

## FOREIGN AFFAIRS

### Will Humans Go the Way of Horses?

#### Labor in the Second Machine Age

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The debate over what technology does to work, jobs, and wages is as old as the industrial era itself. In the second decade of the nineteenth century, a group of English textile workers called the Luddites protested the introduction of spinning frames and power looms, machines of the nascent Industrial Revolution that threatened to leave them without jobs. Since then, each new burst of technological progress has brought with it another wave of concern about a possible mass displacement of labor.

On one side of the debate are those who believe that new technologies are likely to replace workers. Karl Marx, writing during the age of steam, described the automation of the proletariat as a necessary feature of capitalism. In 1930, after electrification and the internal combustion engine had taken off, John Maynard Keynes predicted that such innovations would lead to an increase in material prosperity but also to widespread “technological unemployment.” At the dawn of the computer era, in 1964, a group of scientists and social theorists sent an open letter to U.S. President Lyndon Johnson warning that cybernation “results in a system of almost unlimited productive capacity, which requires progressively less human labor.” Recently, we and others have argued that as digital technologies race ahead, they have the potential to leave many workers behind.

On the other side are those who say that workers will be just fine. They have history on their side: real wages and the number of jobs have increased relatively steadily throughout the industrialized world since the middle of the nineteenth century, even as technology advanced like never before. A 1987 National Academy of Sciences report explained why:

“By reducing the costs of production and thereby lowering the price of a particular good in a competitive market, technological change frequently leads to increases in output demand: greater output demand results in increased production, which requires more labor.”

This view has gained enough traction in mainstream economics that the contrary belief—that technological progress might reduce human employment—has been dismissed as the “lump of labor fallacy.” It’s a fallacy, the argument goes, because there is no static “lump of labor,” since the amount of work available to be done can increase without bound.

In 1983, the Nobel Prize–winning economist Wassily Leontief brought the debate into sharp relief through a clever comparison of humans and horses. For many decades, horse labor appeared impervious to technological change. Even as the telegraph supplanted the Pony Express and railroads replaced the stagecoach and the Conestoga wagon, the U.S.

equine population grew seemingly without end, increasing sixfold between 1840 and 1900 to more than 21 million horses and mules. The animals were vital not only on farms but also in the country's rapidly growing urban centers, where they carried goods and people on hackney carriages and horse-drawn omnibuses.

But then, with the introduction and spread of the internal combustion engine, the trend rapidly reversed. As engines found their way into automobiles in the city and tractors in the countryside, horses became largely irrelevant. By 1960, the United States counted just three million horses, a decline of nearly 88 percent in just over half a century. If there had been a debate in the early 1900s about the fate of the horse in the face of new industrial technologies, someone might have formulated a "lump of equine labor fallacy," based on the animal's resilience up till then. But the fallacy itself would soon be proved false: once the right technology came along, most horses were doomed as labor.

Is a similar tipping point possible for human labor? Are autonomous vehicles, self-service kiosks, warehouse robots, and supercomputers the harbingers of a wave of technological progress that will finally sweep humans out of the economy? For Leontief, the answer was yes: "The role of humans as the most important factor of production is bound to diminish in the same way that the role of horses . . . was first diminished and then eliminated."

But humans, fortunately, are not horses, and Leontief missed a number of important differences between them. Many of these suggest that humans will remain an important part of the economy. Even if human labor becomes far less necessary overall, however, people, unlike horses, can choose to prevent themselves from becoming economically irrelevant.

#### WHAT HUMANS WANT

The most common reason given for why there is no lump of labor is that human wants are infinite. Indeed, throughout modern history, per capita consumption has steadily risen. As Alfred Marshall put it in his foundational 1890 book, *Principles of Economics*, "Human wants and desires are countless in number and very various in kind." Ever since Marshall, people have linked unlimited wants to full employment. After all, who else but workers will be able to fulfill all those wants and desires?

However comforting this argument may be, it is also incorrect, because technology can sever the link between infinite desires and full employment. As recent advances suggest, it's no longer pure science fiction to contemplate completely automated mines, farms, factories, and logistics networks supplying all the food and manufactured goods a population could require. Many service jobs and much knowledge work could also be automated, with everything from order taking to customer support to payment processing handled by autonomous intelligent systems. Perhaps some innovative humans would still be required in this world to dream up new goods and services to be consumed, but not many. The 2008 animated film *WALL-E* provides a vivid and unsettling vision of just

such an economy: most people exist only to consume and to be marketed to, and they have become so obese that they can hardly move under their own power.

As the WALL-E dystopia suggests, people's unbounded economic wants are not guarantors of full employment in a world of sufficiently advanced technology. After all, even if humans' demand for transportation grew infinitely—and it has grown enormously in the past century—that would have little effect on the demand for horses. Technological progress, in short, could be capable of decoupling ever-growing consumption and large-scale human employment, just as it did earlier with equine employment.

Unless, of course, we don't want to be served exclusively by robots and artificial intelligence. This represents the biggest barrier to a fully automated economy and the strongest reason that human labor will not disappear anytime soon. We humans are a deeply social species, and the desire for human connection carries over to our economic lives. There's an explicitly interpersonal element in many of the things we spend money on. We come together to appreciate human expression or ability when we attend plays and sporting events. Regulars frequent particular bars and restaurants not only because of the food and drink but also because of the hospitality offered. Coaches and trainers provide motivation that can't be found in exercise books or videos. Good teachers inspire students to keep learning, and counselors and therapists form bonds with clients that help them heal.

In these cases and many others, human interaction is central to the economic transaction, not incidental to it. Contrary to Marshall's emphasis on the quantity of human needs, it's better to focus on the quality of human needs. Humans have economic wants that can be satisfied only by other humans, and that makes us less likely to go the way of the horse or descend into the world of WALL-E.

#### NOT DEAD YET

But are our interpersonal abilities the only ones that will allow us to stave off economic irrelevance? Over at least the next decade, the answer is almost certainly no. That's because recent technological progress, while moving surprisingly fast, is still not on track to allow robots and artificial intelligence to do everything better than humans can within the next few years. So another reason that humans won't soon go the way of the horse is that humans can do many valuable things that will remain beyond the reach of technology.

When it comes to navigating and shaping the physical world, humans maintain many advantages. We are far more dexterous and nimble than any single piece of machinery, and we are comparatively lightweight and energy efficient. Plus, our senses provide fast and multidimensional feedback that allows precise movement and control. There's no robot anywhere in the world right now, for example, that can sort a bowlful of coins as well as the average child or clear a table as well as a restaurant busboy.

Our mental advantages might be even greater than our physical ones. While we're clearly now inferior to computers at arithmetic and are getting outpaced in some types of

pattern recognition—as evidenced by the triumph of Watson, an artificial-intelligence system created by IBM, over human Jeopardy! champions in 2011—we still have vastly better common sense. We're also able to formulate goals and then work out how to achieve them. And although there are impressive examples of digital creativity and innovation, including machine-generated music and scientific hypotheses, humans are still better at coming up with useful new ideas in most domains. This calls to mind a quote attributed to a 1965 NASA report: “Man is the lowest-cost, 150-pound, nonlinear, all-purpose computer system which can be mass-produced by unskilled labor.”

It is extraordinarily difficult to get a clear picture of how broadly and quickly technology will encroach on human territory (and a review of past predictions should deter anyone from trying), but it seems unlikely that hardware, software, robots, and artificial intelligence will be able to take over from human labor within the next decade. It is even less likely that people will stop having economic wants that are explicitly interpersonal or social; these will remain, and they will continue to provide demand for human workers.

But will there be enough demand, especially over the long term, for those two types of human labor: that which must be done by people and that which can't yet be done by machines? There is a real possibility that the answer is no—that human labor will, in aggregate, decline in relevance because of technological progress, just as horse labor did earlier. If that happens, it will raise the specter that the world may not be able to maintain the industrial era's remarkable trajectory of steadily rising employment prospects and wages for a growing population.

### BATTLING THE ROBOTS

The story doesn't end there, however. Having valuable labor to offer is not the only way to remain economically important; having capital to invest or spend also ensures continued relevance. A critical difference between people and horses is that humans can own capital, whereas horses cannot. People, in fact, own all the nongovernmental wealth in capitalist societies. All shares in firms, for example, are owned directly or indirectly (via vehicles such as retirement funds) by individuals. That means that humans can choose to redistribute that capital in order to replace income lost to robots.

The challenge here is that capital ownership appears to have always been highly uneven and has become increasingly skewed recently. As the economist Thomas Piketty writes in *Capital in the Twenty-first Century*, “In all known societies, at all times, the least wealthy half of the population own virtually nothing (generally little more than 5 percent of total wealth).” Increases over the past few years in the value of stocks, urban real estate, and several other forms of capital have benefited an incredibly small group. Credit Suisse has estimated that in 2014, the richest one percent held 48 percent of the world's total wealth. In part, this increased unevenness reflects growing inequality in wages and other forms of compensation. Automation and digitization are less likely to replace all forms of labor than to rearrange, perhaps radically, the rewards for skills, talent, and luck. It is not hard to see how this would lead to an even greater concentration of wealth and, with it, power.

It's possible, however, to imagine a "robot dividend" that created more wide-spread ownership of robots and similar technologies, or at least a portion of the financial benefits they generated. The state of Alaska provides a possible template: courtesy of the Alaska Permanent Fund, which was established in 1976, the great majority of the state's residents receive a nontrivial amount of capital income every year. A portion of the state's oil revenues is deposited into the fund, and each October, a dividend from it is given to each eligible resident. In 2014, this dividend was \$1,884.

It's important to note that the amendment to the Alaska state constitution establishing the Permanent Fund passed democratically, by a margin of two to one. That Alaskans chose to give themselves a bonus highlights another critical difference between humans and horses: in many countries today, humans can vote. In other words, people can influence economic outcomes, such as wages and incomes, through the democratic process. This can happen directly, through votes on amendments and referendums, or indirectly, through legislation passed by elected representatives. It is voters, not markets, who are picking the minimum wage, determining the legality of sharing-economy companies such as Uber and Airbnb, and settling many other economic issues.

In the future, it's not unreasonable to expect people to vote for policies that will help them avoid the economic fate of the horse. For example, legislatures might pass restrictions on certain types of job-destroying technologies. Although there appear to be few such explicit limits to date, already there are nascent efforts to draft legislation related to autonomous cars and other technologies with relatively direct implications for labor. And in every democracy, there are candidates for office who espouse a desire to help workers. There is no reason they will not continue to act on those impulses.

If and when a large enough group of people become sufficiently displeased with their economic prospects and feel that their government is indifferent or actively hostile to them, a final important difference between horses and humans will become clear: humans can revolt. Recent years have seen explicitly economic uprisings, including both the relatively peaceful Occupy Wall Street movement in the United States and the sporadically violent (and occasionally fatal) anti-austerity protests in Greece.

Over a longer time span, history provides no shortage of examples of up-risings motivated in whole or in part by workers' concerns. Democracy is no guarantee against such uprisings, nor is the fact that the material conditions of life generally improve over time for most people in most countries. The horse population accepted its economic irrelevance with not a murmur of protest (as far as we can tell). If the same happens to human workers, they are unlikely to be so meek.

#### A LABOR-LIGHT ECONOMY

Current discussions of economic policy focus on how to improve workers' job and wage prospects. That makes sense, since robots and artificial intelligence are not on the brink of learning how to do every job. The best way to help workers in today's climate is to equip them with valuable skills and to encourage overall economic growth.

Governments should therefore pass education and immigration reform, enact policies to stimulate entrepreneurship, and increase investment in infrastructure and basic research. They might also use some combination of awards, competitions, and financial incentives to encourage technology innovators to develop solutions that explicitly encourage and support human labor rather than primarily substituting for it.

That said, it is more than a bit blithe to assume that human labor will forever remain the most important factor of production. As Leontief pointed out, technological progress can change that, just as it did for the horse. If and when this happens, humans' other differences from horses will become critical. Once many, even most, people see their income from labor recede, their views on the ownership of capital and the distribution of its proceeds, as expressed through votes or revolts, will matter even more than they do now.

It's time to start discussing what kind of society we should construct around a labor-light economy. How should the abundance of such an economy be shared? How can the tendency of modern capitalism to produce high levels of inequality be muted while preserving its ability to allocate resources efficiently and reward initiative and effort? What do fulfilling lives and healthy communities look like when they no longer center on industrial-era conceptions of work? How should education, the social safety net, taxation, and other important elements of civic society be rethought?

The history of horse labor offers no answers to these questions. Nor will answers come from the machines themselves, no matter how clever they become. They will come instead from the goals we set for the technologically sophisticated societies and economies we are creating and the values embedded in them.

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