

Robots Are Taking My Job?

Advancing Technologies and Perceived Effects on U.S. Employment

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Author Note

This paper was prepared for Composition 211, taught by Dr. Walker Edin

### Abstract

Recent U.S. economic data, along with controversial reports of the expected economic future have only furthered fueled the ongoing debate on technological unemployment and its perceived influence on the years to come. Even its existence stays in constant contention and debate amongst economist. However, most discussion on the topic centers around possible repercussions in the economy, such as mass technological unemployment. However looming this unemployment appears to some, it does not hold high priority at the moment because the future needs to play out for analysts to obtain a better sense of the economic environment ahead. Overall most experts, agree that no matter the perceived impact, technological unemployment currently exists to some extent, which gives some reason to look into possible policy options in case of unexpected economic distress.

Keywords: technological unemployment, robots, artificial intelligence, economic development

## Robots Are Taking My Job?

### Advancing Technologies and Perceived Effects on the U.S. Employment

Robots are taking over the world. Almost? Mostly everyone encounters this concept of machines taking control over Earth at some point in life. Whether it be in a sci-fi movie or the plot of a futuristic book, most dismiss this idea as pure fantasy. However improbable this scenario may seem, robots or “machines capable of automatically carrying out complex series of movements” (“Robots,” 2016) along with artificial intelligence or machines able to “stimulate intelligent behavior” (“Artificial Intelligence”, 2016) already prevail all around us. If you doubt, check your pocket. Maybe ask your personal assistant Siri or Google. They already live with us needing only moving extremities to our take control of our world.

Be watchful and be careful. At least that’s what researchers Frey and Osborne from Oxford University would advise considering their claim that over 47% of U.S. jobs are at risk of automation within the next two decades (Arntz, Gregory, & Zierahn 2015, p. 25). Since the 2013 publishing of these results, the perceived impact of technological unemployment, or unemployment caused by machines, has expanded furthermore as many economists and futurists have expressed unique responses and varying outlooks on the issue. Understanding the quick pace of technological innovation along with its current capabilities and potential applications can help us envision the magnitude for potential employment change and fathom the possibility of social restructuring for the looming economic challenges forecasted in the coming decades such as greater income inequality.

### **Technology and Its Effect in History**

In the 19<sup>th</sup> century and most of the 20<sup>th</sup> century technology provides positive means of economic growth and supports an increasing quality of life for developed nations such as the

U.S. This occurs because the “creation of new jobs usually outran the labour-saving impact of the adoption of new technologies” (Arntz, Gregory, & Zierahn, 2015, p. 7). This means many more jobs came to be created for firms to be bothered by labor costs. However, some experts see this trend changing with current analysis of recent economic evidence (Aho & Barry 2016; Ford, 2015; Saltinski, 2015).

### **Transformative Impact of Information Technology**

In *The Rise of the Robots*, futurist Martin Ford (2015) presents a collection of points revealing the role of information technology as a contributor to technological unemployment.

These include the following:

1. Stagnant wages
2. Declining labor force participation
3. Diminishing job creation with soaring long-term unemployment
4. Soaring inequality
5. Declining income and underemployment for recent college graduates
6. Polarization and increase in part-time jobs

### **Stagnant Wages**

In 1973, the United States reached the highest pay for a typical American worker, and following that year, there begins a decline in pay that never recovers. At the same time the rate of labor productivity, or the total output produced by workers per hour, also declines steadily (Ford, 2015). Both declines point towards a major transition from previous years where rates of productivity actually increased at a steady pace along with the workers’ compensation. This major shift also signals the closing of the “golden era of postwar prosperity” (p. 36). This gap

difference from previous years increases looking ahead in time, especially in the later part of the 20<sup>th</sup> century where technology becomes readily available for the masses.

### **Declining Labor Force Participation**

Ford (2015) explains that the labor force peaks in 2000 at 67%, but that an even more interesting fact come with the “labor force participation rate for adults between the ages of twenty-five and fifty-four [which declines] from 84.5% in 2000 to 81 percent in 2013” (p. 42). He explains the rate of applications for Social Security disability increase from 1.2 to 3 million per year during that same time span, when no data shows a significant increase in workplace accidents. This implies that many workers are attempting to gain the permanent benefits of the Social Security program, which Ford describes as “last-resort” (p. 43) when jobs cannot be attained. He implies that some factor makes it difficult for people to participate in the work force, likely due to the technology’s ever increasing presence in businesses.

### **Diminishing Job creation**

Another point rises when looking at job creation since the 90s. In the first decade of the 21<sup>st</sup> century no jobs were created, a large part of it having to do with the recession of 2007. According to Ford (2015), even if the recession didn’t occur, job projections sit at around 5.8% which still only counts for less than half of the job growth experienced in the 80s and 90s (p. 43). Another thing to consider includes the fact that at the current rate, the job market does not keep up with the job demand for the growing population requiring between 75,000 and 150,00 jobs per month (p. 44). To make matters worse, the Federal Reserve Bank of Cleveland found a “dramatic rate of decline in the rate at which unemployed workers are able to land new jobs” (p. 44). This poses a problem for those becoming unemployed because they are prone to losing job skills when unemployed for extended periods of time. One study found when a person becomes

unemployed for more than six months, they face a lower chance of getting a job interview than a person with no industry experience but more recently unemployed (p.46). These statistics exemplify stark outcomes some face after a long unemployment period, especially during recovery from a recession.

### **Soaring Inequalities**

Income inequality becomes another sign of economic change in the U.S. More than half of the national income goes to households in the top 1% of the income distribution spectrum (Ford, 2015). Even the Central Intelligence Agency found income inequality of the U.S. “on par with that of the Philippines” and exceeding that of other developing countries such as Tunisia, Egypt, or Yemen (p. 46). This sign indicates resources provided by technology allow for cost saving in the structure of heavily technology dependent firms. In turn they generate more profits while needing less human labor. The outcome of a system like this creates a concentration of wealth in few households, while creating more households with less individual wealth. An example of this includes Google which generated a 12 billion dollar profit in 2012 while hiring around 38,000 employees (Ford, p. 76, 2015). Compare this to General Motors having 840,000 employees at its peak in 1979, while generating 11 billion dollars in profit adjusting for inflation (Ford, p. 76, 2015).

### **Declining Incomes and Underemployment for Recent College Graduate**

Skill biased technological change contributes to the increase in use of technologies. As Ford(2015) explained, this idea holds that “information technology has automated or deskilled much of the work handled by less educated workers, while simultaneously increasing the relative value of the most cognitively complex tasks” (p. 48). This situation creates significant inequality since those with a college degree make 80% more hourly than those with no degree (p. 48). At

the same time, many have a difficult time finding a job where they actually utilize the degree they earned making it tough to move up the socioeconomic ladder. Technology can make this exceedingly difficult, especially for those looking for “repetitive routine” (Weaverman, p. 168, 2015) jobs, such as those in the accounting sector with an automation potential of 98% (as cited by Arntz, Gregory, and Zierahn, 2016)

### **Polarization and Part-Time Jobs**

Polarization or “decline in jobs and wages in the middle of the income distribution” (Waverman, 2015,p. 165) occurs in the recovery phase of recessions in the U.S. Studies analyzed this effect and concluded that “the good middle-class jobs are most likely to disappear, while jobs that tend to get created during recoveries are largely concentrated in low-wage sectors” (Ford, 2015,p. 49). During the recession of 2007 there was a loss of 5 million full time jobs while part time jobs increased by 3 million (Ford, p. 49, 2015). Technology does affect polarization according to MIT economist David Autor (p. 50). He attributes job loss to the “automation of routine work” and “offshoring” or shifting of jobs to other countries (p. 50). Further studies have shown that up to “92% of the job losses in mid-range occupations have occurred within a year of a recession” (p. 50). This suggest that after a recession, organizations find ways to implement more information systems to operate more efficiently within their environment.

### **Combination of Factors**

All seven elements rely on the fact that technology has constantly expanded and evolved since its earliest modern transitions beginning in the 70s. Initially, there exists an ongoing technological plateau, however two of the future innovation giants are just forming, Microsoft and Apple, soon become driving forces in innovation and turning that plateau into an incline.

They eventually change the way technology businesses operate. By the 80s computers have been developed and become available to consumers for personal use. The 90s bring a totally new transformation due to the development of the web sparking innovation into the 21<sup>st</sup> century. These advancements make it possible for information systems to gain capabilities to perform some of the repetitive or pattern based tasks. During recovery times of recession, these technologies become enticing for firms as means for labor savings, eradicating a number of jobs.

### **The Argument**

As seen, technology surrounds many aspects of daily life, so it makes sense to think that it has definitely impacted the economy and employment in some way. A study review conducted by economists Ciriani and Perin (2015) suggests, expert viewpoints can vary greatly on whether digital capital, or technological “financial assets” (“Capital”, 2016), increases unemployment. Some factors of consideration when studying this argument include digital innovations, productivity growth, and employment growth. Some of the main points in the research analysis include the apparent polarization or hollowing out of the middle class jobs by technology leading to an overall increase in low skill and high skill labor (Ciriani & Perin,2015). At the same time, other findings suggest that only low-skill jobs face displacement. Tvariations depend on the perspectives and sources used in the research, whether they come from differing economic models, country specific economic data sets, or even the same sets of data.

One of these studies presented by Ciriani and Perin (2015) comes from economic analysts Atkinson and Miller who concluded “that there is no statistical evidence that aggregate productivity growth is detrimental to employment” (p. 149). This serves as a response to those citing productivity growth and decreasing wages as signs of increasing technological applications. Moreover, they present information indicating that the U.S. economy has actually



shows an “inverse relationship between productivity and unemployment” (p. 150) when looking at the long run over the data from 1947-2010.

Another study presented by Ciriani & Perin comes from Collard and colleagues, economic researchers, who found that heavy investment on information and communication technologies only caused a decrease in unemployment in the short run, but this normalized in the long run as new technologies were diffused (p. 150, 2015). However, it should be noted this conclusion came from analysis from calibrated model of the French economy, but France does have developed economy just like the U.S.

Massachusetts Institute of Technology economist Autor accepts technology’s displacement of jobs in the middle-skilled occupations to some degree. However, he doesn’t view this displacement as significant because he insists that it “will not continue indefinitely” (as cited by Ciriani & Perin, p. 157, 2015) because these technologies become complementary due to the fact that digital capital doesn’t have “flexibility, judgement, and common sense” (p. 157) and adding that low-skilled jobs will not decrease because the costs for them are already low. In this case investment in automation technologies appears unlikely. Additionally, he explains the decreases in job creation beginning in the 2000s occurred not because of labor substitution by digital capital, but more so by the “bursting of the internet bubble and financial crisis combined with a general trend of increased international competition” (p. 158).

Many of these studies arguing against mass technological unemployment, make the point that unemployment only presents itself temporarily because newly implemented technologies eventually create jobs requiring adaptation of skills or new skills. Milligan College professor of computer science and information systems, Dr. Carter, holds this view explaining that technology does seem to cause unemployment; however, the job market eventually adjusts

through the creation of job opportunities as outcomes of the new technologies themselves (T. Carter, personal communication, October 31, 2016). Furthermore, she believes that most current displacement of jobs comes with those in the low-skill range and typically involving the manufacturing sector (T. Carter, personal communication, October 31, 2016).

Yet researchers such as Frey and Osborne indicate that 47% of the total jobs in the US face a risk of automation in the next twenty years. They expect low-skill occupations as most susceptible to replacement by computer capital, while those jobs involving social and creative intelligence as least susceptible (Ciriani & Perin, 2015, p. 158,).

In response to Frey and Osborne findings, the Organization for Economic Co-operation and Development released working papers to state their view on these claims. They scrutinize these claims and believe the claims are exaggerated because Frey and Osborne use an occupation-based approach, rather than a task-based approach (Arntz, Gregory, & Zierhan, 2016). This becomes important because Arntz, Gregory, and Zierahn (2016) believe that “automation usually aims at automating certain tasks rather than whole occupations” (p. 7) suggesting Frey and Osborne’s claims as inaccurate.

Another point of critique comes from the fact that because a job has the potential for automation, does not directly indicate that it will because there are “legal as well as ethical obstacles that may prevent such a substitution or at least substantially slow down its pace” (Arntz, Gregory, & Zierahn 2015, p. 7). After applying the task based approach the conclusion results in 9% of U.S. jobs threatened by some form of automation rather than initially proposed 47%. This new figure still portrays a significant change, yet it may not be as severe as one would think. The speed at which new technologies become available should be considered along with and their potential to create new jobs.

### **Speed is Key**

The rate of development in computing power increases at exponential rates. This allows for applications of technology in many sectors. In fact, this exponential increase has its own name, Moore's Law, named after Gordon Moore who made an empirical observation noticing "the number of components on an integrated circuit double every two years" (Clements, 2012, p. 25). This means computing power doubles about every two years. This continuously ongoing acceleration adds up to create significant change in the long run. Today's computing power holds immense capabilities especially with the rise of new computing methods such as quantum computing, which can theoretically compute complex solutions to problems thousands of times faster than the fastest computers of today (Google Quantum, 2014).

Other emerging technologies with great potential include nanotechnologies and sensor technologies (T. Carter, personal communication, October 31, 2016). Nanotechnology can cause a massive disruption because of its theorized applications. It deals with very small mechanized elements with capabilities to work at the cellular level holding potential for the development of a cancer treatment (T. Carter, personal communications, October 31, 2016).

Sensor technology can also cause great impact with devices of the future because it approaches levels of such high sensory accuracy, one day it could produce some artificial like components known as bionics. In fact, there exists a Cybathlon or competition for those with disabilities using technological means to accomplish simple tasks (Lalwani, 2016). During this competition, companies specializing in bionics showcase their most innovative developments to show the useful human applications in the future.

This continual path of innovation gives these two emerging technologies great chances of branching out further expanding their specialty niche. Add to this other unknown

consumer applications, and it can be easy to envision the creation of specialized jobs in their fields.

### **Current Technology and its Capabilities**

In March 13, 2004 the Defense Advanced Research Projects Agency held its first Grand Challenge where it set up competition with a prize of 1 million dollars for teams of autonomous cars to complete a 150 mile course, and the furthest any car made it was seven miles from the start line (Ford, p. 181, 2015). It's now 2016, Uber, a transportation company, releases its first autonomous taxis in September on the streets of Philadelphia (Jeffrey, 2016). On October 24, 2016, Otto, a company developing autonomous trucks, completes its first commercial delivery using a fully autonomous system on a truck from Fort Collins to Denver, Colorado (Davies, 2016). Five days later, Tesla motors announces that all of their newly produced cars have self-driving hardware (Tesla Team, 2016). All the while Google continues work on its autonomous car project founded in 2008 (Ford, 2015). Autonomous vehicles appear poised for a great disruption in the transportation industry.

Ford (2015) provides insight on potential outcomes of such technologies believing that a “true driverless vehicle has the potential to completely upend the way we think about and interact with cars. It could also vaporize millions of solid middle-class jobs and destroy businesses” (p. 191). Autonomous vehicles make a car sharing model likely where people, instead of buying a car, pay for a car subscription service and call the car when needed. In fact, a similar service has already been proposed by Tesla. Such a plan gives potential for less pollution and less crowding of cars in large cities. Additionally, autonomous car systems can provide greater safety on the roads as proven by Google's autonomous car data (Ford, 2015).

However, there exists potential issues with implementation of these vehicles. Autonomous systems will need protection from tampering by hackers, and an even greater challenge comes with social acceptance by the masses (Ford,2015). Additionally, new laws will arise in many states to regulate the use of these autonomous vehicles, nevertheless they hold the potential to transform the future economy of the transportation sector.

According Frey and Osborne, occupations intensive in creative intelligence exemplify fields “least susceptible to substitution by computer capital” (as cited by Ciriani & Perin, p. 158, 2015). However, current technology has proven it can do work in creative fields. Northwestern University developed a software call Stats Monkey that could take the statistics from a sporting event and produce a report of the event in a narrative manner. (Ford, 2015). Later in 2010, this software was adapted to produce a “comprehensive artificial intelligence engine” (p. 84) that could automatically produce articles on various areas. This software became Quill and contributes to Forbes by creating news stories at a rate of one news story every thirty seconds on their website (Ford, p. 85, 2015).

Other areas of creative thinking infiltrated by technology include music composition and visual arts. A computer system named Iamus developed a composition for the London Symphony Orchestra to perform. Eventually this Iamus system became commercialized and has since produced many more compositions now sold in an online store. At the University of London, a program called The Painting Fool was created by professor Colton and holds capabilities to produce its own unique works of art (Ford, 2015).

### **What do we do?**

If technology at its current state proves that it can in fact do some of the jobs that are considered the least susceptible, should there be concern for the future? Saltinski (2015) declares “that technology will dominate our future society is little debate. The impact of that dominating technology is the debate” (p. 31). Aho and Barry (2016) also mention that “we already see large changes in income inequality which may be due to the newest technological changers, leaving vast amounts of workers unskilled and an elite class of experts in computer technologies” (p. 1). One of the most often brought up potential solutions to this threat of technological unemployment comes with a universal guaranteed basic income (Aho & Barry, 2016; Ford, 2015; Hughes, 2014; Illing, 2016; Loi, 2016; Saltinski, 2015) meaning citizens of the country receive income no matter if they work or not.

The idea may seem as a wild, or even socialist to some. However, this idea has lingered for a while with one of its biggest proponent, Friedrich Hayek, a conservative economist having won the 1974 Nobel Prize in Economics. He saw guaranteed income as a “policy designed to provide insurance against adversity” which results from the “transition to a more open and mobile society where many individuals can no longer rely on traditional support systems” (p. 258). In this case, it provides a safety net for all of those affected by technological unemployment. Santens (2016) suggests universal income as a better alternative than a standard expansion of the current welfare system, since it would cost less given the U.S. Government eliminates all current welfare programs (Santens, 2016). Then, this basic income would serve as a minimum income floor allowing people to have just enough to live, while still having the opportunity to find a job if the person wants a better lifestyle.

Yet some oppose this idea such as Kenneth Rogoff of Harvard University acknowledging “since the dawn of the industrial age, a recurrent fear has been that technological change will

spawn mass unemployment. Neoclassical economists predicted that this would not happen because people would find other jobs, albeit possibly after a long period of painful adjustment”(as cited in Aho & Barry, p. 22, 2016). Despite, of this common opinion, researchers Marchant, Yvonne, Stevens, and Hennessey (as cited in Saltinski,p. 30, 2015) have gone ahead to explore and to present a series of policy actions to help cope with mass unemployment in the future. In the midst of this darkness some still hold an optimistic view on such transition. Techno-optimist and author Domingo believes “the transition will be tumultuous, but thanks to democracy, it will have a happy ending” (as cited in Saltinski, p. 31, 2015).

These theories regarding basic income still need field testing to gage their effectiveness. Y-Combinator, a company successful in helping growing startups, announced that it would soon conduct a basic income experiment in Oakland, California to see how “people’s happiness, well-being, and financial health” respond to the change (Altman, 2016). Likewise, the providence of Ontario holds plans for the testing of a universal basic income set to launch its testing sometime in the spring of 2017 (Himelfarb, 2016). Not until more countries test this type of policy, can it gain a solidified reputation as a possible solution given its outcomes provide positive social effect while staying economically feasible.

### **Conclusion**

Technological advancement brings forth the ability for the automation of many tasks with the potential to bring about technological unemployment. At this time, evidence points to its reality, however the length and its continual presence stays highly debatable depending on the time frame analyzed, whether it be the short or long run. This mostly stems from the fact that the future can be very unpredictable and depends on too many variables. Ford (2015) states that the “economy is an enormously complex system, ripe with a myriad of interdependencies and

feedback loops” (p. 206). For this reason, economic forecasting presents a challenge even for leading economists. Like weather forecasters, economic experts can change their expectations from one instance to the next making it difficult to reach a definitive conclusion on the economic future the U.S.

One way to get a sense of technologies impact on the job market involves looking at current events and using them to develop an insightful view of the topic. The possibility of mass technical unemployment seems unlikely, yet should be considered given current capacities of technology. Furthermore, when taking into consideration the hurdles and the time it can take to implement technology due to government regulations, it becomes clear that having the capacity does not equate to instant application. The government plays a significant role in the unfolding of technologies, especially if they can impact the job market in devastating manner (C. Carter, personal communication, October 31, 2016). For this reason, the consideration of universal basic income in the U.S. appears to be of low priority at this moment, yet analysis of basic income studies should not be dismissed. If anything they can provide some guidance against the an unexpected crisis brought forth by technological unemployment. Then at least there will be experimental data for reference.

In the end, “today’s computer technology exists because millions of middle-class taxpayers supported federal funding for basic research in the decade following World War II” (Ford, 2015, p. 80). The United States is a nation of consumption. The people get what they demand. If this demand entails newer technologies, then they will be developed. Demand and consumption support research and development of new technology in a continuous cycle. Where the consumer dollar goes, the future does also.



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