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# ICT Innovation, Productivity, and Labor Market Adjustment Policy

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There is increased interest in the issue of how to facilitate labor market adjustments from technological innovation. Some of this interest appears to be a result of efforts to try to respond to the recent increase in populism from both the right and the left, fueled, as some believe, by labor market insecurities. Some are due to the weak global labor market performance in the wake of the Great Recession, where tens of millions of jobs were destroyed, and job creation has been tepid. And some is due to the belief that technological change, particularly in the information and communications technology sector (ICT) is fueling (or about to fuel) rapid productivity growth and accompanying job loss. Regardless of the reasons for interest, improving worker adjustment policies in the United States is long overdue. The alternatives—doing relatively little—risks not only increasing opposition to ICT-driven technological change but reducing the efficiency of the labor market.

Before making some suggestions to improve adjustment policy it's worth first examining the relationship between innovation and jobs. While productivity growth is the main driver of increases in living standards, in the wake of the Great Recession a growing chorus of voices asserts that economies can no longer afford productivity because it kills jobs. The new narrative is that productivity driven by increasingly powerful IT-enabled "machines" is the

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cause of slow job growth, and in the future accelerating technological change will only make things worse. Many policymakers now believe that they can't afford to support policies that boost productivity because productivity gains come at the expense of needed job growth. If productivity advances come with employment retreat, then policymakers would be well within their rights to be concerned about supporting policies to advance productivity. But fortunately, they need not worry, for there is no tradeoff.

Yet the large and growing chorus of "tech kills jobs" voices persists. Lawrence Summers recently said that he no longer believed automation would always create new jobs. "This isn't some hypothetical future possibility," he said, "This is something that's emerging before us right now."[1] Financial pundit Nouriel Roubini asks forebodingly, "Rise of the Machines: Downfall of the Economy?" Joseph Stiglitz states, "It doesn't have political appeal to say the reason we have a problem [job losses] is we're so successful in technology."[2] Paul Krugman writes: "A much darker picture of the effects of technology on labor is emerging. In this picture, highly educated workers are as likely as less educated workers to find themselves displaced."[3] Moshe Vardi, a professor at Rice University, predicts that with the development of artificial intelligence that global unemployment will reach 50%.[4] Mike Rettig of the Brookings Institution asks with mirth, "Will the last human worker please turn out the lights?"[5] In *The New Yorker*, Gary Marcus writes, "as machines continue to get smarter, cheaper, and more effective, our options dwindle. So, don't bother polishing up that resume, rather here's a link to the unemployment office."[6] Robert Reich argues that robots will "take away good jobs that are already dwindling. They will in short supplant the middle class."[7] Perhaps no one has done more to advance the idea that productivity kills jobs than MIT professors Erik Brynjolfsson and Andrew McAfee. In their popular book, *The Race Against the Machine: How the Digital Revolution Is Accelerating Innovation, Driving Productivity, and Irreversibly Transforming Employment and the Economy*, they write that workers are, "losing the race against the machine, a fact reflected in today's employment statistics."

To start with, all these statements are odd, because if technology-led productivity growth really has been the culprit behind America's anemic job growth since 2009, one would expect that America's productivity growth rate would be higher than normal. In fact, US productivity growth since the end of the Great Recession has been at historic lows—about half the rate before the Great Recession. What the pundits are attributing to anemic productivity growth actually has its roots in the painful and slow recovery from the greatest financial crisis since the Great Depression.

Indeed, historically, there has actually been a negative relationship between productivity growth and unemployment rates. In other words, higher productivity meant lower unemployment. This correlation is shown in the 2011 McKinsey Global Institute report, "Growth and Renewal in the United States: Retooling America's Economic Engine."[8] MGI looked at annual employment and productivity change from 1929 to 2009 and found that increases in productivity are correlated with increases in subsequent employment growth, and that the majority of years since 1929 feature concurrent employment and productivity gains. In looking at 71 10-year slices, only 1% had declining employment and increasing productivity. The rest showed increasing productivity and employment. In looking at 76 five-year periods, just 8% had declining employment and increasing productivity.

In the 1960s, US productivity grew 3.1% per year while unemployment averaged 4.9%. However, during the 1980s, productivity grew just 1.5% while unemployment rates averaged 7.3%. And in the 2000–2007 period, productivity was growing at a healthy 2.7% per year while the unemployment rate was under 5%. But from 2008 to 2015, productivity growth was only 1.2% yet the unemployment rate averaged over 7.5%. Moreover, recently there has been a modestly positive correlation between productivity growth and the labor force participation rate in the 34 Organization for Economic Co-operation and Development (OECD) nations from 2009 to 2015. In other words in nations with stronger productivity, more workers, not less, entered the labor force.

Today's pessimistic views that productivity kills jobs suffer not only from a lack of historical perspective, but also from a fundamental flaw in logic. That flaw is not that people who lose their jobs will get jobs making the new machines. No rational organization spends money to increase productivity unless the savings are greater than the costs. If there are the same number of jobs in the company making the machines as there are lost in the companies using the machines, then costs could not have fallen.

So, it's not that jobs will be created in the new "robot" firms, it's that they will be created across the economy from the new demand that higher productivity enables. To see how, we need to look at second-order effects, something techno-pessimists do not do. If jobs in one firm or industry are reduced or eliminated through higher productivity, then by definition production costs go down. These savings are not put under the proverbial mattress, they are recycled into the economy, in most cases though lower prices or higher wages. This money is then spent, which creates jobs in whatever industries supply the goods and services that people spend their increased savings or earnings on. As a side note, the same logic is true for profits as

well. Even if all the savings went to profits, these are distributed to shareholders who in turn spend at least some of this money, creating demand that is met by new jobs. Even if the shareholders don't spend all of it, the savings reduce interest rates which leads to new capitalized spending (e.g., car loans and mortgages) and investment, which in turn creates jobs in the firms producing this additional output. Moreover, because of competitive pressures in industries, firms don't have unlimited pricing power. If they did, then firms could just raise prices now. Competitive markets force firms to pass savings along in the form of lower prices (or higher wages).

Some will argue that people won't spend the money from lower prices or higher wages, and therefore jobs won't be created. But most Americans would have little problem finding ways to spend their added income if their take-home pay increased from a doubling or even tripling of productivity. In fact, the first thing most would likely do is break out their shopping lists. To see where the new jobs from higher productivity would likely be created, we only have to look at how those in the top-income quintile spend their money versus those in the middle. According to the Bureau of Labor Statistics, top-income households spend a larger share of their income on things like education, personal services, hotels and other lodging, entertainment, insurance, air travel, new cars and trucks, furniture, and major appliances. So, if US productivity doubles, people would spend more than double on these kinds of goods and services, and employment would grow in these industries. Even if productivity were miraculously to increase by a factor of five or even ten, then the vast majority of US households would likely have no problem spending all their added income (either as personal consumption or through higher taxes for public goods, such as a cleaner environment, better cities, or more infrastructure). This is even more true in developing nations where median per-capita income is just $6000. Productivity in these nations could increase by a factor of 50 and still come nowhere near exhausting people's desires for goods and services.

As a recent study by Deloitte notes, technological innovation crates jobs in four different ways.[9] First, in some sectors where demand is responsive to price changes, automation reduces prices but also spurs more demands leading to at least compensating job creation. For example, as TV prices have fallen and quality increased, people have bought many more TVs. Second, jobs are created making the automation equipment. Workers are employed in factories making robots. Third, in some industries technology serves as a complement to workers, making output more valuable, leading to increased demand. For example, as doctors have gained better technology, the demand for health care has increased. Finally, as discussed above, reduced prices from

automation increases consumers purchasing power which creates jobs at the industries they spend their new additional income on.

Not only is the notion that productivity kills jobs rebutted by history and logic, virtually all academic studies on the topic have found that productivity increases do not decrease the number of people working or raise the unemployment rate. If anything, the opposite is true. Trehan found that, "The empirical evidence shows that a positive technology shock leads to a reduction in the unemployment rate that persists for several years."[10] The OECD finds that, "Historically, the income generating effects of new technologies have proved more powerful than the labor-displacing effects: technological progress has been accompanied not only by higher output and productivity, but also by higher overall employment."[11] In its 2004 *World Employment Report*, the International Labor Organization found strong support for simultaneous growth in productivity and employment in the medium term.[12] In a paper for the International Labour Organization's *2004 World Employment Report*, Van Ark, Frankema, and Duteweerd found strong support for simultaneous growth in per-capita income, productivity, and employment in the medium term.[13] A study by Industry Canada's Jianmin Tang found that for 24 OECD nations, "at the aggregate level there is no evidence of a negative relationship between employment growth and labor productivity growth… .This finding was robust for rich or poor countries, small or large, and over the pre- or post-1995 period."[14] The United National Industrial Development Organization finds that in fact, "productivity is the key to employment growth."[15] It goes on to note:

The link between productivity and the creation of jobs is strong but somewhat complex. In a static formulation, employment and productivity are in an inverse relationship: A given quantity of work to be done will require fewer and fewer jobs as productivity increases. In dynamics, though, the relationship is altogether different. Real wages divided by labor productivity is what defines the share of the wage bill in value added. Thanks to this relationship, the share of the wage bill can be reduced without affecting the income of the workers. The larger capital residual stimulates investment and, finally, jobs.[16]

To be sure, this is not to say that in economic recessions productivity might not be accompanied by consumer demand from lower prices and job growth from increased demand, since by definition in these periods, demand is below supply. But the evidence and logic suggest that once demand returns (e.g., when the recession ends) productivity once again leads to compensating job growth. Nor is this to suggest that if productivity is higher than average in some industries—particularly industries with low elasticity

of demand, where lower prices don't lead to accordingly higher sales—that it cannot lead to fewer jobs in those particular industries. But this is very different than the aggregate, economy-wide effects many doomsayers are forecasting.

In summary, even in the face of history, logic and overwhelming scholarly evidence, the "tech kills jobs" true believers remain unconvinced. Even if they acknowledge that productivity hasn't yet killed jobs, for them the future will be different. This is a seductive argument, of course, because there is no way to prove or disprove it.

The doomsayers tell a story about technological change accelerating so much that soon there will be "nowhere left to run": After the super-intelligent robots take our jobs, there will be no new jobs left to create. The narrative is as follows: As automation reduced agricultural jobs, people moved to manufacturing jobs. After manufacturing jobs were automated, they moved to service-sector jobs. But as robots automate these jobs, too, there will be no new sectors to move people into. This argument is not new. Economist Wasily Leontif warned in 1983 that:

> We are beginning a gradual process whereby over the next 30–40 years many people will be displaced, creating massive problems of unemployment and dislocation. In the last century, there was an analogous problem with horses. They became unnecessary with the advent of tractors, automobiles, and trucks. … So, what happened to horses will happen to people, unless the government can redistribute the fruits of the new technology.[17]

In 2006, Ray Kurzweil argued in *The Singularity Is Near* that because of Moore's Law, IT will remain on a path of rapidly declining prices and rapidly increasing processing power, leading to developments we can only barely imagine, such as smart robots and bio-IT interfaces.[18] Kurzweil claimed, "gains in productivity are actually approaching the steep part of the exponential curve."[19] (In fact, productivity growth rates fell by half after he wrote this.) A year later, Stuart Elliott, in a paper for the National Research Council, extrapolates Moore's Law and argues that in 23 years computers are likely to displace 60% of all jobs.[20] Five years later Brian Arthur wrote, "when farm jobs disappeared, we still had manufacturing jobs, and when these disappeared we migrated to service jobs. With this digital transformation, this last repository of jobs is shrinking—fewer of us in the future."[21] And most recently McAfee and Brynjolfsson wrote that we are "reaching the second half of the chessboard," where exponential gains in computing power lead to drastic changes after an initial gestation period.[22]

Some even go so far as to claim that artificial intelligence will lead to "superintelligence," where intelligent machines do all jobs and more, which will spell the end of jobs, and maybe even the end of the human race if the smart machines decide it is in their best interest to kill us.[23] For these pessimists, computers and robots will eclipse the full range of human ability—not only in routine manual or cognitive tasks, but also in more complex actions or decision-making. The logic is as follows: In order for there to be labor demand, there must be things that humans can do better or more cheaply than machines, but machines are becoming more useful than (a large majority of) workers in almost every conceivable way. The gloomy conclusion is we will all be living in George Jetson land (from the US TV show from the 1960s, *The Jetsons*), but unlike George, we won't be working at Spacely Sprockets, we will be at home on the dole, with only Mr. Spacely employed, because he is the one who owns the robots.

But techno-utopians make three crucial mistakes. First, as discussed below, they wrongly assume that current technological trends will continue or even accelerate. Second, they overstate the extent to which digital innovation is transforming occupations. For some of the them, virtually all jobs will be disrupted by smart machines. One of the most widely cited studies on this matter, from Osborne and Frey, found that 47% of US jobs *could* be eliminated by technology over the next twenty years.[24] But they appear to overstate this number by including occupations that have little chance of automation, like fashion models. Osborne and Frey also rank industries by the risk that their workers would be automated. They find that in accommodation and food services, "as many as 87 percent of workers are at risk of automation, while only 10 percent of workers in information are at risk."[25] While this is a speculation about the future, one would expect that there would be some positive correlation between recent productivity growth and risk of automation. In other words, industries they expect to be most at risk of being automated (by definition, through productivity growth) should have enjoyed higher productivity growth in the last few years, since many of the technologies Osborne and Frey expect to drive automation are already here, albeit not at the same levels of deployment. But in fact, there was a negative correlation between the risk of automation in an industry and the industry productivity growth of 0.26.

Moreover, even Osborne and Frey admit that "could be eliminated" is not the same as "will be eliminated." A more likely estimate is that only about 20% of US jobs are likely to be easily automated over the next decade or two, with about 50% being difficult to automate, and the remaining 30% extremely difficult to automate.[26] One reason for this difference is that, for

many occupations, automation doesn't affect the occupation so much as it affects the tasks performed in an occupation. For example, the McKinsey Global Institute concludes that "Very few occupations will be automated in their entirety in the near or medium term. Rather, certain activities are more likely to be automated, requiring entire business processes to be transformed, and jobs performed by people to be redefined."[27] In other words, technology will lead much more to job redefinitions and opportunities to add more value, not to outright job destruction. If 20% of an administrative assistant's time is spent on tasks that can be automated, that doesn't mean we lose 20% of administrative assistants—it means they can spend that time doing more meaningful things instead of routine tasks such as weekly scheduling.

But even if Osborne and Frey are right and 47% of jobs are eliminated by technology over the next 20 years, this would be equivalent to an annual labor productivity rate of 4% a year, barely higher than the productivity rate of the US economy in the 1960s, when unemployment was at very low levels and job creation was high. Similarly, a Citibank report on the future of work ominously predicted that new developments in computer "algorithms could displace around 140 million knowledge workers globally."[28] This indeed might sound ominous until one realizes that this accounts for just 4.6% of global employment and any process is likely to take at least a decade or two to work its way through the labor market.

The techno-utopians third mistake is that this "nowhere left to run" argument is absurd on its face because global productivity could increase by a factor of 50 without people running out of things to buy. Just look at what people with higher incomes spend their money on: nicer vacations, larger homes, more restaurant meals, more entertainment like concerts and plays, etc. Moreover, if we ever get that rich, there would be a natural evolution toward working fewer hours. In sum, the worries of machines overtaking humans are as old as machines themselves.

That said, even if productivity is not reducing the number of jobs, isn't it making the labor market more insecure as more workers lose their jobs? This clearly seems to be what most workers think. In 1987, a solid majority of US workers (59%) said they felt their jobs were secure; by 2014, less than half felt that way (47%).[29] Yet while people feel less secure now than in the past, employment data tell a different story. Data from the U.S. Bureau of Labor Statistics clearly disprove the idea that average American workers are trapped in a perpetual state of job insecurity, regardless of how much they may happen to earn. In fact, Americans today are less likely to lose their jobs than they were in the 1990s. Looking at the broadest measures of total

job loss—defined as jobs eliminated when an establishment closes down or downsizes—the US economy has seen fewer jobs lost as a share of total employment, with similar trends at the individual industry level. Because each establishment is a single physical location that either produces goods or provides services, a single business may have one or more establishments. US workers in 1995 had around a 7.3% chance that their jobs would be eliminated in any given quarter. Two decades later, that figure was down to 5.7%.[30]

The same trend of greater job security holds across industries. Of 10 major sectors, all saw a lower rate of job loss in 2015 than in 1995 defined as the share of jobs lost in that industry through contractions or closings. However, job security differs across industries. For example, in 1995, roughly 15% of jobs per quarter were lost in the construction industry, while the education and health services sectors eliminated about 5% of jobs. Nonetheless, the general trend is reduced losses. Consider that if the share of job losses remained unchanged from 1995 levels, the manufacturing sector would have incurred about two million additional worker displacements in 2015. In fact, while neither manufacturing output nor employment has yet to recover to 2007 levels, compared with all other economic sectors, the risk of losing one's job is the lowest of all major sectors.

So, the evidence is clear that higher productivity from ICT does not lead to net job loss, nor is worker insecurity up. Still, for many workers and advocates the right level of labor market disruption is zero. No one should ever lose their job. Of course, the problem with this is that by definition innovation is about making some industries and occupations redundant, what Schumpeter famously referred to as creative destruction. We didn't need very many buggy whip makers after the car. Over the last decade, we have needed a lot fewer travel agents after online travel booking. And in the future, we can be sure that many occupations, including some currently thought to be relatively immune from disruption from ICT, will in fact be disrupted.

Indeed, radically new models of service delivery could expand and emerge, significantly disrupting many occupational labor markets. Imagine the number of university professors falling from 1.7 million down to perhaps 500,000 as most students take high-quality massively open online courses (MOOC). Imagine advanced software tools providing many of the services now provided by personal investment advisors and business benefit advisors. Imagine autonomous vehicles reducing the number of long-haul truck drivers and taxi drivers. Exactly how this process will take place, at what velocity, and in what industries and occupations is, of course, harder to

predict. Indeed, as noted innovation economist Joseph Schumpeter wrote, "Technological possibilities are an uncharted sea." But what we can chart is that the waters will not be calm.

However, efforts to reduce creative destruction would not only reduce innovation and the rate of productivity growth, it would do little to help workers. In the United States while workers were more likely to lose their job in the 1990s from firm downsizing or closures than since 2009, their labor market fortunes were better in the 1990s, with reduced average length of unemployment and higher wages for their next job.[31]

Moreover, there is strong evidence that stricter labor market regulations designed to protect workers from disruption have a large negative impact on ICT investment and the benefits firms can obtain from it. Van Reenen et al. find that labor market regulations reduce productivity gains from ICT by approximately 45%.[32] The authors attribute one third of this effect to how labor market regulations can slow down the entry and exit of firms: stricter regulations can protect and preserve less productive, less technologically advanced firms. Labor market regulations also reduce the flexibility of managers, preventing them from reorganizing production in more efficient ways. Why buy IT to reorganize production and cut costs when regulations make it difficult to reduce the workforce? Antonelli similarly finds that rigid labor markets make firms less likely to adopt ICTs.[33]

So, if the answer is not to resist ICT-driven innovation, it likewise can't be simply embracing flexible labor markets with workers on their own to adjust to disruption. One promising direction will be to do a better job of ensuring that students have more ICT skills. Despite the views of many, demand for computer science is not consigned just to IT professions. As Ed Lazowska, the Bill and Melinda Gates Chair in Computer Science and Engineering at the University of Washington, states: "Every field is becoming an information field, and if you can program at a level beyond an intro course, it's a huge value to you."[34] Demand for computer knowledge is ubiquitous, and transforms traditional sectors across the economy. Many occupations, suggests IT expert David Moschella, now require "double-deep" skills, with training and expertise in technology and computing in addition to the skills traditionally demanded by these occupations.[35] In today's technology-fueled economy, most industries rely on computer skills. Two-thirds of computer jobs are in non-technology industries, such as healthcare, banking, or manufacturing.[36] Organizations are increasingly technology-driven and technology dependent. For marketers, managers, bankers, designers, accountants, and others, coding experience and advanced understandings of computing technology are increasingly valuable. Professionals are learning technology

and analytical skills and IT specialists are applying their focused skills onto a wide range of practical business applications.[37] Similarly, workers in middle-skilled manufacturing jobs have a need for computer and technology skills. Workers with advanced computer knowledge who can use their experience to address and solve a host of problems and challenges are poised in succeed in a wide variety of fields. This means doing more to support computer science education, particularly in high schools and colleges.

Unfortunately, only around a quarter of high schools offer computer science, and often this course lack rigor or focus on computer use or just coding instead of delving into computer science principles. Only 18% of schools accredited to offer Advanced Placement exams offer the computer science AP exam. And only 22% of students who take the AP exam in computer science are female, the largest gender disparity of any AP exam.[38] Moreover, access to computer science is also limited at universities, where institutions limit enrollment through restrictions, higher admission standards, or introductory "weed-out" courses designed to keep students out of the major. In many cases, universities have few incentives to incur the cost of expanding computer science programs in response to student demand. These artificial constraints disproportionally impact women and minorities, diminishing attempts to promote inclusivity.

To address these challenges policymakers should reform curricula for existing technology classes to focus on core concepts of computer science in primary and secondary schools and provide resources to train and recruit high-quality computer science teachers. All states should allow computer science to count as either a math or science requirement, and more STEM-intensive public high schools that give students in-depth exposure to computer science should be established to allow students with the aptitude and interest in computer science to more deeply explore the subject. And universities should be incentivized to expand their offerings in computer science and prioritize retaining students interested in majoring, minoring, or taking courses in computer science.

But we need to go beyond just computer science education. When worker skills are more developed worker adjustment from dislocation becomes easier.[39] And one key way workers get needed skill is through on the job training. However, corporate investment in workforce training has declined significantly in the past two decades, and that is a big problem for American productivity and international competitiveness. As the *Economic Report of the President* finds, the proportion of workers that received employer-sponsored training dropped 42% between 1996 and 2008.[40] And despite the rhetoric that workers are the main priority for companies, corporate spending

on training as a share of gross domestic product (GDP) declined from more than half a percent in 2000 down to one-third of a percent in 2013.[41] These cuts have made it harder for workers to find new employment after they are laid off and have made it more difficult for US firms to boost productivity and global competitiveness.

Corporations have cut their investment in workforce training for a number of reasons. Declines in employee tenure in the 1980s and 1990s meant that more and more firms sought to simply hire workers with the requisite skills instead of paying to train them. After all, why invest in human capital development when that asset will likely walk out the door to a competitor firm before the investment pays off? The increasing focus on short-term profits has also driven corporations to invest less in the future than they did previously.

In short, this is a classic case of market failure. Firms invest less in training than is optimal from a societal and economic perspective and it negatively impacts economic growth and innovation. It's the same reason firms invest less in research and development than is societally optimal. To fix the latter problem, Congress created the research and experimentation (R&E) tax credit in 1983 to incentivize companies to spend more on research and development (R&D). We need to follow the same model here. Congress should turn the R&E credit into a knowledge tax credit by allowing qualified expenditures on both R&D and workforce training to be taken as a credit. Under the current alternative simplified R&D credit, firms can claim 14% of all expenditures above 50% of base period expenditures. To ensure that companies use this credit to focus on the skills of the majority of their workers, and not just managers, firms taking advantage of the credit would need to abide by rules similar to those for pension program distribution, which limit focus on highly compensated employees.

Federal policy needs to do a better job at ensuring that education is better linked to occupational needs, particularly for middle-skill jobs. One highly successful program designed to build technician skills is NSF's Advanced Technological Education (ATE) program, which supports community colleges working in partnership with industry, economic development agencies, workforce investment boards, and secondary and other higher education institutions. ATE projects and centers are educating technicians in a range of fields, including nanotechnologies and microtechnologies, rapid prototyping, biomanufacturing, logistics, and alternative fuel automobiles. Notwithstanding this, ATE funding is quite small, at around $50 million per year. Congress should expand funding for the ATE program to at least $100 million per year.

In addition, federal policy should do more to help establish wider use of skills credentialing systems. The National Skill Standards Act of 1994 created a National Skill Standards Board (NSSB) responsible for supporting voluntary partnerships in each economic sector that would establish industry-defined national standards leading to industry-recognized, nationally portable certifications. The vision was that each industry define and validate national standards for the skills it was seeking and credential individuals against those skills. One key reason for doing this was so that companies would have a better way to assess the skills of prospective and current workers and so that workers would have a better way to identify and gain the skills they need to be successful. But while some industries stepped up to the plate to organize such a system through the Manufacturing Skill Standards Council (MSSC), the federal government failed to provide matching funding to establish this standards-based system. Moreover, in the 2000s, the national approach was abandoned in favor of a regional approach (embodied in programs such as the Department of Labor's Employment and Training Administration's WIRED—Workforce Innovation for Regional Economic Development—initiative) which contributed to an uncoordinated proliferation of certifications at the regional and state levels. What's really needed is a national approach, so that employers can more readily find workers with the right skills for advanced manufacturing and workers can be confident their skills will be recognized similarly by employers across the entire country. Therefore, Congress and the Administration should work to increase credentialing by expanding the use of standards-based, nationally portable, industry-recognized certifications specifically designed for specific sectors.

The rise of Internet job matching platforms also can play a role in helping adjustment. These platforms often provide needed work and income for workers in transition between jobs. Well-known gig platforms include Uber and Lyft (ride sharing), UpCounsel (legal experts), Instacart (shopping and delivery), and TaskRabbit (odd jobs). All use a combination of Internet and mobile technology to match workers with consumers. One challenge however is that existing labor law makes provides an all or nothing system with regard to the platform-worker relationship. If the platform engages in activities like training, withholding taxes and other services, they increase the chance that courts will find the existence of an employer-employee relationship, which brings with it a host of other obligations. As a result, most gig platforms err on the side of not providing these services to their workers.

One solution would be for Congress to create a special exemption from many of the labor laws specifically for gig platforms. Platforms are unique enough that legislation could define them fairly precisely, making it clear

whom the law covers and whom it does not. Despite their rapid growth, they are also a small enough part of the workforce that treating them differently would not upend the broader labor markets. An exemption, even if it lasted only 5 or 10 years, would give Congress a chance to experiment with the application of labor laws to a new century. The temporary nature could motivate firms to provide more services to their workers in order to persuade Congress to extend and broaden it. We could see whether companies are willing to create a more supportive and involved relationship with their workers in order to reduce turnover, improve quality, and enhance their public reputations. We could also see whether these attempts actually benefitted workers and raised their incomes or job satisfaction.

Finally, policy needs to do more to help workers who lose their jobs. One path to not take is what many continental European nations take, paying workers who lose their jobs relatively high payments for relatively long periods of time. For example, in France and Germany unemployed workers, even ones fired for misconduct, can receive benefits for two years at relatively high levels of wage replacement.[42] Not only do these generous policies hurt job creation—by paying workers not to work they reduce consumer demand from the rest of the workforce who must pay higher taxes to support the generous unemployment insurance payments—but they contribute to an atrophy of skills and an increased duration of unemployment.[43] In other words, the longer a worker is unemployed, the lower their chances of exiting unemployment and reduces their wages when they finally become reemployed.[44]

At the same time, limited benefits and leaving dislocated workers on their own is not an answer either. In the United States, the level of unemployment insurance benefits largely depends on the state in which the worker lives, and the variation in benefits is quite significant, with workers in some states like Mississippi and Arkansas receiving approximately one third the benefits of workers in states like New Jersey and Washington. The challenge therefore is to increase benefits without reducing the incentive for workers to get back in the workforce.[45] One solution is for Congress to increase the Federal Unemployment Tax Act (FUTA) that employers must pay, so that the unemployment insurance tax and benefit floor across the nation increases, so that the UI benefits in third of the states providing the lowest benefits increases. At the same time, the Department of Labor should design incentives so that state unemployment insurance programs provide benefits that decline with the length of unemployment. In other words, the initial amount of benefit would be higher than it is now, but would decline gradually by perhaps 5% for every two weeks being unemployed. This could be done in a benefits

neutral way so that the average worker would still receive the same amount of benefits but would now have a stronger incentive to find work.

Finally, policy needs to do more than enable laid off workers to gain the skills they may need to get back into the workforce. Unfortunately, in many states unemployed workers must be available for work to get benefits and being enrolled in a certified training program can disqualify them for benefits. In other words, just when a worker is available to gain new or upgraded skills (when they are unemployed) policy is often preventing that from happening. Congress could mandate that states change these restrictive policies.

Related to this, Congress should do more to help workers who lose their jobs from technological change. Since the 1960s the United States has had Trade Adjustment Assistance Act (TAA) program. The program was designed in part of substantive reasons to help workers hurt by trade, but also to reduce opposition to trade by helping those hurt by trade. As President Kennedy stated in 1962 at when he signed TAA legislation, "When considerations of national policy make it desirable to avoid higher tariffs, those injured by that competition should not be required to bear the full brunt of the impact. Rather, the burden of economic adjustment should be borne in part by the Federal Government." Today it is time to adapt and expand TAA into a comprehensive Trade and Technology Adjustment Assistance Act (TTAA), to help all displaced workers, no matter the cause of their displacement—and to help workers adapt to changes brought by gains in productivity and automation.[46]

In conclusion, the major risk to the global economy over the next decade is not too much disruption, but too little. In other words, the risk is that productivity will grow too slowly. As such it is critical that labor market policies, including adjustment policies, support, not hinder ICT-led creative disruption. One way to do that is do a better job at workforce training and labor market adjustment policies.

## Notes

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