

Technology and the Future of Work: The State of the Debate

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EXECUTIVE SUMMARY

The changing nature of work in the 21st century and the widening gap in income has led to a vibrant debate about the role of technology in shaping future labor markets and overall economic well-being. For at least a decade, the debate had two clear sides: a) that technology inevitably drives the polarization of the labor market and growing income inequality or b) that the hollowing out of American jobs is the result of a host of policies that have put downward pressure on wage growth and job creation. Recently, we have seen a more balanced view emerge: technology, alongside poor policy choices, has played and could well continue to play a significant role in reducing both the political and workplace power of American workers. As a result, newer research questions have arisen: How has technology shaped not just the number of jobs but also the nature of work? How will new economic opportunities (or constraints) affect people of color, young people, and others who have traditionally faced discrimination or lacked opportunity? And how can we develop policies that seek to balance the creation of good jobs with an acknowledgement that sharing economies, second economies, and other very different structures are presenting challenges as well as opportunities for workers? The ultimate question, then, is not only whether it will “be different this time,” but also how, precisely, technology will change life for various kinds of American workers.

INTRODUCTION

Over the last few years, a debate around technology and the future of work has captured media and academic attention: What is the effect of rapid technological change on the number and quality of jobs, the nature of work, and the structure of labor markets? The positions of scholars, technologists, and practitioners differ widely, not only in their diagnoses and policy conclusions but, more basically, in their focus and timeframe. This disconnect has led to some disagreement and confusion.

This review is an attempt to frame the various arguments and bring clarity to the differences and shared conclusions. The first section of the review will outline the leading theories regarding the effect of technological change on inequality and labor markets over the last 35 years. We will then turn our focus to the future, looking at new questions that have arisen as thinkers project technology's impact on tomorrow's work and workers.

I. TRENDS AND TECHNOLOGICAL FACTORS IN TODAY'S INEQUALITY

The labor market trends of the last 35 years have raised troubling questions about the health of the overall U.S. economy and the American social contract, which in the 20th century depended on the availability of good jobs (with high enough wages to support a family as well as health care and retirement benefits), to deliver on its promise. There is clear evidence that American household incomes are failing to grow. Census Bureau data shows that median household incomes in 2012 (\$51,017) were lower than in 1989 when adjusted for inflation (\$51,681). Since 2000, incomes have fallen for workers of all education levels: high school dropouts, high school graduates, individuals with some college, college graduates, and even individuals with non-professional master's degrees.¹ The outcomes are worse for the demographic groups that have been traditionally disadvantaged including African Americans, Latinos, and young people. To cite just one example, black households were hit twice as hard in the aftermath of the Great Recession than white households, losing 10.1% of their income as compared to 5.4%. And black families earned 61% of white family income in 2010, an even lower percentage than in 2000.²

A deeper look at job statistics since 2000 reveals concerning trends around long-term unemployment and labor force participation, with the lowest number of Americans working or looking for work in 35 years. The long-term trend of declining wages and low workforce participation does not seem to be attenuated by recent economic growth. Despite consistently rising labor productivity, median wages have stagnated. While the average productivity of workers has doubled since 1970, wages for many workers have barely increased, and yet the incomes of the top 1 percent have soared, increasing by 170 percent. Top earners have claimed a huge share of those productivity gains.³ Again, all of these numbers are worse for traditionally disadvantaged groups. For example, Latino median wealth in 2010 was \$1,300, and black median wealth in 2010 was \$4,900, as compared to white median wealth of \$97,000.⁴

The combination of productivity growth and wage stagnation poses a deep economic puzzle: Why are the benefits of growth and productivity not flowing to workers? The debate, for the last ten years, has posed many important questions about the role of technology in shaping employment outcomes, and today's inequality, for a wide range of workers. The skill-biased technology hypothesis and theories around job polarization have highlighted the role of technology in causing job loss at the bottom of the wage scale and hollowing out the middle class. Others have pointed to political and institutional factors, including the low minimum wage, de-unionization, the growth and waste of the financial sector, deregulation, and taxation.

Is Technology a Driver of Wage Stagnation?

In the 1990s, scholars developed a line of thinking dubbed “skills-biased technological change.” They argued that technology was creating jobs that continually required greater skills, which people could gain through college education or other skill development. According to proponents of this theory, this process creates a “race” of sorts, most notably outlined by Claudia Goldin and Larry Katz in *The Race Between Education and Technology*.⁵ The race, the results of which determine the “return,” or value, of attending college or acquiring skills, is between how quickly technical change happens and how quickly (and well) human capital is improved as measured by supply of skills to the labor market (e.g. people with college educations). Goldin and Katz argue that, up until the 1980s, the best way to ensure a relatively equal society was to educate more people to fill a rising demand for skilled labor. To promote more equal outcomes, education needed to stay ahead of the technology curve.

A variation on this school focuses on job polarization, or the role that technology has played in “hollowing out” the middle class. The argument is that the large majority of middle-skill, middle-wage positions consisted of routine tasks that computer programmers were able to capture in code, which made these jobs easy to automate. As David Autor and David Dorn have pointed out, “Logically, computerization has reduced the demand for these jobs, but it has boosted demand for workers who perform ‘non-routine’ tasks that complement the automated activities. Those tasks happen to lie on opposite ends of the occupational skill distribution.”⁶

The job polarization theory suggests that with education, creative workers will continue to have strong job prospects; demand for their work is strong, and wages should remain high. But for workers without a college education, who in the mid-20th century could stable jobs with benefits and good salaries, prospects are dim. Indeed, we have seen that non-college-educated workers are becoming much more concentrated in low-wage, low-skill jobs.

While concerned about the downward impact on wages and the rise in low-income work, job polarization scholars remain optimistic about technology’s impact on unemployment, noting that “overall employment rates have largely been unaffected in states and cities undergoing this rapid polarization. Rather, as employment in routine jobs has ebbed, employment has risen both in high-wage managerial, professional and technical occupations and in low-wage, in-person service occupations.”⁷ In this conception, the economy will continue to create good, high-wage jobs, and education could provide a pathway to stable employment for many.

Importantly, both Autor, a leading proponent of job polarization, and the theory’s leading critics, including Heidi Sheirholz, Larry Mishel, and John Schmitt, have observed a breakdown in these trends in the 2000s. Since 2000, employment growth has been concentrated in low-skill, low-wage jobs while wage growth has occurred almost exclusively at the top. This has begun to raise significant questions about the validity of job polarization as an overall explanation for rising inequality since 2000.

Are Policy and Politics the Key Causes of Inequality?

Some economists explain job loss and wage inequality over the last several decades very differently. Most prominently, Mishel, Shierholz, and Schmitt argue that technology fails to explain the story of wage inequality in America. Instead, in a 2013 paper Mishel et al. use Current Population Survey data to explain that while the technology may have driven an increased need for education and skills, this need has largely been met by an increased supply. They instead blame U.S. wage inequality on economic policy.⁸ A variety of policies—macroeconomic, trade, finance, and labor market-specific—have affected workers differently depending on which part of the wage distribution they inhabited.

Other economists, most notably Dean Baker and Joseph Stiglitz, have also suggested that technology's role in causing inequality is overstated. Instead, as Stiglitz says, "inequality is a choice." Stiglitz, in particular, views technological change not as exogenous but rather as a product of the rules and regulations guiding investment. The current policy regime encourages labor-reducing innovation, Stiglitz says, whereas policy changes could push investment toward, for example, carbon-reducing technology that would lead to job creation.⁹ Further, inequality has been worsened by tax cuts for the rich, the deregulation and financialization of the U.S. economy, and the associated underinvestment in infrastructure, education, health care, and the social safety net. Weak corporate governance, financial engineering, and excessive rent-seeking reinforce an ever-growing gap in incomes and wealth.

Baker echoes the arguments of Mishel et al., pointing to the weakening of labor market institutions, including the decline in union representation, which has dropped from 20 percent of the private sector in the mid-1980s to less than 7 percent in 2014. Industry deregulation—trucking, telecommunications, and airlines—has further forced down the wages of millions of workers who had previously held middle-class jobs. In addition, trade agreements have opened up manufacturing labor markets with different standards and exposed workers to competition. Finally, the minimum wage has failed to keep up with inflation. All of these labor market factors have contributed to the decline in wages of less-educated workers.¹⁰

Most recently, Larry Summers and others have noted that we do not see the data that would indicate technology is the driver of slack labor markets. Not only has productivity stagnated, but also, Summers argues, if there were a major wave of labor-saving technology development, we might expect to see a short-term increase in labor demand during this time that has not materialized.¹¹

An Emerging Third Perspective: Technology as Shaper, Not Determinant, of Work

Recently, a third view has emerged that bridges these two schools. This view is that the prevailing explanations for wage stagnation and rising inequality that we have described are not entirely unrelated. Certainly there is an interaction between multiple variables: not only technological change but also declining union power, deregulation, and the growth of the

financial sector. Certainly, technology is a factor in job change and in the evolution of markets. But technology does not just mean automation or robots. It is more useful to see changing trends in technology as underlying and enabling a vast reorganization of both corporations and the overall economy. This reorganization has a number of different potential consequences.

This view holds that, in the last decade or so, technology has played a huge role in the shift to service by making manufacturing less labor-intensive and has inherently made workers generally less “valuable” to firms. This plays out in simple technologies like communication and transportation, both of which allow for geographic dislocation. It also continues to play out with scheduling software, which makes it easier to limit hours and optimize schedules to reduce costs; recruitment software, which makes it much easier and less intensive to fill positions; and analytics software, which can track performance, efficiency, and ultimately whether a human worker is cost-effective. Thus, technology has played an important role in changing the nature of work and can serve as an explanatory mechanism for why policy fell so far behind so fast.

The weak position of the American worker today is enabled by technology and is clearly also a matter of political will and political choice. Yet the deck seems stacked against building that power, in part because technology has helped place workers in increasingly untenable bargaining positions. Looking backward, we can acknowledge that technology has played an important and nuanced role in the rise of inequality over the last 35 years, though it is not the only factor. The larger question is how technology will shape the future for American workers.

II. FORECASTING THE FUTURE OF WORK: MORE NUANCED LINES OF DEBATE

One important point about the debate over technology and inequality is that almost all of it attempts to explain the status quo today, but not necessarily tomorrow. In particular, the argument made by Mishel et al. uses data through the 2000s to suggest explanations of the recent past. To understand how technological change will affect employment in the coming decades, we need to extrapolate beyond existing, backwards-facing data.

We have identified four major streams of debate around the future impact of technology on the labor market.

1. First, a segment of research is dedicated to the question of how significantly technology will continue to change and the degree to which this will reshape the economy. While some theorists predict a technological transformation on par with the Industrial Revolution, others argue innovation is, in fact, dwindling.
2. Second, scholars following the skill-biased technological change tradition focus on breaking down the specific capabilities of technology to see what tasks and jobs may be automated and what effect this will have on the distribution of workers throughout the labor market.

3. A third group, primarily “institutionalists,” is concerned that entertaining the question of technological change as a past or future cause of inequality is a distraction from a more important focus on policy.
4. Fourth, a group of academics focuses less on the skill breakdown of new technologies replacing workers and more on the systemic ways in which technological change may continue to transform the underlying structures of our economy and therefore, inherently, affect all facets of the economy.

These debates are playing out as outlined below.

Debate #1: Technology Optimists vs. Pessimists

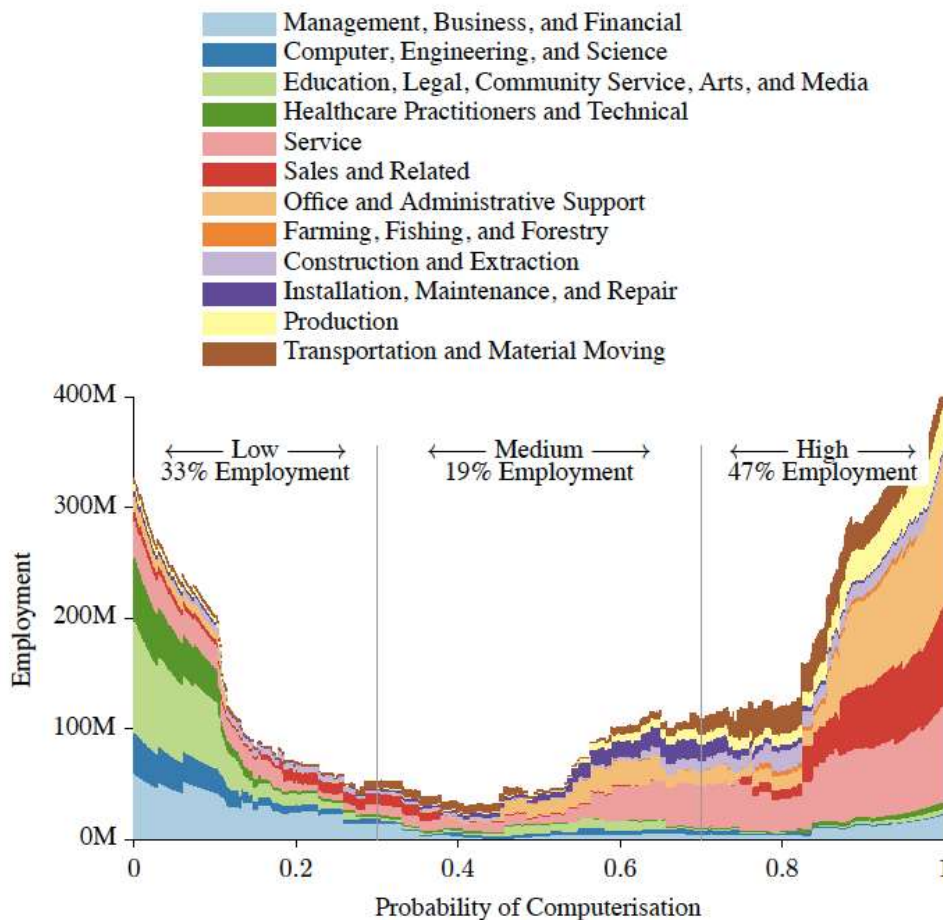
Some researchers argue that the effect of technology on the future of jobs is overblown. Robert Gordon, for example, argues that the “post 1972 pace of technological change peaked in 1996–2000.”¹² Other trends—demographic shifts, declining educational attainment, and the rising ratio of debt to GDP—are far more significant. And the innovations that some technologists herald as world-changing—medical advances, robots, 3D printing, big data, and driverless vehicles—are in fact anything but, and pale in comparison to previous technological revolutions. Gordon suggests that these innovations and nearly all others in the modern age still rely on a truly great innovation: electricity. Thus, techno-optimists overstate the impact of current technologies and misuse the definition of general-purpose technology, which should be reserved for inventions such as electricity rather than computers or networks.

Others, most notably MIT’s Erik Brynjolfsson and Andrew McAfee, argue, in contrast to Gordon, that we are on the cusp of an inflection point at which the exponential powers of Moore’s Law mean that innovation will lead to wide-scale disruption. It is possible that it will indeed “be different this time.” Despite history’s lesson that the Luddites have been wrong and that technology ultimately creates jobs, newer technologies may be completely disruptive. Brynjolfsson and McAfee point to next-generation technologies, including advancements in artificial intelligence, automated vehicles, robotics, 3D printing, and nano-technology, that are currently in their infancy and could radically change the modern economy, from services to transportation and manufacturing. Thus, technology is capable of creating unemployment if left unchecked.¹³ They further argue that the falling cost of technology and advances in computing power and machine intelligence will allow more and more jobs to be replaced by automation. Such an impact is likely to be pervasive “in every industry and function across the economy, from retail and financial services to manufacturing and marketing.”¹⁴ Jobs that once seemed safe from automation because they involved complex tasks, such as cooking and driving, are now being performed without human assistance, and associated products are on the verge of becoming commercially viable.

Brynjolfsson and McAfee are not alone in their predictions. Jeffrey Sachs and Laurence Kotlikoff suggest that technology is already replacing, not complementing, unskilled labor, and the possibility of ever-smarter technology replacing more high-skilled workers could create

significant havoc in the labor market.¹⁵ Larry Summers points out that technology is permitting large-scale substitutions.¹⁶ James Huntington and Jaron Lanier both suggest that technology will limit the number of jobs and that the American economy will fail to provide the amount needed for full employment.^{17,18} Gary Marcus, a neuropsychologist, suggested “there is no causal mechanism, physical, economic, sociological, or legal, that guarantees that new jobs will always come into existence.”¹⁹

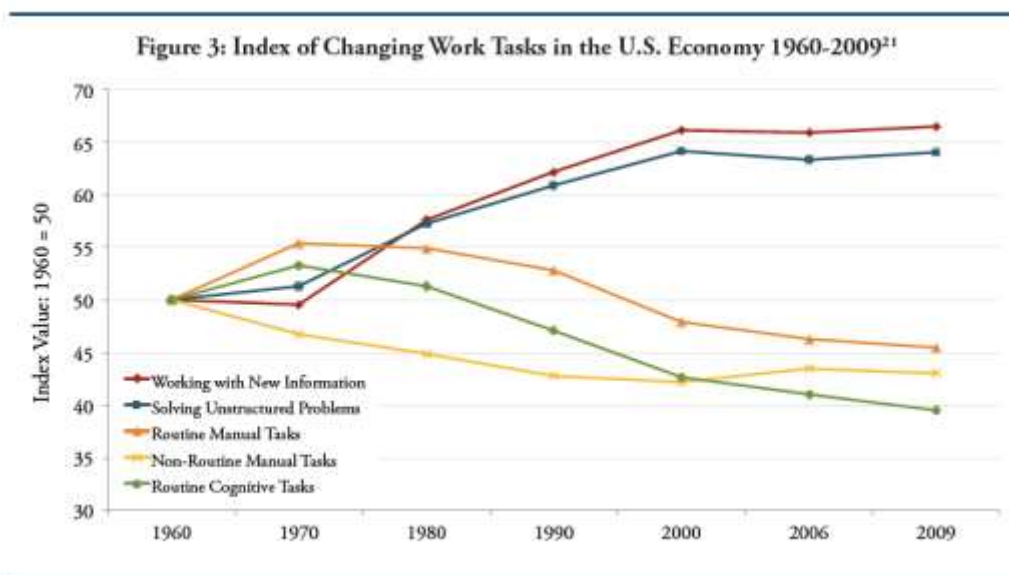
Carl Frey and Michael Osborne have attempted to quantify the potential effect of automation if technological change progresses as rapidly as predicted by the techno-optimists. Frey and Osborne point to advances in data mining, machine vision, computational statistics, mobile robotics, and other fields of artificial intelligence as a reason to reconsider the limited task assignments of the job polarization literature. While the traditional task model suggests that automation will be limited to routine tasks, Frey and Osborne suggest, boldly, that any non-routine task could be automated if there are no significant engineering bottlenecks.²⁰ Driving a car, deciphering handwriting, and other “non-routine” tasks could be done by computers. Frey and Osborne’s “probability of computerization” estimate is below.



In a headline-making number, Frey and Osborne suggest that 47 percent of all U.S. employment is at high risk of automation over the next two decades. The occupations they single out include transportation and logistics, office and administrative support, and additional manufacturing and production jobs. Perhaps most troubling, Frey and Osborne predict that a number of service occupations including food service and retail jobs, where the economy is likely to continue to grow, are also vulnerable to automation.

Debate #2: Specific Tasks Matter

The second strand of the future-oriented conversation is more focused on specific tasks. What are the specific job functions most and least likely to be automated, and what are the resulting compensation effects along the skills spectrum? Frank Levy and Richard Murnane, whose visualization of work tasks is below, argued in “Dancing with Robots” that human work can be divided into three types of tasks: “non-routine manual tasks, solving unstructured problems (car repair), and working with new information (determining a customer’s Internet problem).”²¹



Levy and Murnane note that computers will ultimately perform nearly all “tasks for which logical rules or a statistical model lay out a path to a solution,” including “complicated tasks that have been simplified by imposing structure.”²² However, they predict a continued high demand for people in solving complex tasks that require the creative integration of many pieces of new information. Policy recommendations here focus on education; Levy and Murnane argue that we need to innovate in order to teach people the kinds of creative problem-solving at which human beings will continue to excel.

Similarly, Autor and Dorn argue that middle-skill jobs will continue to exist since many of them consist of a combination of tasks that require adaptability, common sense, and a service orientation, and therefore can’t be easily unbundled. Further, “Labor-saving technological

change necessarily displaces workers performing certain tasks — that’s where the gains in productivity come from — but over the long run, it generates new products and services that raise national income and increase the overall demand for labor. In 1900, no one could foresee that a century later, health care, finance, information technology, consumer electronics, hospitality, leisure and entertainment would employ far more workers than agriculture.”²³

Debate #3: Maintain Focus on Politics, Policy, and Institutions

Many of the “institutionalists,” who don’t see technological change as a driver of current U.S. wage stagnation, agree that technology poses real challenges but continue to encourage a focus on policy and politics. Baker, for example, writes that “there is no basis for believing that the natural development of technology will lead to mass unemployment and declining income shares for the bulk of the working population. If we face a threat from a continuation and possible acceleration of the upward redistribution of income that we have seen in the last three decades it is due to institutional structures that have been put in place for this purpose. These structures can be altered to ensure that the gains from technology are broadly shared, if there is the political will.”²⁴ The concern for many, including Stiglitz and Mishel, is that as we look to the future, we pay careful attention to the intersection of technological change and policy—and that we not let the technology debate distract us from the very difficult work of making tax, regulatory, trade, and other policy changes that will, they argue, positively affect U.S. workers and labor markets.

Debate #4: New Forms of Work and the Rise of the Second Economy

The final strand of the future-oriented debates that we examine here looks at the more subtle ways that technology shapes jobs and the economy. The arguments in this strand have taken many forms, from the emergence of a shadow “second economy” to a set of questions about how new the “new economy” really is.

W. Brian Arthur, writing for McKinsey, argued in 2011 that over time a second, distinct economy driven by 21st century technologies has been emerging. Behind the physical economy where things are made, built, and consumed, there is a growing digital economy: “constant conversation among multiple servers and multiple semi-intelligent nodes that are updating things, querying things, checking things off, readjusting things, and eventually connecting back with processes and humans in the physical economy.”²⁵ John Zysman and Martin Kenney, similarly, describe emergence of cloud computing as an “enabler for the creation of entirely new workplaces and new markets for work.”²⁶

The nuance in Arthur and Zysman and Kenney’s arguments is not recognition of the networks, but in the way networks may grow, largely out of the spotlight, to take a more central role in the economy and shrink the size of the physical economy. While Arthur acknowledges that at this point in time the digital economy is not actually producing much, he notes that it is orchestrating much of the economy, from supporting architects in designing buildings to

coordinating major logistics operations to guiding laparoscopic surgery. Over time, we would expect to see the nature and scope of much human work change as a result.²⁷ Some researchers, like Lilly Irani and Mary Gray, raise concerns about the quality of work for “data janitors,” those who work in tech-mediated environments like Amazon’s Mechanical Turk.²⁸

Note that this second economy has been undetected in statistics for the most part, largely because the economics of 21st century digital technology is quite different from previous technologies that have impacted the labor market at a broad scale. The unique nature of digital goods makes it very hard for us to track the actual impact of these innovations and developments. Our current measure of national output, GDP, does a poor job of measuring the Internet and generally struggles to track the true value of tech-enabled services. This leaves us without a clear picture of the true effects of technology.

Technology has also led to changing employer–employee relationships. Annette Bernhardt remains skeptical that contingent, part-time work is as widespread as some would have it.²⁹ But there is little question that new technologies have allowed employers to reduce labor costs by, in Michael Spence’s words, “reducing transaction costs often at the expense of traditional employer–employee relationships.”³⁰ Businesses can now employ workers for short periods of time and in detached agreements, as we can see throughout the sharing economy.

Finding ways to replicate this success and eliminate labor from the business model completely is the focus of many emerging entrepreneurs and start-ups. Narratives coming from both investors and managers—most notably Barclays executive Steven Berkenfeld, who has organized working groups around this issue—largely support this theory.³¹ Other thinkers and practitioners, including Saket Soni, Denise Cheng, Arun Sundarajan, and Michelle Miller, have begun to ask a number of questions about the sharing economy, the “gig economy,” and the precarious nature of work in these new market structures. How do flexibility and uncertainty trade off for workers? Are some sharing platforms more passive, allowing users to earn money from goods that would otherwise lay fallow, while others are more active, requiring constant and perhaps unsustainable levels of work? How does one provide workers benefits—health care, retirement— in the newer tech-enabled economy? And what kinds of regulations do newer models require in order to thrive and balance the common good with business interests?

Additionally, a growing body of work questions the “newness” of the emerging economy, especially for communities faced with historical employment discrimination. Many boosters of the emerging platform-based economy suggest peer-to-peer models can circumvent traditional power structures designed to disenfranchise communities and can, in fact, provide new opportunities to the traditionally disadvantaged, whether they be women, youth, communities of color, or former prisoners. But others, including Color of Change’s Rashad Robinson, question this. “In reality, the sharing economy often relies on and replicates old patterns of privileged access for some and denial for others. At a recent conference on these new forms of commerce, I asked, ‘Will this just be another expression of an extractive economy?’”³²

Lori Lobenstine and Kenneth Bailey of Design Studio for Social Intervention find little new about the “new economy” other than the fact that the regulatory structure is now being shaped to condone behavior that has been traditionally condemned when manifested in communities of color. For Lobenstine and Bailey, the “sharing economy” has a long history in disenfranchised communities forced to “hustle” and “innovate” to survive. The primary difference between tech-driven ride-sharing and the gypsy cab drivers aiming to make extra income is that one model is “hit with anti-competition policies (like no-hailing) and rampant ticketing.”³³

Can technology-driven marketplaces level the playing field for people of color and others? The answer is unclear. In a 2003 study cited by Robinson, African American and Latino customers were better able to secure an equal price for cars via a web platform.³⁴ However, a 2011 study, of peer-to-peer lending found “loan listings with Blacks in the attached picture are 25 to 35 percent less likely to receive funding than those of whites with similar credit profiles.”³⁵ Similarly, a 2014 study of AirBnB listings found that non-Black providers could charge an average of 12 percent more for a similar space than Black providers.³⁶

CONCLUSION

The question of technology’s impacts on work, jobs, and human behavior is age-old. The current debate first became heated as the networked computer revolution became apparent in the early 1990s, and as it evolves, we are seeing newer questions and newer voices emerge. It is clear to many of us that technology has had a role in shaping the current relationship between workers and work and, given the very weak position of workers and worker organizations, is likely to continue to do so. In the face of growing wealth and income inequality, policymakers must develop tools and institutions to support an increasingly insecure workforce.

But additionally, we are seeing new needs that funders, decision-makers, and nonprofits should address head on. How are technology’s subtle changes disproportionately affecting communities of color, low-income and working-class Americans, and both older and younger people (who are at different ends of the age spectrum, and thus differently vulnerable)? As newer market structures emerge, who is working within them, and how? As 20th century manufacturing has disappeared, and as low-wage work becomes dominant, can the Internet be the prevailing work platform or “factory of the 21st century,” for whom, and to what end?

The emergence of a new type of technology produces a unique set of challenges, distinct from and potentially in addition to the challenges already posed by potential automation and disintermediation. In order to ensure future growth and widely shared economic health in a radically shifting economy, we should continually consider new tools and policies that address the range of opportunities and challenges of technological change.

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