new tools to monitor workers' conversations. Employers often monitor phone calls,[205] and their power to do so may be augmented by natural-language processing. A phone conversation can be translated instantaneously into text, and then it can be scanned with machine learning for particular words or phrases, or simply analyzed to determine whether an employee accurately judged what a caller needed. Labor unions that represent call center workers report that nascent forms of such technology are now being used to oversee their members. One report from the Communications Workers of America describes an AI-powered system known as CallMiner, which recorded all telephone conversations and sought (often in a buggy fashion) to determine whether workers were appropriately handling customer complaints.[206] Since the technology affected disciplinary policies, the employer had a duty to bargain over its use,[207] and unionized call center workers were able to establish rules around when the monitors could be turned on and off and when workers could be disciplined based on

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[202] As long ago as 2007, 45% of employers tracked what workers did at computer workstations. AMA Staff, *The Latest on Workplace Monitoring and Surveillance*, AMERICAN MANAGEMENT ASSOCIATION (Apr. 8, 2019), https://www.amanet.org/training/articles/the-latest-on-workplace-monitoring-and-surveillance.aspx, *archived at* https://perma.cc/H3SW-SLYA; *see also* Kirstie Ball, *Workplace Surveillance: An Overview*, 51 LAB. HIST. 87 (2010) (summarizing literature and data on workplace surveillance).

[203] Olivia Solon, *Big Brother Isn't Just Watching: Workplace Surveillance Can Track Your Every Move*, THE GUARDIAN (Nov. 6, 2017), https://www.theguardian.com/world/2017/nov/06/workplace-surveillance-big-brother-technology, *archived at* https://perma.cc/7ZVR-CXE9.

[204] Chen Liang et al., *IT-Enabled Monitoring and Labor Contracting in Online Platforms: Evidence from a Natural Experiment*, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2838045, *archived at* https://perma.cc/D33G-GQFV. Such monitoring programs also raise general concerns about worker privacy and autonomy.

[205] *See generally* Ball, *supra* note 202, at 88 (summarizing data on extent of employer monitoring of telephone and other communications).

[206] *See* NELP & AFL-CIO, *Wheeling and Dealing Misfortune: How Santander's High Pressure Tactics Hurt Workers and Auto Loan Customers* at 6–8 (July 21, 2017), https://static1.squarespace.com/static/58d8a1bb3a041137d463d64f/t/597239986a4963db06ef5ff1/1500658073098/Wheeling+and+Dealing-+FINAL.pdf, *archived at* https://perma.cc/4UWT-AQV9 (describing monitoring system known as "CallMiner").

[207] *See* discussion *supra* notes 76–82 (summarizing rules governing collective bargaining around technological change).

data gathered.[208] Of course, the vast majority of workers who are not unionized have no rights to bargain over such matters.

Another example comes from Amazon. The company has used data gathered while goods move through its warehouses to determine how quickly workers are performing tasks, and to push them to work faster.[209] Documents disclosed as part of a labor dispute between Amazon and a worker who alleged that he had been fired in retaliation for organizing efforts showed that various aspects of that oversight had been automated.[210] "Amazon's system tracks the rates of each individual associate's productivity," a reporter who reviewed the filings wrote, "and automatically generates any warnings or terminations regarding quality or productivity without input from supervisors."[211] Around 300 workers in that warehouse had been terminated via that process for productivity reasons alone in a twelve-month period, a number representing over 10% of the warehouse's staff.[212]

These examples suggest that employers have less incentive to pay decent wages as they gain more information about workers' performance. As with scheduling programs, there is nothing natural or necessary about this result. Under a different set of background rules, employers' monitoring powers could be used to ensure compliance with basic labor standards. They could also be subjected to collective bargaining, so that workers could trade off some monitoring for higher wages or share in the productivity gains that result. Part IV discusses that possibility.

C. Data-Driven Fissuring

Contemporary information technologies also make it easier for companies to purchase labor through intermediaries, thereby avoiding duties under labor and employment laws. This has come to be known as the "fissuring" of employment, since it creates a legal gap between workers and the companies that utilize their work.[213] While fissuring is often legitimate and beneficial for all involved, it can also undermine labor standards, as discussed

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[208] Communication Workers of America. *CWA Issue Brief: Protections Against Abusive Monitoring*, CWA Research Department (Feb. 2014) (on file with author) (describing contract language around such matters). Walmart may soon begin using similar monitoring technology at cashier stations. *See* Sam Levin, *Walmart Patents Tech That Would Allow it to Eavesdrop on Cashiers*, THE GUARDIAN (July 12, 2018), https://www.theguardian.com/business/2018/jul/12/walmart-surveillance-sound-sensors-employees, *archived at* https://perma.cc/ST7Z-NNAT.

[209] Colin Lecther, *How Amazon Automatically Tracks and Fires Warehouse Workers for 'Productivity*,' THE VERGE (Apr. 25, 2019), https://www.theverge.com/2019/4/25/18516004/amazon-warehouse-fulfillment-centers-productivity-firing-terminations, *archived at* https://perma.cc/W8EL-MTBP.

[210] *See id.*

[211] *See id.*

[212] *Id.* Uber has also used algorithmic monitoring and tasking extensively, often generating and exploiting informational asymmetries vis-à-vis drivers. *See* ROSENBLAT, *supra* note 2, at 91–93; Rosenblat & Stark, *supra* note 2, at 3762 (2016); *see also* Levy, *supra* note 47, at 171 (discussing monitoring of truck drivers through data-driven "telematics" systems).

[213] *See* WEIL, *supra* note 31, at 7 (drawing this metaphor).

below.[214] There are three key fissuring strategies today. The first involves classifying individual workers as independent contractors rather than employees.[215] This is common in the gig economy, among delivery firms such as FedEx, and elsewhere in the logistics sector.[216] A second fissuring strategy is subcontracting, in which user firms hire labor through agencies or third-party contractors. Unlike independent contractors, subcontracted workers clearly have an employer—the contractor—but the user firm may have more power to set working conditions than that employer. Subcontracting is especially common in building services, agriculture, logistics, hotels and warehouses (where workers are often hired through temporary agencies).[217] The third strategy is franchising, where core firms, especially in fast food and retail, license their trademarks and product line to independent businesses, who in turn employ line-level workers.[218]

Fissuring today often depends on the low costs "of gathering information and undertaking monitoring in light of developments in the digital world."[219] According to the basic Coase/Williamson theory of the firm, companies have greater incentives to produce goods in-house, and to control production tightly, when it is difficult to specify outputs with precision or to monitor outside parties' performance.[220] However, bringing workers in-house as employees makes the firm responsible for substantial employment-related costs. If new technologies enable a firm to ensure high-quality production through suppliers and outside contractors, that firm will have incentives to fissure away the work to reduce labor costs.[221]

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[214] *See* discussion *infra* notes 215–27.

[215] *See* CATHERINE RUCKELSHAUS ET AL., NAT'L EMP. L. PROJECT, WHO'S THE BOSS: RESTORING ACCOUNTABILITY FOR LABOR STANDARDS IN OUTSOURCED WORK 7 (May 2014).

[216] *See generally id.*; *see also* Alexander v. FedEx Ground Package System, Inc., 765 F.3d 981, 984 (9th Cir. 2014) (finding that FedEx misclassified drivers under California laws regarding wages, hours, and work-related expenses); Cotter v. Lyft, 60 F. Supp. 3d 1067, 1067 (N.D. Cal. 2015) (denying defendant's motion for summary judgment on employment status of Lyft drivers); O'Connor v. Uber Tech., 82 F. Supp. 3d 1133, 1133 (N.D. Cal. 2015) (denying defendant Uber's motion for summary judgment in similar case under California law); Dynamex Operations W., Inc. v. Super. Ct. of L.A., 416 P.3d 1, 7 (Cal. 2018) (adopting new test for employment status for purposes of California wage orders, due to widespread concerns about misclassification of gig economy and other workers under extant test).

[217] *See* RUCKELSHAUS ET AL., *supra* note 215, at 8.

[218] *See* WEIL, *supra* note 31, at 122–58 (discussing franchising and its effects).

[219] WEIL, *supra* note 31, at 61; *see also id.* at 64–72 (discussing companies' monitoring strategies in retail and fast food); *accord* Tyson & Spence, *supra* note 179, at 187; NATIONAL ACADEMY OF SCIENCES, INFORMATION TECHNOLOGY AND THE U.S. WORKFORCE: WHERE ARE WE AND WHERE DO WE GO FROM HERE? 66 (2017).

[220] *See* Oliver Williamson, *The Economics of Organization: The Transaction Cost Approach*, 87 AM. J. SOC. 548, 559 (1981); *see also* Coase, *supra* note 94, at 397.

[221] It is clear that fissuring has this effect. *See, e.g.*, Samuel Berlinski, *Wages and Contracting Out: Does the Law of One Price Hold?*, 46 BRIT. J. INDUS. RELATIONS 59, 59 (2008) (demonstrating that subcontracted janitors and security guards earn 15% and 17% less, respectively, than in-house workers doing same jobs); WEIL, *supra* note 31, at 88; Rosemary Batt & Hiro Nohara, *How Institutions and Business Strategies Affect Wages: A Cross-National Study of Call Centers*, 62 INDUS. & LAB. RELATIONS REV. 533, 540 (2009) (showing lower wages in outsourced call centers).

The rest of this section summarizes several prominent examples of data-driven fissuring in today's economy.[222] Some of these do not require particularly advanced information technologies. Nevertheless, machine learning may render fissuring cheaper and easier by enabling closer oversight of fissured workers, and by concentrating that oversight capacity within large firms. Moreover, assuming that data on work processes is becoming more plentiful and more accurate due to some of the monitoring techniques discussed above, and that the costs of transmitting and processing that data continue to fall, such efforts should become cheaper and more widespread over time.

Logistics: FedEx has long used sophisticated suites of devices known as "telematics" systems to monitor drivers' delivery times, driving speed, and seatbelt usage, while classifying them as independent contractors.[223] Similar uses of technology are clear in the on-demand economy of Uber, Lyft, and the like. As noted in Part II.B, Uber uses algorithms to manage an enormous and constantly changing workforce with almost no direct human supervision. Meanwhile, Uber has disclaimed any duties towards its drivers under labor and employment laws by classifying them as independent contractors rather than employees.[224] What is striking about Uber is not that it uses an independent contractor model—taxi companies have long done the same—but that it does so while using modern technologies to supervise workers closely, which has almost certainly contributed to its ability to keep labor costs low.[225]

Hotels: Today, most major hotel brands use contractors to ensure "clean rooms, cheery front desk staff, or prompt curbside service."[226] They also use a franchise business model, where the brand leases operating rights and provides some services to independent businesses who own particular

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[222] In addition to the examples discussed below, see generally MARY L. GRAY & SIDDHARTH SURI, GHOST WORK: HOW TO STOP SILICON VALLEY FROM BUILDING A NEW GLOBAL UNDERCLASS (2019) (surveying use of off-site workers for many purposes by Silicon Valley firms in their development of artificial intelligence and other products); *id*., at xvii–xviii (noting that such workers are almost always never legally employed by the companies that use their labor).

[223] *See* Alexander v. FedEx Ground Package System, Inc., 765 F.3d 981, 997 (9th Cir. 2014) (overturning district court judgment that FedEx drivers were independent contractors as a matter of law, because FedEx exerted extensive control over their work).

[224] *See* Razak v. Uber Tech., 2016 WL 7241795, at *1–*2 (E.D. Pa., Apr. 18, 2018) (granting defendant's motion for summary judgment on issue of employment status in FLSA case). *But see* O'Connor v. Uber Tech., 82 F. Supp. 3d 1133, 1133 (N.D. Cal. 2015); *see generally* Rogers, *supra* note 7, at 512–14 (arguing that existing statutory tests for employment are broad enough, if interpreted purposively, for courts to find that Uber and Lyft employ drivers).

[225] Uber drivers' average pay is not publicly known, but one study estimated that drivers earn around $9.21/hour after accounting for expenses and taxes. LAWRENCE MISHEL, ECON. POL'Y INST., UBER AND THE LABOR MARKET 10 (May 15, 2018). The company itself has contested those figures. *See* Erin Winick, *Maybe Uber and Lyft Drivers *Can* Make a Living*, MIT TECH. REV. (Mar. 6, 2018), https://www.technologyreview.com/f/610428/maybe-uber-and-lyft-drivers-can-make-a-living/, *archived at* https://perma.cc/EZB3-TK9H.

[226] WEIL, *supra* note 31, at 145–46.

properties. Indeed, by 2011, Marriott "owned and managed only 1 of the 356 properties operating under one of its brands."[227] At the same time, Marriott has integrated systems for reservations and supply chain management to serve its global network of hotels. Some of its practices are centralized and others are decentralized, but it uses a single integrated platform for both sourcing and accounts payable. As a recent article put it, that platform "ensures data that can be analysed and be transparent, enabling Marriott to better determine where commodities are needed, in real-time."[228]

Fast food: McDonald's is not a single legal enterprise but an amalgamation of tens of thousands of enterprises. At the center is McDonald's corporate; at the edges are the many McDonald's franchises that are independently owned and operated as separate corporations.[229] But unions have argued that point-of-sale and payroll management systems are integrated between franchisees and McDonald's corporate, which gives corporate a good sense of which franchisees and workers are over- or underperforming.[230] McDonald's also standardizes how work is performed across franchisees by training managers and other staff,[231] and it sets specifications for the performance of specific tasks, sometimes down to the second.[232] According to unions, it also coordinated franchisees' responses to recent worker organizing.[233]

Summary: Data-driven fissuring is perhaps the best illustration of the relationship among law, political economy, and technological choice. Under different background rules companies would have less incentive to fissure away work—and perhaps less ability to do so. For example, if definitions of employment were broader, it would be harder to avoid labor costs through

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[227] *Id.* at 146.

[228] Nell Walker, *How Marriott Has Achieved the Mammoth Task of Streamlining Its Worldwide Supply Chain*, Supply Chain Digital (Oct. 11, 2017), https://www.supplychaindigital.com/company/how-marriott-has-achieved-mammoth-task-streamlining-its-worldwide-supply-chain, *archived at* https://perma.cc/AFK2-YBTR.

[229] On the franchising business model, see generally Weil, *supra* note 31, at 123–32. On how antitrust laws have encouraged franchising, see Brian Callaci, V*ertical Power and the Creation of a Fissured Workplace: The Case of Franchising* 4–13 (U. Mass. Amherst, Dept. of Econ. Working Paper Sept. 5, 2018); Sanjukta Paul, *Fissuring and the Firm Exemption*, 82 Law & Contemp. Probs. 65, 68–72 (2019).

[230] *See* discussion of McDonald's immediately below; *see also* Memorandum of Law in Support of Verified Petition at 3, *People of the State of N.Y. v. Domino's Pizza*, No. 450627 (Nov. 4, 2016) (alleging that Domino's pizza "possesses contemporaneous time records for all franchisee employees . . . [including] detailed records showing each employee's minute-by-minute actions each day," and arguing that fact should lead to Domino's being classified as those workers' joint employer).

[231] Charging Parties' Post-Hearing Brief, *supra* note 184, at 17–18.

[232] *See id.* at 20 (citing McDonald's regulations providing that "[g]uests should wait no more than 90 seconds from your greeting to the completion of their order," and that their "total experience time should not exceed 3 minutes, 30 seconds") (internal citation omitted).

[233] *Id.* at 21–23. *But see* Jones Day, Letter Brief to NLRB Associate General Counsel (May 22, 2014), http://static.politico.com/4d/78/21e5bc034511b798336d0c20a6aa/mcdonalds-memo-defending-against-joint-employer-liability.pdf, *archived at* https://perma.cc/6648-7W8F (denying that McDonald's responses to the organizing drive were evidence of joint employment, and denying that the company uses technology to exert control over franchisees or their employees)

subcontracting or independent contracting. Similarly, if unions had the ability to take wages out of competition across industrial sectors, companies would be unable to reduce labor costs through fissuring.[234] But under existing rules companies have incentives to use such strategies to reduce their labor costs. One result is that each of the sectors discussed above involves centralized authority over work but diffuse responsibility toward workers.

IV. Toward a New Politics of Workplace Technology

This final Part draws out some broader lessons of the argument above: that our labor and employment laws both facilitate technological change and channel employers toward power-augmenting uses of technology. Part IV.A draws on comparative evidence to further illustrate the relationship among law, political economy, and workplace technology. Part IV.B then considers reforms that may encourage a different politics around workplace technology.

A. Historical and Comparative Perspective

The technical and legal factors discussed above have encouraged U.S. companies to utilize large amounts of low-wage, low-skill labor. At the micro-level, investors and managers within firms have sought to disempower labor through technological and other means. At the meso- and macro-level, such practices often take root within sectors, making it difficult for individual firms to raise wages without losing market share.[235] Other advanced economies at the technological frontier have followed different paths, in part due to their distinct labor market institutions.[236] For example, German industrial workers have worker voice through three institutions: unions that bargain at the industry level; works councils, which are nonunion bodies that provide collective worker voice at the firm or worksite level; and seats on companies' supervisory boards.[237] German manufacturers have adapted by focusing on high-wage, high-skill, high-productivity strategies,

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[234] *See* Andrias & Rogers, *supra* note 91, at 16–20.

[235] *See* Kathleen Thelen, Presidential Address, *The American Precariat: U.S. Capitalism in Comparative Perspective*, 17 Persp. on Pol. 5, 14–15 (2019) (noting high incidence of low-wage work and precarious work in the U.S. compared to other countries); *see generally* Hall & Soskice, *supra* note 55. For a complementary account of skill differences among nations that centers power relations between workers/unions and employers/employer associations, see Wolfgang Streeck, *Skills and Politics: General and Specific* (Max-Planck-Institut für Gesellschaftsforschung, Köln, MPIfG Discussion Paper No. 11/1, 2011). To be clear, there are basic economic limits to the low-wage, low-skill strategy. If wages fall below a certain level, companies may be unable to recruit workers with even minimal skills, leading to declines in quality.

[236] *See generally* Hall & Soskice, *supra* note 55.

[237] *See generally* Tobias Schulze-Cleven, *German Labor Relations in International Perspective: A Model Reconsidered*, 35 German Pol. & Soc'y. 46 (2017).

which enable profitability despite high labor costs.[238] While the German model is no longer as robust as it once was,[239] it continues to influence firms' practices.

In some cases, the institutional context affects the choice of technologies themselves. For example, German and U.S. call centers tend to have different labor relations, even as they provide services to the same companies. U.S. centers use "a narrow division of labour, tight discipline and individual incentives" along with managerial efforts to homogenize jobs, while German centers utilize "high-involvement employment systems with broad skills and worker discretion," in part because works councils have limited employer monitoring and encouraged upskilling.[240] Similarly, a recent working paper found that German companies subject to a stricter form of codetermination had higher capital intensity than companies subject to forms of codetermination that give workers less power, suggesting that worker voice can encourage companies to pursue higher-productivity strategies.[241]

In other cases, political-economic factors influence how particular technologies are used, rather than the choice of technologies themselves. This is apparent in nations' differing responses to Uber's arrival. While the company used essentially the same set of technological tools in different nations, its entry into their markets triggered different responses rooted in those nations' distinctive political-economic alignments. As Kathleen Thelen has shown, most cities and states in the United States partnered with Uber to facilitate the company's operations, reflecting workers' structural weakness. In Germany, incumbent taxi companies, which were well-organized into associations, united to block Uber's entry into local markets. In Sweden, regulators enabled the company's operation while ensuring that it paid all applicable taxes.[242] The employment status of Uber drivers mattered less in the Swedish context due to its universal and tax-funded welfare benefits, and since unions who represented taxi drivers at the sectoral level and enjoyed access to

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[238] *See generally* Wolfgang Streeck, Re-Forming Capitalism: Institutional Change in the German Political Economy (2009); Hall & Soskice, *supra* note 55; Joel Rogers, *Divide and Conquer: Further 'Reflections on the Distinctive Character of American Labor Laws'*, 1990 Wis. L. Rev. 1 (1990).

[239] *See* Thelen, *supra* note 55, at 30–31 (2014) (discussing emergence of "dualism" in Germany, where precarious work is common outside of industrial core).

[240] Virginia Doellgast, *Collective Voice under Decentralized Bargaining: A Comparative Study of Work Reorganization in US and German Call Centres*, 48 British J. Indus. Rel. 375, 375–76 (2010); *see also* Simon Jäger et al., *Labor in the Boardroom* (IZA Discussion Paper No. 12799, 2019), http://economics.mit.edu/files/17273, *archived at* https://perma.cc/W93Y-QENA (finding that German companies subject to a stricter form of codetermination had higher capital-intensity, on average).

[241] *See generally* Jäger et al., *supra* note 240.

[242] Kathleen Thelen, *Regulating Uber: The Politics of the Platform Economy in Europe and the United States*, 16 Persp. On Pol. 938, 939 (2018) [hereinafter Thelen, *Regulating Uber*]; *see also* Kathleen Thelen, *Transitions to the Knowledge Economy in Germany, Sweden and the Netherlands*, 51 Comp. Pol. 295, 300 (2019) (tracing how different coalitional alignments in those nations led to distinct innovation patterns).

lawmakers had already set a high wage floor in the sector.[243] Institutions in all three countries—American liberalism, German corporatism, and Swedish social democracy[244]—influenced how the new technology was received in each case.

Uses of technology have also differed meaningfully in the retail sector. The emergence of bar code scanners, integrated point-of-sale systems, and supply chain management technologies enabled mega-retailers to drive many smaller players out during the 1980s and 1990s, yet the specific transitions differed across nations. In the United States, Walmart (relatively unchecked by unions or powerful associations of incumbent retailers) implemented a "lean retailing" model that used "dominating relationships with suppliers and workers to strip costs and retailer control over logistics to improve efficiency."[245] In contrast to the American model, in Denmark and Germany, a "relational contracting" model emerged in which retailers "work with workers and suppliers, finding ways to share and reduce long-term costs through worker training, improved productivity, and reduced costs from confrontation."[246] These differences reflected different interest group politics and industrial relations structures within those nations.

Taking a further step back, this account supports some political economists' suggestions that the United States and other liberal market economies have a comparative advantage in "radical innovation," or innovation that "entails substantial shifts in product lines, the development of entirely new goods, or major changes to the production process."[247] Amazon's partial automation of its warehouses, Uber's development of a new means of taxi facilitation, and Walmart's previous revolutions in supply chain management

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[243] Thelen, *Regulating Uber*, *supra* note 242.

[244] *See generally* GØSTA ESPING-ANDERSEN, THE THREE WORLDS OF WELFARE CAPITALISM (1990) (dividing welfare states into three models: "liberal" states such as the U.S. and U.K. that provide meager benefits, "Conservative" or "Christian Democratic" states such as Germany which provide generous benefits to workers in the industrial core, and "Social Democratic" states in Scandinavia that provide relatively universal benefits).

[245] Bartholomew C. Watson, Nations of Retailers: The Comparative Political Economy of Retail Trade (2011) (unpublished Ph.D dissertation, UC Berkeley), https://escholarship.org/uc/item/18z1138t, *archived at* https://perma.cc/3RE2-7262; *see also* ZEYNEP TON, THE GOOD JOBS STRATEGY 37–54 (2014) (discussing "vicious cycle in retail" as overworked employees end up mis-scanning items or not being able to help customers, which harms sales and inventory tracking). Walmart has also taken steps toward a "good jobs" model recently, perhaps in response to higher labor costs driven by minimum wage increases and the affordable care act. *See* Katie Bach et al., *The Financial Case for Good Retail Jobs*, HARV. BUS. REV. (June 26, 2019), https://hbr.org/2019/06/the-financial-case-for-good-retail-jobs, *archived at* https://perma.cc/434S-3GGF (connecting Walmart's recent investment in robotics to its efforts to improve working conditions in its stores).

[246] Watson, *supra* note 245. *But see* Maarten Hermans & Miet Lamberts, Presentation at the 37th International Labour Process Conference, Digitalization in the Belgian Retail Sector: Tensions, Discourses, and Trade Union Strategy (Apr. 25, 2019) (demonstrating changes in Belgian retail sector that parallel U.S. changes, despite substantially different industrial relations systems).

[247] Hall & Soskice, *supra* note 55, at 38–39. The Article uses "suggestion" because Hall & Soskice presented their theory as a framework for subsequent research rather than a fully fleshed-out account of institutional differences.

are all excellent examples. But those efforts also reflect an American political economy that encourages extensive use of low-wage, low-productivity labor, in part by granting extensive legal rights and powers to employers.

These comparative examples also suggest that institutions that give workers more power within the workplace and the broader political economy can encourage a different politics around technology. If required to negotiate with workers over such matters, employers may choose a different mix of productivity-enhancing and power-augmenting technologies. The potential causal mechanism is clear: If power exertion is foreclosed or made more difficult due to labor's countervailing power, profit-seeking employers will invest comparatively more in productivity enhancements. Labor laws are, of course, not the only important institution here. They interact with corporate governance laws, financial regulations, and trade policy, for example.[248] Employee privacy is also likely to be increasingly important, and the different privacy regimes between the United States and European Union, especially after the European General Data Protection Regulation ("GDPR"),[249] may over time lead employers in the two jurisdictions to make divergent technological choices.[250] Nevertheless, it seems clear that worker voice and power at the point of production is necessary to alter the micro-level politics of workplace technology.

B. Democratizing Workplace Technology

Workers and their organizations in the United States have already been pushing for a greater voice in technological change. Part III mentioned call center workers' efforts to set standards around machine-learning-powered supervision. Technology has also been an issue in several recent major strikes. For example, one issue behind the 2018 West Virginia teachers' strike was the state's effort to establish a new health care plan that would give teachers premium rebates if they wore Fitbit-type devices that tracked health metrics.[251] Similarly, when Marriott hotel cleaners went on strike later in 2018, they demanded a voice in how technology was used to manage

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[248] Hall & Soskice, *supra* note 55.

[249] Regulation 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation), 2016 O.J. (L 119) 1.

[250] The magnitude of that effect may depend on whether transnational firms apply GDPR throughout their operations. *See* Anupam Chander, Margot E. Kaminski & William McGeveran, *Catalyzing Privacy Law* 26–27 (U of Colorado Law Legal Studies Research Paper No. 19-25, 2019), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3433922, *archived at* https://perma.cc/9GBC-SVJZ (noting that some but not all multinationals have applied GDPR across their operations).

[251] Jane McAlevey, *The West Virginia Teachers Strike Shows That Winning Big Requires Creating a Crisis*, The Nation (Mar. 12, 2018), https://www.thenation.com/article/archive/the-west-virginia-teachers-strike-shows-that-winning-big-requires-creating-a-crisis/, *archived at* https://perma.cc/YTF2-YTVS.

them. Cleaners had complained about the company's development of a new app that assigned them to clean rooms, often in a random order that made their days more hectic and difficult, and desk staff had concerns about the company's development of check-in and related apps.[252] The eventual contract gave their union the right to be consulted early about the development and adoption of new technologies.[253] The Fight for $15, a major effort to raise minimum wages and to unionize fast food workers, has been arguing for some time that McDonald's corporate is the party with real power over franchisee working conditions and therefore the legal employer of line-level workers, as evidenced, in part, by its use of advanced technologies to manage those relationships.[254] Finally, when tens of thousands of Google employees walked off the job in 2018, the immediate spark for the protests was the revelation that the company had paid a high severance to an executive who had sexually assaulted a subordinate; but many workers were also frustrated at their lack of a voice in the company's decisions to develop new technologies for the military, or technologies that would enable censorship in China.[255]

In each case—teachers, hotel workers, fast food workers, and tech workers—workers were demanding that their companies' development of and use of technology be subject to democratic norms and checks. This final section considers what such a democratic agenda might entail.

Raising minimum standards and expanding the scope of employment: A first set of reforms here would be straightforward: Workers' statutory entitlements around wages and hours could be strengthened. This would respond to companies' use of advanced information technology to keep wages low, or to ensure a faster pace of work. States and/or the federal government could mandate higher minimum wages and could require employers to give workers reasonable notice of schedules and guarantees of steady hours.[256]

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[252] Juliana Feliciano Reyes, *Hotel Housekeeping on Demand: Marriott Cleaners Say This App Makes Their Job Harder*, PHILADELPHIA INQUIRER (July 2, 2018), https://www.inquirer.com/philly/news/hotel-housekeepers-schedules-app-marriott-union-hotsos-20180702.html, *archived at* https://perma.cc/7D9P-49RN; *see also* Sarah Holder, *Why Marriott Workers Are Striking*, CITYLAB (Oct. 19, 2018), https://www.citylab.com/equity/2018/10/why-marriott-workers-are-striking/572923/, *archived at* https://perma.cc/27NW-J47S.

[253] Samantha Winslow, *Marriott Hotel Strikers Set a New Industry Standard*, LABOR NOTES (Dec. 20, 2018), https://labornotes.org/2018/12/marriott-hotel-strikers-set-new-industry-standard, *archived at* https://perma.cc/AGD8-U7WF.

[254] *See* discussion *supra* Parts III.B, III.C.

[255] *See* Brishen Rogers, *Solidarity in Silicon Valley*, BOSTON REVIEW (May 14, 2019), http://bostonreview.net/class-inequality-law-justice/brishen-rogers-solidarity-silicon-valley, *archived at* https://perma.cc/5AYU-C2WR; *see also* Farhad Manjoo, *Why the Google Walkout Was a Watershed Moment in Tech*, N.Y. TIMES (Nov. 7, 2018), https://www.nytimes.com/2018/11/07/technology/google-walkout-watershed-tech.html, *archived at* https://perma.cc/24GE-MZMC.

[256] *See, e.g.*, Sara Eber Fowler & Lynn Kappelman, *As Predicted. . . . On July 1, Oregon Will Become the First State with a Predictable Scheduling Law*, SEYFARTH SHAW LLP: EMPLOYMENT LAW LOOKOUT (June 28, 2018), https://www.laborandemploymentlawcounsel.com/2018/06/as-predicted-on-july-1-oregon-will-become-the-first-state-with-a-predictable-

There is nothing technologically advanced about such mandates, but technology could assist in enforcing them. As discussed above, fissuring is an impediment to enforcement of wage and hour mandates today, and many companies that fissure away workers also use new technologies to monitor the underlying work. Legislatures could respond by expanding definitions of employment under major labor and employment law statutes to capture the relationship between Uber and its drivers, for example, or between McDonald's and its franchisees' workers.[257] Legislatures could also define work relationships in certain sectors as legal employment for purposes of particular statutes, declaring for example that major franchisors are jointly liable for wage/hour violations by their franchisees. Or legislatures and regulators could begin to take technological monitoring and management strategies into account when determining whether a firm employs particular workers. In the case of Uber or McDonald's, for example, evidence that the companies monitor how work is performed, or help to hire or schedule workers, could be presumptive evidence of employment status.[258]

The theory behind such reforms is not that they would prohibit companies from organizing work relationships as they like, nor that they would limit the deployment of new technologies to manage work. Rather, it is that companies should, regardless of the organizational strategy used, have duties toward workers over whom they enjoy substantial economic or operational power. At the same time, reforms that directly raise wages and ensure more predictable scheduling may have beneficial knock-on effects on subsequent technological development. If companies cannot drive wages below, say, $15 an hour, and cannot escape duties to pay workers overtime, they may have greater incentives to use new technologies to enhance productivity, to share productivity gains with workers, and to train workers accordingly.[259]

Data-sharing to encourage enforcement and organizing: Efforts to enhance wage and hour enforcement, and to extend duties across corporate boundaries, would both benefit from an additional reform: ensuring that workers and regulators have reasonable access to companies' data about workers' performance.[260] Once data on workplace performance is gathered

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scheduling-law/, *archived at* https://perma.cc/2DQS-VNQQ (discussing newly enacted Oregon law as well as similar laws passed by municipalities).

[257] The California Supreme Court articulated a broad definition of employment in the landmark 2018 decision Dynamex Operations W., Inc. v. Super. Ct. of L.A., 416 P.3d 1 (Cal. 2018). *See id.* at 35 (establishing "ABC" test for employment for purposes of wage orders promulgated by the California Industrial Welfare Commission).

[258] For ideas along these lines, see ANDRIAS & ROGERS, *supra* note 91, at 16–20 (discussing problems of fissured work in the labor law and collective bargaining context, and suggesting various solutions); Zatz, *supra* note 96, at 288–94. *See generally* Rogers, *supra* note 7 (discussing misclassification suits against Uber and Lyft, and possible solutions); Brishen Rogers, *Toward Third-Party Liability for Wage Theft*, 31 BERKELEY J. EMP. & LAB. L. 1 (2010) (discussing the relationship between supply chain management and employment status).

[259] As noted above, see Bach et al., *supra* note 245, this may already be happening with Walmart.

[260] Current trade secrets law may limit regulators power to do so. *See* sources cited, *supra* notes 115–16.

and analyzed by companies, it is essentially costless to transfer it to regulators or workers. Regulators could use their own algorithms on that data, for example, to spot potential noncompliance with wage and hour or antidiscrimination laws. Workers could potentially use it for the same purposes in private suits, to demonstrate, for example, that a particular hiring practice has a disparate impact on women or people of color, or that an employer has not been paying workers for all hours worked.[261]

Access to such data could also enhance workers' organizing efforts. Gig economy workers, for example, have at times turned off their apps en masse to protest companies' policies.[262] Those protests could be more effective and potent if the workers and organizers had access to data on where other workers are geographically located, for example, so that they could more easily contact them. Similarly, gig economy workers and organizers would benefit from being able to communicate directly with gig economy customers about their concerns via apps, much as picketing workers have rights to speak directly to potential customers of struck companies even when doing so causes some infringement of the company's property rights.[263]

Encouraging organizing and bargaining around technological choices: Another set of reforms would encourage collective bargaining around technology. Such an approach would stand in contrast to two alternative regulatory strategies around workplace technology. One is our existing system, as discussed above, which gives employers near-plenary entitlements to choose technologies. The second involves centralized rule-setting intended to shape the course of workplace technological development directly. For example, policymakers could prevent employers from deploying new monitoring devices, or from using the data such devices generate to develop new al-

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[261] Disclosing this type of data to regulators and/or private parties may of course raise privacy concerns. If the data includes identifying information about particular workers, and the recipient agency is required to share it with other agencies, then workers may fear that their workplace data could be used against them for tax enforcement, or to track down criminal suspects or irregular immigrants. Data breaches are also a risk, of course. These issues are beyond the scope of this Article, but would need to be taken into account at the stage of institutional design. I am grateful to a participant in the Yale Law School Private Law Theory Colloquium for this observation.

[262] *E.g.* April Glaser, *Instacart Workers Are Striking Because of the App's User Interface*, SLATE (Nov. 5 2019), https://slate.com/business/2019/11/instacart-workers-striking-app-user-interface-dark-pattern-design.html, *archived at* https://perma.cc/HQC7-L7WQ; Kate Conger et al., *Uber Drivers' Day of Strikes Circles the Globe Before the Company's I.P.O.*, N.Y. TIMES (May 8, 2019), https://www.nytimes.com/2019/05/08/technology/uber-strike.html, *archived at* https://perma.cc/XVD7-VFHY.

[263] The Supreme Court has found such consumer communications important enough to protect them under the First Amendment even in circumstances where they may have been prohibited by the NLRA, as amended. *See* Labor Bd. v. Fruit Packers, 377 U.S. 58, 71–73 (1964). Another parallel set of cases raised the question whether workers can use employer-provided email for organizing efforts. *Compare* Purple Commc'ns, 361 N.L.R.B. 1050, 1122 (2014) (finding that employees have a right to use their employer-provided email system for Section 7 protected communications around wages, hours, and other terms and conditions of employment), *with* Caesars Entertainment, 368 N.L.R.B. 143, *1 (2019) (overruling *Purple Commc'ns*).

gorithmic management systems or even new forms of automation. Or policymakers could tax robotics or machine-learning-powered systems in order to deter their development.

A risk of centralized rule-setting is that it may thwart beneficial innovations, even from workers' perspectives. In the past, when regulators have restricted the development of specific branches of scientific or technical knowledge—for instance, through restrictions on human cloning—there have been unusually strong moral or ethical considerations, or even an imminent danger to the public.[264] Some of the workplace privacy rules surveyed in Part I.B, such as protections for individuals' health data and social media passwords, have been motivated by these sorts of considerations, and rightly so. At the moment, however, the most prominent worries about automation relate not to safety but rather to fears that the pace of automation will spiral out of control. As Part II argued, those fears appear overblown. As a result, policies that seek to deter automation by taxing it, or restricting employers' access to work-related data, may do more harm than good. For many workers, the best-case scenario is for task automation to displace fairly rote or boring tasks, and for employers to invest in upskilling and technologies that complement labor. Moreover, to the extent that automation enables production of goods at lower net energy cost, it will assist in the transition to a green economy.

A democratization strategy, in contrast, would empower workers to consult on or bargain over employers' technological decisions. Such a strategy may be most productive where workers themselves are well-placed to understand both the costs and benefits of new technologies and may be able to respond to them in a more nuanced fashion than regulators. Workers' optimal bargaining approach when an employer seeks to implement a new technology would vary based on the circumstances. Sometimes their best move would be to block uses of technology that seem likely to drive down wages or undermine their autonomy, as often occurs with data-driven fissuring. In other cases, workers might trade off more intense supervision for other goods. For example, warehouse workers might permit new monitoring devices and a somewhat faster pace of work as long as they enjoyed higher wages in exchange. In still other cases workers would welcome new technologies and help their employers determine how best to use them. Ride-sharing drivers might welcome GPS guidance so long as they are free to deviate

[264] Conversely, once certain technologies are developed and deployed, it may be too late to mitigate or even shape their social impact. As Langdon Winner argued, the nuclear bomb is a clear example: it needs to be managed by a "rigidly hierarchical chain of command" to avoid accidents and misjudgments. Winner, *supra* note 13, at 131. While the nuclear bomb is perhaps a singular case, facial recognition technology, human cloning, and even global social media may have similar characteristics: Once in use at scale, they may have negative social and political consequences that cannot be unwound. This suggests that many technological decisions cannot be left to the sort of co-determination process outlined in this final Part, and that there remains a substantial role for general precautionary regulations. I am grateful to Paul Ohm for this observation.

from a proposed route or have means of communicating that the guidance is somehow flawed. Such collaboration, however, requires a degree of trust that is very hard to achieve in nonunion, low-wage enterprises today.

Lawmakers could nevertheless encourage this sort of bargaining through reforms to our labor and employment laws.[265] For example, Congress could make it far easier for workers to unionize in the first place and alter rules around appropriate subjects of bargaining so that companies would need to bargain over most or all technological changes and associated workplace reorganizations.[266] Nearly every aspect of workplace technology discussed above, including firms' abilities to monitor work, reorganize work, and terminate workers at will, could be opened to democratic debate by such reforms.[267] Congress could also guarantee all workers some rights to engage with their employers over technological changes, regardless of their unionization status. As noted in Part IV.A, German works councils have such rights, though they have no rights to strike.[268]

There are downsides to establishing such rights: They may enable workers to block their employers from developing or implementing productive technologies in some cases, placing those employers at a competitive disadvantage. What's worse, it often will not be clear *ex ante* whether a particular technology is more likely to enhance or undermine labor standards.

But those challenges do not necessarily undermine the case for reform. In many cases, the optimal use of technology will need to be worked out in practice, and worker voice can help ensure that power-augmenting uses are foreclosed or minimized. Any comparative disadvantage suffered by unionized firms could also be mitigated if collective representation were the norm rather than the exception. For related reasons, a growing number of scholars and activists in the United States are now proposing that our labor laws be

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[265] For a kindred proposal from the 1970s, see James C. Oldham, *Organized Labor, the Environment, and the Taft-Hartley Act*, 71 MICH. L. REV. 935, 1029–40 (1973) (proposing legal reforms to enable unions to bargain over the environmental effects of their employers' production processes).

[266] For a summary of recent proposals to ease the organizing process, see ANDRIAS & ROGERS, *supra* note 91. For further details on the distinction between mandatory and permissive bargaining subjects, and potential reforms to enable more bargaining on permissive subjects, see generally James R. Rasband, *Major Operational Decisions and Free Collective Bargaining: Eliminating the Mandatory/Permissive Distinction*, 102 HARV. L. REV. 1971 (1989); Donna Sockell, *The Scope of Mandatory Bargaining: A Critique and a Proposal*, 40 INDUS. & LAB. REL. REV. 19 (1986).

[267] Such reforms could also encourage workers to form new sorts of unions, and to organize through new communications tools such as social media. *See* Brishen Rogers, *Social Media and Worker Organizing Under U.S. Law*, 35 INT'L J. COMP. LAB. L. & INDUS. REL. 127, 143–49 (2019).

[268] *See* Dimick, *supra* note 70, at 688, n.49; *see also* European Trade Union Institute, Workplace Participation: Germany, worker-participation.eu, at https://www.worker-participation.eu/National-Industrial-Relations/Countries/Germany/Workplace-Representation, *archived at* https://perma.cc/A2UV-ZL3F (summarizing legal rights of German works councils).

reformed to encourage sectoral bargaining.[269] That may be especially important for workers in sectors such as fast food, hospitality, retail, and logistics, where low wages and fissuring are today the norm, but where current industrial structures make worksite- or firm-based collective bargaining difficult to obtain and not very effective.[270] Debates around sectoral bargaining have largely focused on its effectiveness at setting a wage floor. But doing so, and thereby moving distributive conflict outside the firm, could also pave the way for workers to collaborate with firms more readily around technology.

Many details would need to be worked out: how to define industrial sectors, how to appropriately balance workers' rights to exercise voice over technological change with employers' need for some flexibility, and the appropriate balance between local and sector-level negotiations. The core idea, however, is clear: Granting workers some rights to help shape the course of workplace (and perhaps firm- or even sector-level) technological change may have substantial positive effects on wage equality and broader patterns of social equality, and may also encourage, over time, more high-wage, high-productivity production strategies.

To be clear, such reforms cannot ensure a fulsome worker voice in technological change on their own, nor can they ensure economic equality more generally. They would need to be coupled with other reforms to the fundamental terms of the employment relationship, perhaps including guarantees of cause prior to dismissal or broader privacy rights in employment that could be waived or mitigated in collective bargaining.[271] Ensuring decent work in today's economy may also require industrial policy that encourages the creation of large numbers of mid-skill and high-skill jobs in leading sectors as well as training efforts that prepare workers for such jobs.[272] Such efforts may be especially important to ensure that a significant segment of workers are in sectors where significant and ongoing productivity gains are

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[269] *See, e.g.*, ANDRIAS & ROGERS, *supra* note 91, at 4; SHARON BLOCK AND BENJAMIN SACHS, CLEAN SLATE FOR WORKER POWER: BUILDING A JUST ECONOMY AND DEMOCRACY (2020), https://assets.website-files.com/5ddc262b91f2a95f326520bd/5e28fba29270594b053fe537_CleanSlate_Report_FORWEB.pdf, *archived at* https://perma.cc/2824-BC27; Dylan Matthews, *The Emerging Plan to Save the American Labor Movement*, VOX (Sept. 3, 2018), https://www.vox.com/policy-and-politics/2018/4/9/17205064/union-labor-movement-collective-wage-boards-bargaining, *archived at* https://perma.cc/VD6C-PQPX.

[270] *E.g.*, ANDRIAS & ROGERS, *supra* note 91, at 5–6.

[271] Such a provision would parallel unionized workers' ability to waive certain statutory rights under the Fair Labor Standards Act pursuant to a collective bargaining agreement. *See, e.g.*, 29 U.S.C. § 207(b) (2010) (providing for certain exceptions to overtime pay requirements where work hours are set via collective bargaining agreement).

[272] *See* Dani Rodrik & Charles Sabel, *Building a Good Jobs Economy*, POLITICAL ECONOMY AND JUSTICE (Allen, D., Benkler, Y., and Henderson, R. eds., forthcoming 2021); *see also* Dani Rodrik & Charles F. Sabel, *An Industrial Policy for Good Jobs*, SOC. EUROPE (June 12, 2019), https://www.socialeurope.eu/an-industrial-policy-for-good-jobs, *archived at* https://perma.cc/WD2E-K684; *see generally* MARIANA MAZZUCATO, THE ENTREPRENEURIAL STATE: DEBUNKING PUBLIC VS. PRIVATE SECTOR MYTHS (2013) (outlining history of public investment in innovation and proposing expansive public investment in green technology and other forms of industrial policy); TODD TUCKER, ROOSEVELT INST., INDUSTRIAL POLICY AND PLANNING: WHAT IT IS AND HOW TO DO IT BETTER (2019).

possible.[273] Complementary reforms to antitrust law and policy may also be warranted to alter the balance of power in the political economy, including by limiting the size and scope of the tech giants.[274]

Before closing, it is worth comparing this strategy to another high-profile proposal to deal with technological change and even wage stagnation: an unconditional basic income, or UBI. Many in public-facing debates have encouraged policymakers to consider a UBI due to fears of looming technological unemployment.[275] As should be clear from the argument above, while there may be sound reasons to embrace a UBI, imminent technological unemployment is not among them. More generally, a UBI may have little effect on labor politics, since employers' powers over workers are legally overdetermined.[276] A strategy of democratization may be a better solution to workplace power disparities. Such an effort should also be coupled with more universal benefits, including health care, and with greater investment in public goods such as education, housing, and transportation, so that even low-wage workers have access to the resources and services they need to thrive. While a UBI or cognate policies may be necessary in the long term to ensure a decent standard of living for workers in sectors where substantial productivity increases are more difficult to generate, and/or for those unable to work,[277] rebuilding state regulatory capacity and institutions of countervailing power are likely higher priorities in the meantime.

Conclusion

Firms are using advanced information technologies to change work—but not in the ways that many believe. The pace of automation has not increased in recent years, and it seems unlikely that it will soon displace tens

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[273] *See* Rodrik & Sabel, *Building a Good Jobs Economy supra* note *272* (proposing reforms along these lines); *see also* Ton, *supra* note 245 (arguing that productivity can be significantly increased in the retail sector through worker training and changes to business strategy).

[274] *See generally* Lina M. Khan, *Amazon's Antitrust Paradox*, 126 Yale L.J. 710 (2017) (arguing that consumer welfare standard in antitrust is a poor fit for contemporary markets); Lina Khan & Sandeep Vaheesan, *Market Power and Inequality: The Antitrust Counterrevolution and its Discontents*, 11 Harv. L & Pol'y Rev. 235 (2017) (arguing that market concentration may encourage greater economic inequality).

[275] *See generally* Ford, *supra* note 4; Stern with Kravitz, *supra* note 4.

[276] *See* discussion *supra* Part I.B; *see also* Brishen Rogers, *Basic Income and the Resilience of Social Democracy*, 40 Comp. Lab. L. & Pol'y. J. 199, 213–16 (2019); Brishen Rogers, *Basic Income in a Just Society*, Bos. Rev. (May 15, 2017), http://bostonreview.net/forum/brishen-rogers-basic-income-just-society, *archived at* https://perma.cc/38PV-L6Q8; De Stefano, *supra* note 5, at 35–36 (arguing that UBI is limited in its capacity to increase workers' bargaining power within the firm due to laws protecting managerial prerogatives).

[277] I am grateful to Neel Sukhatme for pressing me on this point. There are overlapping arguments for welfare policy reforms based in critiques of the historically gendered division of care work and the enormous quantity of unpaid work, typically performed by women, that labor market regulations typically ignore. *See*, *e.g.*, Noah Zatz, *Supporting Workers by Accounting for Care*, 5 Harv. L & Pol'y. Rev. 45, 45–48 (2011); Noah Zatz, *Care Work In & Beyond the Labor Market*, LPEBlog.org (Dec. 6, 2019), https://lpeblog.org/2019/12/06/care-work-in-beyond-the-labor-market/, *archived at* https://perma.cc/D2FH-R4VX.

of millions of workers. However, companies can use (and are using) new technologies to disempower workers in other ways, including through algorithmic management and the fissuring of employment. Firms' abilities both to develop such technologies, and to use them to disempower workers, is in large part a function of our labor and employment laws—including the fundamental rules governing the employment relationship, workplace privacy rules, and workers' rights (or lack of real rights) to unionize and bargain collectively. Policy reforms to give workers a greater voice in workplace technology could right the balance, encouraging employers to use data-driven technologies to enhance productivity rather than to disempower workers.