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## Conference Paper

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# The economic impact of AI on employment and income disparities

Dan Sholler and Ian MacInnes

## 1. Introduction: AI on Two Sides of the Income Spectrum

Dr. Richardson sits alone at a computer workstation in a 100-square foot room off the main hallway of her urban healthcare clinic. She is about to see her last patient for the day, a 67-year-old woman who has experienced discomfort while breathing. Dr. Richardson is reviewing scans of the woman's lungs done by a clinic technician just a couple of days ago. She looks first at the original image, scanning it for abnormalities. "Hmm hmm, not seeing anything," she mutters to herself. She then closes the image and opens a second image, this one with three areas of the lungs marked by small green squares. She focuses her eyes on the areas enclosed by green boxes, which a new AI program has identified as "abnormal." She sees nothing that her experience-based rubric would flag as problematic. Still, she gets up from her wheeled chair, walks a few feet to the next door, and asks another doctor to come take a look at the images. They spend 10 minutes discussing possible reasons for the AI-generated annotations—discolorations invisible to the naked eye, differences from previous imaging results, and technical errors—before deciding that additional tests are necessary to determine the cause of the annotations and, possibly, the patient's breathing difficulties. Dr. Richardson signs into the electronic medical record for her patient to order the tests. She then calls for the patient to enter the room and advises the patient to schedule appointments for the additional tests.

Over a thousand miles away from the healthcare clinic, Sophia holds up her pedometer to show that she has walked 8 miles through a clothing retailer's warehouse floor so far today. She accrued these miles zooming through rows and rows of 5-foot-high shelves to pick items ordered by online shoppers from open boxes of shirts, pants, facemasks, and undergarments. Her route through the warehouse is calculated and dictated by software running on a mobile phone-like device strapped to her arm. The software plans a route that prevents traffic jams and coworker small-talk by preventing any two workers being within 10 feet of one another, ensuring that Sophia takes the fastest path to her next pick. She looks at the device for path instructions, uses it to scan each item she picks, and consults it to see how much work she has left to complete on her shift. She looks away from the device only while walking or placing an item into the wheeled cloth cart she rolls around in front of her. If her two years of warehouse work are any indication, she will walk two to four more miles before her shift ends at 2:00 P.M., each step guided by the device. She is tired, but her night classes at the local community college begin next month, and the \$1 per hour increase she received for working through the pandemic will be a good head start toward the costs of books and a new laptop she needs for her education. So she presses on.

Once her cart is full, Sophia empties it onto a spiral conveyor belt that leads to a mechanical sorter on the floor below. Just down a set of stairs from the picking area, George tends to a line of 6 AI-enabled robots that again sort the clothing items into orders destined for online shoppers. Items of clothing fall off of the mechanical sorter belt into a holding bay encircling a robotic arm. The arm picks up each item by its plastic packaging with a suction gripper, rotates the item so that a set of 360-degree barcode scanners can identify the item, and places it into one of 40 cubbies, each cubby corresponding to a single customer's multi-item order. George walks down the row of robots looking for green lights on any of the 240 cubbies, indicating that all items in an order are present. He removes the items from green-lit cubbies and places them in a plastic tote on a wheeled baker's rack, scanning a barcode on the tote to confirm all items are present. Once his baker's rack is full, he wheels the rack to a station where his coworker will scan the tote barcode, pack the orders into boxes, and apply a shipping label. When George started his job at the warehouse, he was responsible for sorting these items himself, standing at a wall of cubbies and scanning each item as he placed it into the correct location. Tending to the robots is easier work, he tells us, requiring more walking but less arm movement and even less cognitive attention.

Sophia and George have different jobs in the warehouse, but both make the same wage, a dollar per hour above the state minimum. Both hope to become supervisors for their areas once peak season—the months leading up to the winter holidays when orders are at a fever pitch—rolls around and they have an opportunity to prove their worth in a seasonal supervisor role. Last year, neither Sophia nor George was able to keep their supervisor role after the holidays ended. “It’s such a short period of time and everyone, the workers, the managers, everyone is working so hard that they aren’t paying attention to how I’m performing. Unless I screw up, then they pay attention,” George tells us.

Both the warehouse and the urban healthcare clinic are sites of deployment for advanced AI. For Sophia and George, AI helps to organize and administer their work; for Dr. Richardson, AI introduces complexity and uncertainty to diagnosing patient conditions. Both settings might also be viewed as sites of deskilling: Work contexts in which a larger share of the analytical work once done by humans is being done by machines. Yet warehouse workers and doctors, as we know, do not face the same level of risk and opportunity when it comes to navigating the changes introduced by AI. Warehouse workers will not, for example, be sued for malpractice if their AI-enabled devices lead them astray in their picking path, while doctors must still sign off on diagnoses and treatment decisions recommended by AI. Likewise, Sophia and George did not receive formal education to perform their work duties and therefore have little reason to question or consult with one another about the decisions made by the devices and robots that organize their work.

The employment and income consequences of AI deployment, though, quite clearly threaten Sophia and George more than they do Dr. Richardson. Doctors will not, in the near term, lose their jobs to AI-enabled automation; even if job loss was a risk, doctors have powerful professional organizations and lobbying groups at their disposal to shape the trajectory of technological futures (c.f. Sholler 2020). Warehouse workers, on the other hand, may start to see hiring quotas and shift hours shrink at their automated workplaces, with little to no collective bargaining power available to them to affect change (Rosenberg and Greene 2021). In this chapter, we ignore the autonomy problems facing the highly-trained professionals who are increasingly asked to use AI in their everyday work. We instead focus on the causes and consequences of the predicament low-wage workers find themselves facing as AI gains popularity and technical maturity in workplaces such as warehouses. We take this stance because, in our estimation, the worsening income inequality in the United States is driven more by shrinking opportunities for workers in the low-wage end of the income spectrum than it is by autonomy threats to those in the high-wage end of the spectrum. We support this claim by first demonstrating that “low-skill” workers have, for decades or more, lost the most in terms of income and employment compared to mid- and high-skill workers. We then summarize the possible organizational and policy avenues for avoiding the continuation of trends that have, to date, been detrimental to income equality in the U.S.

## **2. AI in historical context: Ongoing skill- and technology-based polarization in the U.S. economy**

All new workplace technologies are embedded in an array of historical, economic, political, and social systems that shape their impact on work and workers regardless of technical capabilities. Accordingly, AI, like many other general purpose technologies, has contributed to higher productivity, efficiency and growth for companies that have implemented it (Bahrin et al., 2016; Prettner, 2016). Today’s AI—robots, chatbots, and the like—continues a pattern of technology-enabled growth that has roughly been consistent since the Industrial Revolution in the 1700s.

The trend we focus on here, job and income polarization, has likewise been a consistent trend in at least the last two decades. Evidence from the early 2000s indicates that the introduction of information technology affected the demand for labor, sometimes substituting for manual and cognitive labor via encoding work in explicit rules that can be translated into algorithms; in other cases, technology can complement labor by enabling humans to take on non-routine, complex tasks. Autor et al. (2003) estimated that from 1960 to 1998 these shifts in labor demand favored college educated workers: the labor market rewarded high-skill composition jobs, a phenomenon sometimes referred to as skill-biased technological change.

There is no doubt that the loss of jobs in the 1980s, as a result of outsourcing and automation in manufacturing, created tremendous hardship to workers who lost reliable and high paying jobs

where they were able to grow within the company from low skill operators to management positions. Positions like these are less abundant and people with low skills who lose their jobs end up in worse circumstances. According to (Acemoglu & Restrepo, 2017) there is “mounting evidence that the automation of a range of low-skill and medium-skill occupations has contributed to wage inequality and employment polarization.” (p. 3).

In the process of implementing artificial intelligence, a worker can experience two outcomes, depending on where he/she is positioned at the time of the transition (Goyal & Aneja, 2020). S/he can either move to a higher level position that provides more opportunities for professional growth and income, or the opposite, to be relegated to another similar task, potentially with lower wages, if it is not being eliminated altogether. It is clear that the distinction between these two moves depends on education, experience and skills. In the absence of these qualifications the worker can spiral downwards towards destitution. In lower income and education levels, the change in worker position to a lateral equivalent may not be possible. Few marketable skills and greater supply of low skill labor can increase the probability that the next job will also be low skill, lower pay, and with few, if any, benefits.

AI can alleviate or exacerbate income inequalities. Evidence thus far about the impact of labor saving AI is reduction in employment. In the United States labor participation of low skilled workers has declined by 2.34% and of medium skill jobs by 2.56% (Fersht, 2016; Petropoulos, 2018).

Early in the history of computing, changes in demand for skilled labor have accelerated from minimal in the 1960s to much more prevalent in the subsequent decades (Autor et al., 2003). We know that computers are increasingly capable of taking on more and more complex tasks. In the 1960s, for example, when Polanyi (Polanyi & Sen, 1960) were writing the Tacit Dimension, they stated that “the Skill of a driver cannot be replaced by a thorough schooling in the theory of the motorcar” and, even 50 years later, (Autor et al., 2003) still list driving a car as a complex task that would be difficult to replace with computers. However, today two decades later we see an increasing number of car manufacturers developing autonomous vehicles and trucks, some of which are already on the road (Ackerman, 2021). This is to say that the set of tasks that computers can undertake is widening.

We know that work is changing as a result of technology and it affects people differently depending on demographics, experience, skills and education. Economists have called this skills-based technological change (SBTC). Inequalities emerge when technologies require companies to hire high-skill workers who would command higher salaries, thus resulting in wage inequality (Autor et al., 2003). Perhaps the most well-known cases of the technology and income inequality relationship are professions replaced by computers. Computers can perform better than humans as they are able to store, retrieve and act upon information better. These capabilities have made

obsolete professions such as bookkeepers, telephone operators, cashiers, and many other routine occupations (Bresnahan, 1999).

### 2.1. Decoupling of Wages and Productivity

When information technology is introduced, it can have two effects on work. It can be labor saving (displacement effect) or labor enhancing (productivity effect) (Chiacchio et al., 2018). Contextualizing the polarization of jobs and wages requires assessing whether these poles developed in response to productivity trends. Employers, in other words, may be keeping wages low for a substantial portion of the workforce to accommodate downward trends in their productivity. Economic data from the Federal Reserve suggests that the period from 1950 to today has been marked by a steady increase in output per employee in the U.S. (see Figure 2), growing by over 250 percent. Real hourly compensation, though, grew by just over 115 percent, (Bureau of Labor Statistics, 2021). It appears that wages in the U.S., then, are decoupled from productivity, and/or that productivity gains are being reinvested into the top end of the workforce (e.g., by the creation of “superstar” firms - c.f. Autor et al. 2020). The latter explanation aligns with observations of high-quality, high-wage job growth outpacing middle and low-quality jobs.

Additional research on the general trend of wage-productivity decoupling list technological development and globalization as possible causes (e.g. OECD, 2018). As discussed above, technological innovation tends to be skill-biased (Berman et al., 1998; Card and DiNardo, 2002; Fernandez, 2001), meaning that new production technologies increase the demand for educated, experienced labor over unskilled labor as cause and consequence of skilled workers’ technology-enabled productivity gains (and a greater share of work being done by technologies rather than low-skill labor). The globalization argument for wage-productivity decoupling suggests that the availability of low-wage labor and inputs at the global scale produces cost and productivity benefits that do not translate into higher wages locally. In reality, “The Great Decoupling” in the U.S. is likely the result of a combination of factors (Brynjolfsson & McAfee, 2012). No matter the cause of decoupling, it is essential to understand how increasingly-capable AI systems might contribute to increasing polarization in the U.S. job market.

### **3. How AI stands to exacerbate polarization and income inequality**

Without intervention, AI will exacerbate a problem that has plagued the United States workforce for decades: wage increases will go to the highest earners, and the lowest earners will have modest to no growth in their incomes. There is no reason to believe things will happen any differently: The trend has been ongoing for over 20 years alongside the development of automation technologies. An additional factor that will contribute to the social and economic inequalities we will experience with AI is the speed at which these changes are happening. Several studies (Chiacchio et al., 2018; Friedman, 2016) have alluded to the faster pace at which

technology is being introduced. A report by McKinsey Global Institute (Dobbs et al., n.d.) indicated, for example, that technological advance is now ten times faster and 300 times the scale of what it was during the Industrial Revolution in the 18<sup>th</sup> century, thus resulting in 3,000 times the impact. While there are indications that integration of new technology to old systems is not always fast, if their predictions are correct and AI is implemented much faster than in prior technological revolutions, it will not provide enough time for the population to adapt, find alternative positions for their skills or the time to invest in acquiring new skills to integrate smoothly into a more technologically driven economy. Rapid changes and the competitive pressure companies face to keep up with the advances they face can result in rapid and significant increases in income and wealth inequality (Korinek & Stiglitz, 2021b).

One of the main challenges for low skill, low paid populations is that some of those tasks are repetitive and can be easily automated with the use of more intelligent machines and robots. At the low end of the AI spectrum simpler machines are replacing workers through automated kiosks and, as technology advances, they are starting to replace other functions that are more routine in nature, such as fast food that has simple ingredients and steps for preparation. Regarding the way technologies like robots affect the labor market, early studies (Graetz & Michaels, 2017) that used the industrial robots database estimated that it reduced low skilled labor and negatively affected the position of these workers.

There are, nonetheless, jobs toward the mid- and high-levels of the wage distribution that can benefit from computers as these cannot yet be done by these systems. Searches and research about patents or legal cases, for example, can significantly increase the productivity of lawyers, while market information can improve managerial decision making.

While this analysis focuses on the effects in the United States, these are likely to be felt in other countries as well. The long term trends in income inequality among rich english-speaking countries (the United States, the UK, Canada, Ireland, and Australia) shows that since about 1980 the share of income going to the richest 1% has gone up almost to the levels of 1920. The effect has been much less pronounced in continental Europe and Japan, which indicates that this effect is not inevitable. Institutional and political frameworks play a role in shaping inequality of incomes. (Roser and Ortiz-Espina, 2016).

#### **4. Averting increasing inequality: Labor movements, technology development, and policy measures**

The question becomes, then, how we can produce policies and technologies that reduce income inequality. We begin to develop ideas for how to do so via an examination of the causes of the current polarization we see, rooted in economic and political systems that have de-facto governed technology development over at least the past 15 years. We argue that the increasing

capabilities of technology—namely, artificial intelligence and related technologies—demand a more active approach to using AI to reduce job polarization and resulting income inequality.

#### 4.1. Labor movements

A commonly-cited reason for increasing polarization is an overall reduction in collective bargaining power of U.S. workers. Union membership in the U.S. has declined substantially since the 1950s. Declining union membership is linked to polarization in a number of ways. Probability of low wage employment, for example, is reduced by 39 percent with union membership, compared to a 33 percent reduction among college degree holders (California Future of Work Commission, 2021). Aside from negotiating higher pay and better benefits, unions also play a critical role in retraining workers when economic cycles or technological change interrupt the normal operation of a given occupation. Likewise, unions have driven changes to pregnancy and parental leave regulations, working hours and conditions, unemployment insurance, and wrongful termination laws, each of which supports workers' ability to transition into and out of jobs with less risk to meeting basic needs.

The decline in union membership represents a departure from the U.S.'s deep history of labor organizing—César Chávez and Dolores Huerta's work to establish the National Farm Workers Association, for example, is a critical part of national history. Such efforts resulted in California being an international leader in cementing workers' rights into policies and legislation.

Despite the decline in union membership in previous decades, the U.S. is showing signs of a labor organizing revival. Service and industrial workers are organizing unionization efforts at some of the nation's largest employers. Similarly, the 2020 vote on Proposition 22 in California prompted discussion about the need for collective action among workers in gig economy contract positions (Hiltzik, 2021). The revival of unionization efforts is not relegated to low-wage occupations, either: Recent developments in the information technology industry, for example, demonstrate U.S. high-wage workers' willingness to reengage their collective bargaining power. The formation of the Alphabet Workers Union, a group of Google engineers and other workers who organized to gain some control over the company's global influence, suggests that the reemergence of unions may be seen across the income spectrum (Conger, 2021).

Union membership data from the past two years add support to the anecdotal examples listed above. California's union membership, for example, increased for the first time in many years in both 2019 and 2020, rising by 99,000 in 2019 and 139,000 in 2020 to a rate of 16.5 percent of the labor force (Bureau of Labor Statistics, 2021). While still well short of the membership levels from decades past, these numbers give reason to pay close attention to labor organizing and its potential impact on polarization in the near future.



Unions and professional organizations have always been a primary tool workers use to shape the trajectory of technological change. There are implications for labor during this transition period that can lead to increased inequality. With diminishing bargaining power in recent decades, workers have been unable to coordinate to demand better wages and conditions. An example of the weakening of labor power in America was the effort by Amazon workers to unionize, which was counteracted with aggressive anti-union efforts from the company (Streitfeld, 2021). Their weakening power, however, is not only manifested in their inability to negotiate directly with the company but also in political arenas. In countries like the U.S. where political campaigns are financed by large contributions, corporations and wealthy individuals will likely exert more power than workers. As (Korinek & Stiglitz, 2021a) state, “in a political system dominated by money, the innovators, increasingly rich, may use their economic and political influence to resist redistribution” p. 13. In the United States, labor protections are weak, as entities like the National Labor Relations Board, do not have the power to impose sanctions on aggressive anti-union campaigns by companies facing unionization efforts.

#### 4.2. Universal basic income, EITC and incentives through subsidies

The U.S. and its state governments have several policy avenues available for averting deepening income inequality in the wake of AI. Universal basic income is perhaps the most common policy proposal for averting technology-driven income inequality. Giving people a source of income that is not linked to employment can serve to increase their bargaining power. They would be less likely to choose the first job available and could focus more on how a job will foster their long term goals. Having income that would cover basic needs, including food and housing, gives workers some bargaining power. They have the option to refuse a job but no disincentive to seek one, because any new income would not be taken away through graduation from traditional safety net programs, such as welfare and unemployment insurance.

While UBI has advantages we also think that policies involving cash linked to incentives are also desirable, and should perhaps form the bulk of the assistance. For example, the earned income tax credit, which works as a subsidy for wages issued directly to lower income workers, encouraging people to seek jobs. The current program in the US is, in our view, insufficient: too few people qualify. It should be expanded to a wider range of incomes, and phased out gradually as income increases. The taxation system should be integrated with subsidies such as EITC and UBI, and then simplified for those at lower income levels to ensure that everyone files a tax return, and that all people who qualify receive tax subsidies.

These subsidies should include tax credits for seeking education and training. In this way, people would be more likely to invest in their long term income rather than taking the first job that comes available. This process could be assisted on the demand side of the labor market by giving subsidies to employers that offer apprenticeships. The government should also address child

care, another impediment to labor force participation. It may make sense for some people to not take full time jobs so that they can take care of children but there should also be options for those who want to be formally employed. Providing a tax credit to those with young children could help them pay for child care if they choose to be employed.

#### 4.3. Reskilling initiatives

Labor, unlike machines, cannot be easily “programmed” to take on other tasks. While one could argue that humans are to an extent a “general purpose technology,” the switching costs of moving from an obsolescent profession to a growing one are substantial and it is often the case that such unemployed workers may not be able to find another job at a similar wage.

Both in developed and developing countries there is a risk of having a wave of unemployed and low educated people who, in the absence of support, could resort to addiction and crime. During these transition years when companies are adopting AI more broadly, both the private and the public sector need to implement policies that facilitate a move by workers to better positions. This may involve governments requiring companies installing these technologies to implement training that can facilitate a transition to higher paid and more professionally challenging/rewarding tasks. Because the private sector has not faced incentives to increase its labor costs either in wages or training, governments need to place incentives or laws in place that provide for a better alignment between the company and the larger interests of the nation to have incomes that will meet the needs of a modern economy. Governments need to invest in education by supporting the research and development enterprise of their countries while also making education more economically accessible. Among low skilled workers some will be unable to make the transition and could lose their livelihood entirely. Under those circumstances governments should consider a universal basic income which, unlike most welfare systems, does not provide a disincentive to seek a job.

#### 4.4. Unemployment policy and benefits

With limited education a person may be unemployed for several months. Lack of perfect mobility may prevent workers to look in more economically vibrant markets. A person with employment gaps is also likely to receive a lower wage and be more vulnerable to discharge given their short tenure (Hall et al., 1995). One of the most concerning empirical results about the impact of robotization on employment is that the introduction of employment resulted in the loss of jobs while no evidence was found that employment was created somewhere else in the economy in any occupation or education group (Acemoglu & Restrepo, 2020). The history of technological change has not yet shown a long term trend toward persistent unemployment. This is, perhaps, not surprising as it is possible to find things for people to do, even if they are not paid as much as they were prior to the advance. It is a mistake, in our view, to focus on unemployment as an outcome of technological change. Job quality and mobility matter more.

Many of the people in jobs made obsolete by AI advances will not immediately find comparable employment at similar wages. To the extent that this type of displacement becomes common, more will have to be done to find productive things for these people to do and ensure that they have sufficient income to ensure mass market demand. In the past technological advance was slow enough that people would not have to change careers multiple times in their lives. If AI advance accelerates this could require much more investment in retraining than has occurred in the past.

The lack of universal benefits providing basic protection to people also impedes the movement of workers from one job to another. In a payroll-based insurance and benefits model, people are more likely to stay at their jobs for longer than they should simply to maintain those benefits. As a result, they do not give themselves the opportunity to update their skills before they become obsolete, making the transition to a new job much more difficult. Some unemployment programs worsen this problem by incentivizing people to take any job, rather than focusing strategically on new skills that could be in demand.

Lack of social protection during transition periods and employment arrangements that are not covered by benefits or labor regulation protections will exacerbate the inequalities between those in non-traditional employment settings or unemployed/in transition compared to those with higher education and experience with higher incomes and benefits. In recent years, the United States is experiencing an expansion from traditional to non-traditional freelance type work that provides limited benefits or labor protections. From 2014 to 2019 four million more people in the United States have become freelancers, amounting to 35% of the workforce (Upwork, 2019). This movement requires a redesign of the benefits system. To the extent that freelancing is good for the economy, it is necessary to ensure that workers choosing this type of employment have access to comparable benefits at similar cost. Perhaps it is necessary to move to a portable system where benefits are not linked to a particular employer. Employer based health insurance in the United States, for example, was established by accident due to labor market conditions facing employers after World War 2, and it seems suboptimal, particularly in the context of the growth of freelancing and the increasing frequency that people are now changing jobs.

#### 4.4. Globalization and remote work

Labor markets are global, which tends to put downward pressure on wages. Technologies that reduce the cost of labor can also reduce the costs of goods and services, which also causes companies to keep wages low.

Inequality is manifested at the local level with workers at the bottom of the economic ladder having little bargaining power and opportunities to grow their skills to meet the demands of the global business environment. Inequalities across countries are also emerging. Companies from

developed countries are entering less developed countries, bringing with them technologies that dominate those markets, leaving any local technological development difficult to achieve. When a nation is unable to develop technology of its own and becomes instead an adopter it can 1) limit investments in technological development, 2) reduce investment in innovation, 3) reduce spending on IoT infrastructure, 4) fail to pass laws or regulation around AI that could provide protections or foster education in STEM (Goyal & Aneja, 2020).

From an economic perspective, the calculations being made thus far are about whether the introduction of technology leads to greater productivity and whether it is labor saving or not. This argument fails to take into consideration that those calculations are dynamic and change depending on the price of technology and labor. The year 2021, for example, saw an increase in inflation related to increased spending after a reduction in Covid-19 restrictions. With limited opportunities for travel and entertainment many workers and, even the unemployed receiving enhanced benefits, were able to save money. This led to an increase in prices, including for labor. Once vaccinations began in early spring and restrictions were starting to ease around the U.S., hourly workers experienced a 3.9% real average increase in their weekly earnings (Bureau of Labor Statistics, 2021). With greater demand for goods and services, commodities also experienced shortages and increased prices. The introduction of AI will result in what Hicks (Hicks, 1963) called labor-saving (displacing effect) where at any given wage the introduction of a technology will reduce the demand for labor. It was also during the height of the Covid-19 pandemic that delivery of products became necessary, making workers at warehouse distribution centers essential. Some businesses that are unable to have workers congregated may explore AI technologies.

There are factors that will challenge our governments' ability to respond to the digital transformation of work that can negatively affect workers. One of them is taxation of global digital companies that do not need to have a physical presence for the provision of their services. The global nature of their operations can allow them to find locations that give them tax advantages. The same is true for workers and there has been already a pattern of production where products and services are made in nations with low wages and labor standards. This could add pressure on wages for developed nations that now compete with the drastically lower wages of developing nations. A global world with different economic contexts leads to two impact paths. In poor nations the existence of these digital platforms with low barriers to entry can afford them greater freedom, independence and a higher wage to what they obtain in their own countries under potentially exploitative labor conditions. In developed nations they get the same benefits of freedom and flexibility regarding location and time but their wages are impacted by the presence of workers with significant lower wages willing to perform digital tasks at minimal pay.

There are many countries in the world with inadequate welfare systems that could protect a person when they are unemployed. According to the World Bank, in developing nations eight in

10 people receive no social assistance and six in 10 work without health insurance (World Bank, 2019). A similar problem prevails in the United States, where health insurance coverage is tied to employment and only larger entities are able to provide coverage. There are now many more work arrangements that lack health protections, leaving people vulnerable and potentially open to bankruptcy if they suffer from an unexpected illness or accident. It has also been estimated, for example, that 50% of the income of multinationals is reported in jurisdictions that levy a tax rate of less than 5% (Clausing, 2016).

## **5. Conclusion: What do we want the future to look like?**

Because AI is implemented in various industries, inequality, which is normally defined in economic terms, can also be present in other areas, such as health care. The use of AI for clinical as well as administrative decisions by doctors and insurers can negatively affect people in the absence of frameworks or principles that can prevent an unequal treatment of individuals (Takshi, 2021).

Labor costs also need to be compared to both the type of labor needed as well as the cost of technology. Prior research suggests that the introduction of new technology is slow because integration with old systems as well as the lack of qualified labor with experience in the new technology led to slow, painful and costly integration (Garcia-Murillo & MacInnes, 2019). It is possible that the changes that companies undertake when implementing AI in their operations and services are a response to market forces where the motivation to use emerging technologies is not necessarily driven by the desire to reduce costs but much more by the pressure to use or offer state of the art technologies. If some companies are introducing AI, it could generate concerns in others that they also need to do so to remain competitive.

During this transition, however, companies will be experimenting and, in the process, taking advantage of low wage labor, which, in the US and in some other developed countries, is poorly protected. Companies can now take advantage of technologies that can provide labor on demand for short term projects. They can issue a call for proposals and give the work to the lowest bidder, thus reducing the total number of workers on their payroll.

As some implementations of AI, such as more intelligent robots at work that take on more of human responsibilities, the demand for some types of labor decreases. The impact of technology on work affects countries differently. Developing nations which have lower levels of education and technological skills will suffer greater economic consequences when technology begins to replace labor as costs increase.

## References

- Acemoglu, D., & Restrepo, P. (2017). Robots and jobs: Evidence from US labor markets. NBER Working Paper, w23285.
- Acemoglu, D., & Restrepo, P. (2020). The wrong kind of AI? Artificial intelligence and the future of labour demand. *Cambridge Journal of Regions, Economy and Society*, 13(1), 25–35. <https://doi.org/10.1093/cjres/rsz022>
- Ackerman, E. (2021). This Year, Autonomous Trucks Will Take to the Road With No One on Board. *IEEE Spectrum*. <https://spectrum.ieee.org/this-year-autonomous-trucks-will-take-to-the-road-with-no-one-on-board>
- Autor, D. H., Levy, F., & Murnane, R. J. (2003). The skill content of recent technological change: An empirical exploration. *The Quarterly Journal of Economics*, 118(4), 1279–1333.
- Bahrin, M. A. K., Othman, M. F., Azli, N. H. N., & Talib, M. F. (2016). INDUSTRY 4.0: A REVIEW ON INDUSTRIAL AUTOMATION AND ROBOTIC. *Jurnal Teknologi*, 78(6–13). <https://doi.org/10.11113/jt.v78.9285>
- Berman, E., Bound, J., & Machin, S. (1998). Implications of Skill-Biased Technological Change: International Evidence\*. *The Quarterly Journal of Economics*, 113(4), 1245–1279. <https://doi.org/10.1162/003355398555892>
- Bresnahan, T. F. (1999). Computerisation and wage dispersion: An analytical reinterpretation. *The Economic Journal*, 109(456), 390–415.
- Brynjolfsson, E., & McAfee, A. (2012). *Jobs, Productivity and the Great Decoupling*. 3.

- Bureau of Labor Statistics. (2021). Real weekly earnings up 3.9 percent for year ending March. <https://www.bls.gov/opub/ted/2021/real-weekly-earnings-up-3-9-percent-for-year-ending-march-2021.htm>
- California Future of Work Commission. (2021). The Future of Work in California: A new social compact for work and workers. Institute for the Future. Available at: <https://www.labor.ca.gov/wp-content/uploads/sites/338/2021/02/ca-future-of-work-report.pdf>.
- Card, D., & DiNardo, J. E. (2002). Skill-biased technological change and rising wage inequality: Some problems and puzzles. *Journal of Labor Economics*, 20(4), 733-783.
- Chiacchio, F., Petropoulos, G., & Pichler, D. (2018). The impact of industrial robots on EU employment and wages: A local labour market approach. [https://www.bruegel.org/wp-content/uploads/2018/04/Working-Paper-AB\\_25042018.pdf](https://www.bruegel.org/wp-content/uploads/2018/04/Working-Paper-AB_25042018.pdf)
- Clausing, K. A. (2016). The effect of profit shifting on the corporate tax base in the United States and beyond. *National Tax Journal*, 69(4), 905–934.
- Conger, K. (2021). Hundreds of Google Employees Unionize, Culminating Years of Activism. *The New York Times*. Retrieved June 8, 2022, from <https://www.nytimes.com/2021/01/04/technology/google-employees-union.html>
- Dobbs, R., Manyika, J., & Woetzel, J. (n.d.). The four global forces breaking all the trends. 5.
- Fernandez, R. M. (2001). Skill-Biased Technological Change and Wage Inequality: Evidence from a Plant Retooling. *American Journal of Sociology*, 107(2), 273–320. <https://doi.org/10.1086/324009>
- Fersht, P. (2016, July 4). Automation Impact: India's services industry workforce to shrink 480,000 by 2021 - a decline of 14%. *Horses for Sources*.

<https://www.horsesforsources.com/indias-services-industry-set-to-lose-640000-low-skilled-jobs-to-automation-by>

Friedman, F., Thomas L. (2016). Thank You for Being Late: An Optimist's Guide to Thriving in the Age of Accelerations: Picador. <https://www.amazon.com/Thank-You-Being-Late-Accelerations/dp/0374273537>

Garcia-Murillo, M., & MacInnes, I. (2019). AI's path to the present and the painful transitions along the way. *Digital Policy, Regulation and Governance*.

Goyal, A., & Aneja, R. (2020). Artificial intelligence and income inequality: Do technological changes and worker's position matter? *Journal of Public Affairs*, 20(4), e2326.

Graetz, G., & Michaels, G. (2017). Is modern technology responsible for jobless recoveries? *American Economic Review*, 107(5), 168–173.

Hall, R. E., Farber, H., & Haltiwanger, J. (1995). Lost jobs. *Brookings Papers on Economic Activity*, 1995(1), 221–273.

Hicks, J. (1963). *The theory of wages*. Springer.

Hiltzik, M. (2021). Column: A California judge pinpointed the biggest problem with Prop. 22 — its greediness. *Los Angeles Times*. <https://www.latimes.com/business/story/2021-08-24/proposition-22-worker-rights>

Korinek, A., & Stiglitz, J. E. (2021a). Artificial Intelligence and Covid-19: Covid-19 driven advances in automation and artificial intelligence risk exacerbating economic inequality. *The BMJ*, 372.

Korinek, A., & Stiglitz, J. E. (2021b). Artificial Intelligence, Globalization, and Strategies for Economic Development (Working Paper No. 28453). National Bureau of Economic Research. <https://doi.org/10.3386/w28453>



- OECD. (2018). Decoupling of wages from productivity: What implications for public policies? In OECD Economic Outlook, Volume 2018 Issue 2 (pp. 51–65). OECD.  
[https://doi.org/10.1787/eco\\_outlook-v2018-2-3-en](https://doi.org/10.1787/eco_outlook-v2018-2-3-en)
- Petropoulos, G. (2018). The impact of artificial intelligence on employment.  
<https://www.bruegel.org/wp-content/uploads/2018/07/Impact-of-AI-Petrououlos.pdf>
- Polanyi, M., & Sen, A. (1960). The tacit dimension. University of Chicago press.
- Prettner, K. (2016). The implications of automation for economic growth and the labor share of income (Working Paper No. 04/2016). ECON WPS.  
<https://www.econstor.eu/handle/10419/141275>
- Rosenberg, E., and Greene, J. (2021). The union’s defeat at Amazon is shaking up the labor movement and exposing a rift between organizers. The Washington Post.  
<https://www.washingtonpost.com/technology/2021/04/18/after-amazon-bessemer-union-fight-labor-movement/>
- Roser, M. and Ortiz-Espina, E. (2016). Income Inequality. Our World in Data.  
<https://ourworldindata.org/income-inequality#within-country-inequality-in-rich-countries>.
- Sholler, D. (2020). Infrastructuring as an occasion for resistance: Organized resistance to policy-driven information infrastructure development in the us healthcare industry. Computer Supported Cooperative Work (CSCW), 29(4), 451-496.
- Streitfeld, D. (2021, March 16). How Amazon Crushes Unions—The New York Times.  
<https://www.nytimes.com/2021/03/16/technology/amazon-unions-virginia.html>
- Takshi, S. (2021). Unexpected Inequality: Disparate Impact From Artificial Intelligence in Healthcare Decisions. Journal of Law and Health, 34(2), 215–251.

Upwork, F. U. (2019). Freelancing in America: 2019 Survey - Upwork.

<https://www.upwork.com/i/freelancing-in-america/>

World Bank. (2019). World Development Report 2019: The Changing Nature of Work. World

Bank. <https://elibrary.worldbank.org/doi/pdf/10.1596/978-1-4648-1328-3>