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Technology, Inequality, and Labor-Capital Dynamics in the United States, From the Gilded Age to the Present

Executive Summary

In this paper, I explore technology's role in exacerbating inequality, as well as efforts to counter such tendencies through policy.

In Part I, I attempt to address the following question: what has been the historical relationship between the rise of transportation technologies and the relative power of labor versus capital in the United States? I find that while in an unfettered market these technological advancements disproportionately benefit capital and increase class disparity, regulated technological productivity gains are conducive to labor power and relative middle class prosperity. I choose the transportation industry because transportation infrastructure has historically played a particularly important role in the geographic, social, labor, and economic structures of American life. More importantly, the industry provides a good large-scale model to demonstrate capital-labor interactions with technology.

In Part II, I discuss the implications of Part I's transportation industry thesis in today's broader society, which increasingly has the ability to replace human labor with machines. The deep division reflected in this year's populist uprising and the election of President Trump can partly be attributed to the frustration of Americans whose wages have stagnated and whose jobs have been displaced by the forces of globalization and automation. Although President Trump has not proposed any technology-specific policies, it is possible to analyze the implications of his

economic policy on inequality and anticipate how technology will exacerbate the ever-growing class division under his proposal.

Part 1

Unregulated increases in productivity due to technological capital have the effect of increasing wage inequality and fomenting disparity along identity lines, while regulated technologies have the opposite effect: they create relative prosperity and result in a stable middle class. To prove the first part of this thesis, we'll take a look at the railroad industry in the Gilded Age and the automobile industry prior to the New Deal, and to prove the second part, we'll examine the post-Depression auto industry.

The Rise of Rail and the Depression of the Middle Class

Rail as a technological innovation during a laissez faire political regime increased capital's leverage over labor, resulting in a depression of the middle class wage.

In the early 20th century, the rise of the large corporation and the increasing ubiquity of the factory workplace depersonalized the once intimate employer-employee dynamic and routinized work, expropriating power from labor to capital.[1] These broader Gilded Age trends were epitomized by, and perhaps due to, the meteoric rise of railroad technology. During the Gilded Age, rail was the middle class job.[2] In Hudson River R. R. Chairman Chauncey M. Depew's 1914 *A Half Century With a Railroad* speech, he establishes rail's role as the key industrial foundation of the American middle class:

> *"There are nearly two millions on the payrolls of the railroads, and with their families they number ten millions or one-tenth of the population of the country. There are nearly as many dependent largely on the railroads in the coal and iron mines, the steel rail mills and the manufacture of railway supplies. There are ten*

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[1] Carnegie, Andrew. "The Common Interest of Labor and Capital." In *Addresses: Business and Industry*, by Thomas B. Reed and Ashley Horace Thorndike, 42-44. Vol. 4. New York: Modern Eloquence, 1923.
[2] Dubofsky, Melvyn, and Joseph Anthony McCartin. *Labor in America: A History*. 7th ed. Hoboken, NJ: John Wiley & Sons, 2017.

million depositors in the savings banks, and the largest investment of those banks is in railroad securities. So here are nearly two-thirds of the people directly or indirectly dependent on the prosperity of the railroads."[3]

As the driver or enabler of most growth—from the Midwestern meatpacking industry to the Northeastern textile mills to the suburban commuter lifestyle—rail was also a technological innovation that doled unprecedented leverage to capitalists by collapsing time and distance at every point along the supply chain, increasing access to raw materials and expanding both consumer and labor markets.[4]

Because of the high cost of operation and the network effects of the rail industry, the economic downturn of 1873 caused many smaller railroad companies to either go bankrupt or become absorbed into larger regional railroad conglomerates.[5, 6] Additionally, rail's supporting industries—from the steel and ironworks industries that formed rail's inputs to the drygoods industries that relied on rail for transportation—became increasingly integrated with advanced machinery.[7]

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[3] Depew, Chauncey M. "A Half Century With a Railroad." In *Addresses: Business and Industry*, by Thomas B. Reed and Ashley Horace Thorndike, 91. Vol. 4. New York: Modern Eloquence, 1923.
[4] Lind, Michael. *Land of Promise: An Economic History of the United States*. New York: Harper, 2013. 120.
[5] Ibid., 154.
[6] Note: It is common for technological advancement to exacerbate winner-takes-all network effects, especially when the technology expands a market, thereby removing the protection of localism. We see this reflected particularly strongly today in digital and internet technologies, especially on platforms that employ ratings systems, like Amazon and Yelp. Why purchase something second best when you can just as easily purchase the best? In this way, distance-collapsing technologies are conducive toward monopolization, and I argue, capital power. Uber perhaps best parallels the railroad network narrative, in that the more cities Uber captures, the greater value Uber can serve to its users; the more users it has, the more favorably it presents in regulatory wars with cities (the more cities it can capture). As Uber monopolizes the ride share economy and displaces the alternative—the incumbent taxi industry, drivers lose choice of employment. See McAfee and Brynnjolfson's *The Second Machine Age* for a similar argument. In particular, "The Bounty and the Spread" delves into the winner-take-all effect of digital ratings platforms.
[7] Lind, 120.

The overwhelming power of the railroad conglomerate both infrastructurally and politically, through proxy of the US Railroad Labor board and the Inter-State Commerce Commission, which Depew calls "the most powerful bureau in the world," meant that railroad workers were at the mercy of railroad bosses and investors.[8] Superficially, the existence and endowed power of transportation regulatory agencies like the US Railroad Labor Board and the Inter-State Commerce Commission would seem to create tension with my thesis, as it suggests that the period from 1887 (the year of the ICC's inception) to 1926 (the year of the RLB's termination) was one of government intervention on behalf of labor, rather than one of laissez faire capitalism.[9] Certainly, a face-value reading of Pennsylvania R. R. Vice-President William Wallace Atterbury's *The Public Can Secure the Railroad Service it Wants,* in which he argues that a decade's worth of rampant regulation has stifled growth and reduced managerial initiative, would support this idea:

> *"Always there was growing the ever-swelling stream of legislation of a restrictive character, some fanatical, some political and some utterly selfish, but all tending to increase the cost of operation and lessen the initiative of the management. There came a veritable avalanche of regularity legislation: Safety Appliance Acts, Hours of Service Act, Employers' Liability Act, Ashpan Act, Clayton Anti-Trust Act, Headlights, Fire Doors, Transportation of Explosives, Adamson Act, Railway Mail Service, Full Crew Laws, Bills of Lading, Boiler Inspection,—and so on—some good, the majority bad, but all working to take away from the management actual control of the operation of the property."*[10]

However, closer scrutiny reveals that the bureaus themselves were very much in the pocket of railroad executives from their inception. While many of Theodore Roosevelt's Anti-trust regulations during this time were created to temper corruption, many of these efforts were

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[8] Depew, 91.
[9] Dubofsky, Melvyn, and Joseph Anthony McCartin. *Labor in America: A History*. 7th ed. Hoboken, NJ: John Wiley & Sons, 2017. 383.
[10] Atterbury, William Wallace. "The Public Can Secure the Railroad Service It Wants." In *Addresses: Business and Industry*, by Thomas B. Reed and Ashley Horace Thorndike, 5. New York: Modern Eloquence, 1923.

structurally weak until the New Deal renewed and revived them.[11] Soon after its charter under the Transportation Act of 1920, the US Railroad Labor Board's susceptibility to the influence of capital manifested in a series of steep wage cuts for the 2 million railroad workers under their purview, culminating in the 1922 approval of a reduction of 7 cents per hour for railway repair and maintenance workers—equivalent to an average wage loss of 12 percent for these workers.[12] Atterbury himself betrays his antagonism toward the scope of the RLB when he acknowledges his own railroad company's sway in its wage setting: "We are now before the United States Railroad Labor Board requesting them to authorize a *still further* reduction in wages."[13] During the early 20th century, the façade of government involvement on behalf of labor wasn't enough to mitigate inequality. It failed to thoroughly resist capital's powerful lobbying ability within government, a role that a third party—unions—would come to fill in the next half century.

The factory environment normalized in rail's supporting industries also marginalized labor by deskilling and routinizing work. This effect of technology made each laborer interchangeable with the other and thus, less valuable. In Andrew Carnegie's *The Common Interest of Labor and Capital* speech, given to his steelworkers in 1889, he laments the "irresistible tendency of our age, which draws manufacturing into immense establishments," and increasingly leaves the laborer's human capital "impaired or depreciated."[14] He goes on to describe the lost "feeling of mutuality" between labor and capital: "Thus the employees become more like human machines, as it were, to the employer, and the employer becomes almost a myth to his men."[15] Carnegie's *Common Interest* speech, in conversation with the Great Railroad

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[11] Lind, 156.
[12] Foner, Philip Sheldon. *History of the Labor Movement in the United States: The T.U.E.L. to the End of the Gompers Era.* Vol. 9. New York: International Publishers, 1991. 175.
[13] Atterbury, 4. (Italics mine)
[14] Carnegie, 43.
[15] Ibid, 44.

Strikes of 1887, speaks to the period's unchecked, growing divide between capital and labor.[16] The depersonalization of factory work also allowed capitalists to balkanize the labor force along identity lines, directing resentment of joblessness onto strikebreakers and scapegoats, like immigrants and women workers.[17] This escalating tension erupted into labor violence following the Panic of 1893 and culminated in William Jennings Bryan's populist nomination for presidency in 1896, which we see paralleled today by 2016's global malaise and Trump's populist election.[18]

Commoditization of Labor in the Early Days of the Auto Industry

Prior to the New Deal, the nascent automobile industry and the revolutionary Ford factory layout again drastically deskilled work, this time by making each worker perform a single recursive step within the larger schema of a continuously moving assembly line, which could be sped up at the touch of a button.[19] This forced autoworkers to increase their pace—sometimes dangerously so—for fear of "holding up the line," which was a punishable offense.[20] From 1920 to 1925, Ford plants increased their production from 25,000 to 31,200 cars per week without any complementary increase in machinery or labor force.[21] Subdivision and standardization of work enabled by mechanization also made labor more replaceable than ever, transforming the typical semi-skilled autoworker or mechanic into an unskilled machine tender. While in 1910, up to three-quarters of Michigan autoworkers were skilled tradesmen, by 1924, only one-tenth held the same qualifications.[22] Ford also boasted in his memoir that in his

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[16] Lind, 156-172.
[17] Ibid., 172.
[18] Ibid., 156-172.
[19] Barnard, John. "Auto Workers Before the Union." In *Walter Reuther and the Rise of the Auto Workers*, 20-24. Boston U.a.: Little, Brown, 1983.
[20] Barnard, 23.
[21] Barnard, 23.
[22] Ibid. 19-20.

factories, “43 per cent. of all the jobs require not over one day of training” and that an additional “36 per cent. require from one day to one week.”[23] This unprecedented onboarding efficiency provided one of the reasons why the pre-New Deal auto industry faced difficulty achieving any sort of unionization. Early attempts to organize labor without the benefit of legislative authority proved ineffective, as Ford plants were able to quickly recoup production capacity even under threat of strikes.[24] The dispensability of workers also gave foremen and managers an arbitrary exercise of power, as their ability to hire and fire without restraint proved conducive to bribery, corruption, and favoritism.[25]

The argument is often made that the relatively high wages of the auto industry compensated for the qualitative exploitation autoworkers experienced as a result of commoditization.[26] Although history has painted Ford’s 1914 $5 per day wage policy as a capitalist victory for labor, the entire picture was less rosy. In reality, because of the seasonal nature of auto employment, the high rates were well qualified, since employers laid off workers during times of slack production.[27] The $5 per day policy also came with less obvious wage grievances, such as irregular payments, piece rates, complicated bonus payments, and even probationary periods contingent on a paternalistic program of moral reform.[28] During the 1920s, the annual real wages of autoworkers were only marginally higher than those of the average manual worker.[29] As a result, it would be overly optimistic to say that the pre-New Deal auto industry equalized wages in any significant capacity. Indeed, the relative power accrued by foremen and manufacturing shareholders far outpaced any gains to labor.

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[23] Ford, Henry, and Samuel Crowther. *My Life and Work*. Sydney: Angus & Robertson, 1924. 110.
[24] Barnard, 23.
[25] Ibid., 26.
[26] Ibid.
[27] Barnard, 26.
[28] Ibid.
[29] Ibid.

The conglomeration of the rail industry and the mechanization of the auto industry allowed owners of capital to accrue disproportionate power and wealth, resulting in the Roaring Twenties, one of the most prosperous, yet deeply disparate, periods in American history. In 1929, the top 0.1 percent of Americans had a combined income equal to that of the bottom 42 percent.[30] They also controlled 34 percent of all savings, while 80 percent of Americans had no savings at all.[31] The economic instability resultant from this unequal distribution of growth and wealth in large part contributed to the Great Depression.[32] In this way, the rail and auto industries' meteoric rise as the driver of the nation's pre-war economic growth normalized a powerful elite of capitalists while simultaneously commoditizing middle class labor.

New Deal Labor Regulation and the Rise of Middle Class

After World War I, the pro-labor policies adopted during New Deal helped turn the auto industry into an equalizer and a middle class engine. Although the exploitative conditions in the early years of the auto industry ought to have been conducive to labor organizing, it wasn't until the Great Depression's series of large-scale unemployment riots and the government's pro-labor response that unionization took off in the auto industry.[33] In 1935 the National Labor Relations Board was established through the Wagner Act, providing unions with validation, legal protection, and authority at a moment in which many leftist organizations were publicly denounced for any suspected communist affiliation.[34] The inroads made by unionization at this time allowed for the normalization of exclusive representation, improved pay, overtime, holiday, and grievance provisions, and the right of a union to challenge the timing of production

[30] McElvaine, Robert S. The Great Depression: America. Times Books, 1983. 38.
[31] Ibid.
[32] Ibid.
[33] Barnard, 26.
[34] Ibid., 33.

operations.[35] Under close scrutiny of the NLRB for racketeering and company brutality, even the notoriously hard-to-crack Ford was quickly forced to shift from a hardline policy of anti-unionization to a UAW-CIO settlement that gave the United Auto Workers far more than it had obtained from anyone else.[36] From 1933 to 1941, the unionized proportion of the manufacturing work force increased from 11.5 to 28.2 percent.[37] During this period, organized labor went from having little voice in national affairs to becoming a key player in Congress and the White House.[38] The unilateral concentration of power in the hands of management had shifted.

Perhaps unsurprisingly, this period of heavy wealth redistribution through taxation, in conjunction with the rise of the manufacturing union, resulted in some of the lowest levels of inequality in American history. It would be remiss, however, to overlook the key ways in which technology interacted with New Nationalist and New Deal policies. In the first decade of the 20th century, Theodore Roosevelt's Square Deal broke up monopolies and trusts, whose unwieldy and exploitative characters were unique products of the unregulated technological Gilded Age.[39] The Social Security, disability, and unemployment insurance advanced by the New Deal countered the specific abuses faced by autoworkers and other manufacturing workers of the time—dispensability due to deskilling and rampant workplace injury.[40] Certainly, the shift toward a labor regulatory political regime was the result of myriad complicating historical factors, from the Great Depression, to the appropriation of capital during World War I, to the pervasive anti-fascist cultural sentiment, which American Federation of Labor President Samuel Grompers described well: "We fought to crush militarism. We fought to crush autocracy, political

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[35] Ibid., 65.
[36] Ibid., 68.
[37] Ibid., 69.
[38] Ibid., 69.
[39] Lind, 156.
[40] Special Report. "As You Were; History." *The Economist (US)*, October 13, 2012.

autocracy, in Germany and Austria. We resent the thought that industrial and political autocracy shall be proclaimed and be the practice in the United States now."[41] However, whether the New Deal policies were induced by technological labor change or not is perhaps less relevant than its effect: that by the mid 1950s, the auto industry transformed from a lucrative productivity boost for capital into an equitably shared foundry of middle class prosperity for millions of autoworkers.

Part 1 Conclusion

In the last century of American history, relative middle class prosperity and the lowest inequality figures have come not simply at times of technology-induced productivity gains, but more specifically at times of peak unionization and government labor regulation within those technology industries. In Figure 1, pictured below, I've tried to correlate government regulation and income inequality as early as congressional records begin, in 1973. On the left axis, the number of pieces of labor legislation introduced represents government labor regulation, and on the right, the GINI Index measures the income inequality ratio out of 1. Because the mere fact that a labor bill was introduced says little about its content, I've split each Congress' labor bills into those proposed by Democrats (in blue) and those proposed by Republicans (in red) as a close proxy for bills that may be pro-labor and anti-labor, respectively. Because this is just a proxy, it may still be valuable to consider each Congress' aggregate bar height as a measure of government intervention into labor versus capital relations, regardless of party.

Although perhaps the best case study for this association, the post-New Deal auto industry, peaked well before 1973, in the 1950s, Figure 1 still elucidates some key insight into the correlation between anti-labor administrations like Reagan's and a sharply increasing GINI

[41] Grompers, Samuel. "The American Federation of Labor." In *Addresses: Business and Industry*, by Thomas B. Reed and Ashley Horace Thorndike, 156-64. New York: Modern Eloquence, 1923.

Index, as well as the pro-labor agenda of Obama's first year in office with a plummeting GINI Index. Also worth noting is that the two datasets do not necessarily interact one-way. Legislation is also raised in response to inequality, and I would suggest that this type of trailing indicator is best represented by the Clinton presidency.

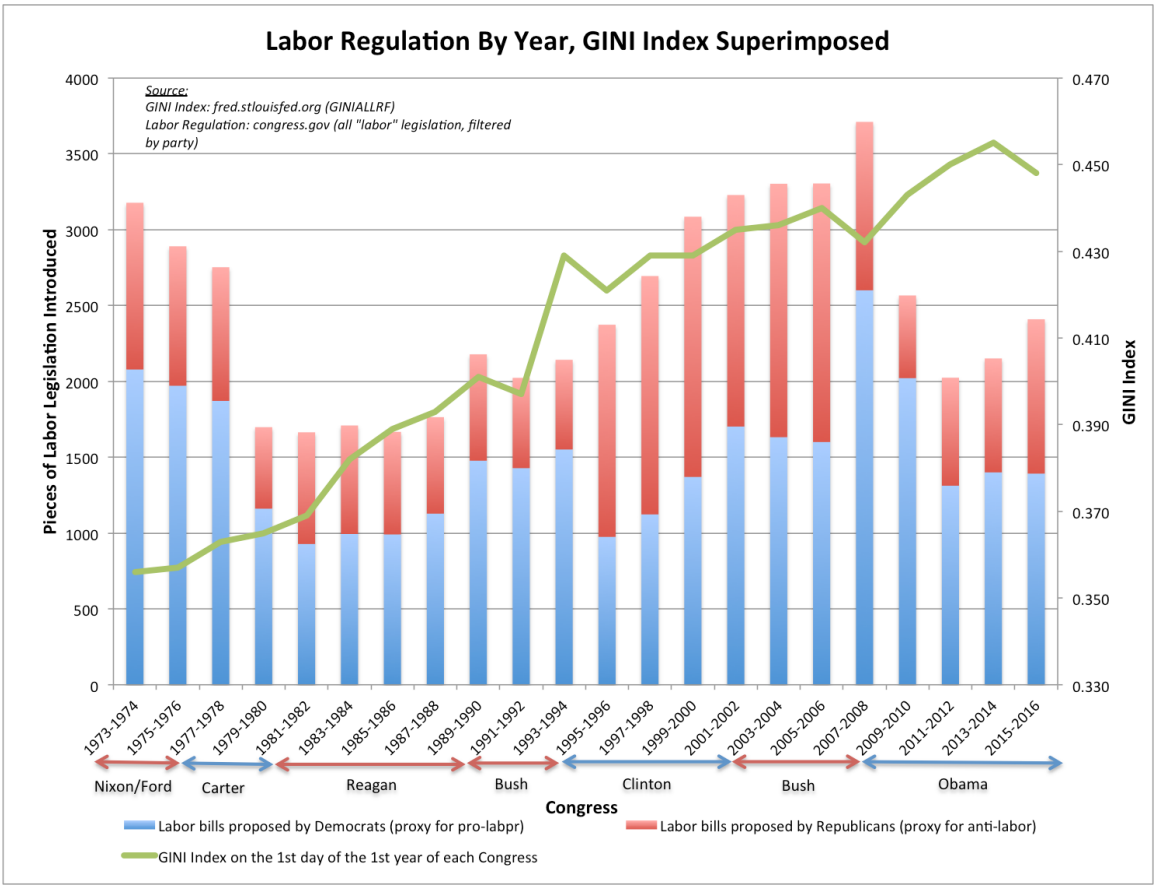

Figure 1[42, 43]

[42] "Income Gini Ratio of Families by Race of Householder, All Races." FRED. September 13, 2016. https://fred.stlouisfed.org/series/GINIALLRF.

[43] "Legislative Search Results." Congress.gov. Accessed March 02, 2017. https://www.congress.gov/search?q=%7B%22source%22%3A%22legislation%22%2C%22search%22%3A%22labor%22%7D&searchResultViewType=expanded.

Part II

In Part I, it was determined that government intervention, often impelled by labor unions, was necessary to counter technology's natural bent in favor of capital. As automation begins to make real the promise of a machine-driven society, what form should this intervention take? To answer this question, I'll situate a set of normative policy recommendations within the scope of today's technological context, and then I'll attempt to describe some of the consequences of Trump's presidency based on the historical analysis presented above.

Today's Technological and Labor Context

Machines have replaced the jobs of millions of Americans, and the push toward automation is accelerating. In December, Amazon launched AmazonGo, a completely automated grocery store with no cashiers.[44] In October, an autonomous Otto truck owned by Uber made the world's first autonomous truck delivery, transporting 50,000 beers across more than 120 miles to a Budweiser warehouse in Colorado.[45] In January, Bank of America opened branches staffed by a single employee along with ATMs and video terminals.[46] Advances in technology have made American farms and factories more productive than ever, while simultaneously cutting the number of workers employed in these sectors from 36 percent of the total workforce in 1950 to less than 10 percent in 2014.[47] There is a growing fear that working class jobs will one day cease to exist.

The idea of controlling, curbing, and responding to technology is not new. People have been predicting chronic working class unemployment as early 1964, when a group of prominent

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[44] Pfluger, Ryan. "The Jobs Americans Do." The New York Times. February 23, 2017. https://www.nytimes.com/2017/02/23/magazine/the-new-working-class.html?_r=0.
[45] Davies, Alex. "Uber's Self-Driving Truck Makes Its First Delivery: 50,000 Beers." Wired. October 25, 2016. https://www.wired.com/2016/10/ubers-self-driving-truck-makes-first-delivery-50000-beers/.
[46] Pfluger.
[47] Ibid.

liberals wrote to President Johnson, warning him of a technological future in which "a permanent impoverished and jobless class" exists "in the midst of potential abundance."[48] With every wave of technology-driven change, there have always been interest groups that have benefitted and disrupted incumbents that have suffered. Historically, the beneficiaries of technological advancement have far outweighed the casualties: the mechanization of industry allowed for the shortening of the work week; the automobile industry built a broad middle class; medical advancements in the last 50 years have extended the average life expectancy by around a decade; the internet has democratized instant access to information and education at an unprecedented scale.[49] For this reason, most economists to date have remained comfortable with the idea of sustained technological development—in the long run, technology has always ended up creating more jobs than it displaces and lifting the standard of living for people across the socioeconomic spectrum.[50]

Today, however, as automation and artificial intelligence become more of a reality than a distant possibility, the relative size of each interest group has become less clear. For the first time, we're seeing middle class jobs—from cashiers to factory workers to customer service representatives—being substituted by automation, rather than complemented by it. And the statistics reflect it: for the last 30 years, the American middle class has been shrinking; in 2015, it made up less than the majority for the first time on record.[51] In Part 1, we found that the standardization of work normalized by the assembly line made workers more easily replaceable

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[48] Ibid.
[49] Drucker, and Peter F. "Beyond the Information Revolution." The Atlantic, October 1999.
[50] Atkinson, Robert. "Technology May Disrupt Occupations, but It Won't Kill Jobs." *Monthly Labor Review*, February 2016. https://www.bls.gov/opub/mlr/2016/article/technology-may-disrupt-occupations-but-it-wont-kill-jobs.htm.
[51] "The American Middle Class Is Losing Ground." Pew Research Center's Social & Demographic Trends Project. December 09, 2015. http://www.pewsocialtrends.org/2015/12/09/the-american-middle-class-is-losing-ground/.

and less valuable. Automation is the furthest extreme of this labor commoditization.

This deep threat to labor comes at a time when unions have significantly lost leverage. In 2016, the percent of wage and salary workers who were members of unions was 10.7 percent, down from 20.1 percent in 1983.[52] Additionally, the sectors with the highest rates of unionization are no longer technology-based industries (which we've decided require intervention by a pro-labor force to counter capital), but rather education, training, and library occupations.[53] The loss of unions in the technology-based industries that tend to drive economic growth has created a power vacuum in the arena of labor capital relations. In the nascent on-demand or sharing economy, this power vacuum is being quickly filled: capital has been able to further balkanize, commoditize, and exploit the labor force through the popularization of the 1099, or independent contractor, model.[54]

Labor unions as they exist today have become outdated; neither their operating strategies nor their demands have evolved to stay relevant in a working class labor market that is at once increasingly composed of independent contractors and also at threat of outsourcing and automation. Manufacturing labor unions are perhaps most embattled, as their agenda has moved away from more progressive democratic positions on the environment. From Part 1, we learned that unfettered advancements in technology lead to an increase in income disparity and a marginalization of the working class. In the past, through the New Deal and the rise of unions, the US was able to take advantage of productivity gains while still maintaining a stable middle class. Today, we will have to make similar concerted regulatory efforts to temper technological capital if we intend for growth to be similarly inclusive.

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[52] "Union Members Summary." U.S. Bureau of Labor Statistics. January 26, 2017. https://www.bls.gov/news.release/union2.nr0.htm.
[53] "Union Members Summary" BLS
[54] Golden, Lonnie. "How On-Call and Irregular Scheduling Harm the American Workforce." In *Rethinking Work*. Amenia, NY: Grey House Publishing, 2016.

Quantitatively, the productivity gains experienced due to digital technologies have decoupled from wages. In the last 20 years, although the overall trajectory of economic growth has been positive, that growth has not been inclusive- 80% of Americans have seen wages stagnate or fall as the top 20% have pulled away.[55] Since the 1980s, increased automation, globalization, neoliberalism, and decreased union power have led to widening income inequality after forty years of decline.[56] While the benefits of globalization and the digital age cannot be underestimated, the rapid nature of these shifts have resulted in startling political consequences: the aftermath of 2016's global malaise, marked by Brexit, Trump, and populist uprisings in France and Hungary, is just now being felt.[57]

Eventually, technology may become a net job destroyer, but for now, it is still hard to tell, since digitization and automation have created lucrative jobs for high-skilled workers in the engineering and software industries.[58] We can, however, examine the shifting demographics of the jobs being replaced and created. I've included analysis and policy recommendations for each of three relevant sectors—manufacturing, service, and technical work. In areas where Trump has proposed early policies, I've assessed them in context.

Manufacturing

In the historical case studies of Part 1, manufacturing industries served as the backbone of the American working class and a key fairground for labor organizing. Today, however, manufacturing jobs no longer represent the majority of working class labor, as much manufacturing has either been outsourced to countries with cheaper labor or replaced by

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[55] McAfee, Andrew, and Erik Brynjolfsson. "Human Work in the Robotic Future: Policy for the Age of Automation." *Foreign Affairs*, July 2016.
[56] Gold, Howard R. "How Piketty Is Wrong-and Right." Chicago Booth Review. Spring, 2015. http://review.chicagobooth.edu/magazine/spring-2015/how-piketty-is-wrong-and-right.
[57] "Shooting an Elephant; Global Inequality." The Economist (US), September 17, 2016.
[58] Note: The implications of this sector shift are discussed in the section titled 'Skill biased technological change and inequality"

technology. What does the next decade of manufacturing, with a focus on the auto industry, look like and what steps can be taken to empower labor? 90 percent of auto executives anticipate that by 2025, electric cars will dominate the transportation industry.[59] Because the process used to produce electric cars has been streamlined to require only three main manufacturing components (compared to the thousands of components required for an internal combustion engine), it has become much more feasible to produce a car entirely with robots, a prospect which should delight capitalists at the expense of labor.[60] In a similar vein to Ford's assembly line, which standardized and deskilled labor during the early years of the auto industry, Tesla has announced plans to revolutionize the factory concept, dramatically reducing the labor force required for automobile manufacturing.[61] Equally significantly, the rise of the electric vehicle may marginalize auto's supporting industries, as EVs require far less servicing and maintenance than traditional diesel.[62] While automobile manufacturing jobs once formed a path to the middle class for many blue-collar workers, these opportunities are fast shrinking.

Policy

As the average working class job shifts inevitably away from manufacturing, what can we do to transition labor to other sectors as painlessly as possible? I argue that unions may not be the answer this time around. In fact, they may serve to expedite decline of American manufacturing jobs more quickly than workers are able to learn new skills.

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[59] Grover, Sami. "Even Auto Execs Say Electric Cars Will Dominate by 2025." TreeHugger. January 09, 2017. http://www.treehugger.com/cars/even-auto-execs-say-electric-cars-will-dominate-2025.html.
[60] Gardner, Greg. "Why Most Self-driving Cars Will Be Electric." USA Today. September 19, 2016. http://www.usatoday.com/story/money/cars/2016/09/19/why-most-self-driving-cars-electric/90614734/.
[61] Levin, Doron. "Tesla Won't Be Making the 500,000 Cars a Year It's Promised by 2018." MIT Technology Review. September 26, 2016. https://www.technologyreview.com/s/602436/teslas-next-broken-promise/.
[62] Hingorani, Prakash. "The Coming Disruption of the Auto Industry." Marlabs. September 16, 2016. http://www.marlabs.com/coming-disruption-auto-industry.

In today's manufacturing environment, unions are fighting a losing battle. In the 1970's, labor power was fatally undermined by the growing presence of foreign manufacturers in US auto markets.[63] Much of this foreign production was located in the south, where there existed fewer union protections than in the traditional manufacturing north.[64] American auto manufacturers, saddled with lofty union packages leftover from the 1950s, were unable to compete.[65] Unions in their present state have never been able to adequately counter this sort of widespread foreign competition, and their dogged efforts to hold on contributed to the collapse of GM, Ford, and Chrysler in the late 2000s, which had devastating consequences for the working class in cities like Detroit.[66] The 2008 automotive industry crisis warns us that union leverage, if pursued too rigidly, can lead to a fate arguably more harmful for workers than low wage work. In addition to industry collapse due to foreign competition, today's threats of automation and outsourcing additionally contribute to the inadvisability of unionization, as both may displace labor more quickly than workers are able to retrain.

President Trump has used the incentive of lower corporate taxes, deregulation, and tariff threats to encourage US corporations to manufacture in the US. [67] While this may result in a short-term gain for US manufacturing employment, it doesn't address the long-term issue of job replacement by automation. Furthermore, the relatively high labor costs involved in bringing manufacturing jobs back from overseas will likely make American-made goods uncompetitive in the global marketplace. It is possible that this could force US manufacturers to expedite the use

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[63] Dubofsky, Melvyn, and Joseph Anthony McCartin. Labor in America: A History. 7th ed. Hoboken, NJ: John Wiley & Sons, 2017., 395.
[64] Ibid.
[65] Ibid.
[66] Meyerson, Harold. "The Seeds of a New Labor Movement." The American Prospect, September 1, 2014.
[67] DeBord, Matthew. "It Would Be a Disaster If Automakers Do What Trump Wants." Business Insider. January 24, 2017. http://www.businessinsider.com/trumps-plan-for-automakers-is-flawed-2017-1.

of technology to replace human labor, or suffer industry collapse. Therefore, while Trump's policy could buy time in slowing down middle class shrinkage, it could also have the unintended effect of expediting it, especially if it doesn't couple with other policies that increase the value of human capital, like retraining programs and education.

Service

While manufacturing jobs are on the decline in the US, service jobs are on the rise. In 1950, service work comprised around 40 percent of working class labor; by 2005, that portion had risen to 56 percent.[68] Service jobs, while less quantitatively threatened by automation, are also being critically shaped by digital technologies, most of the time to the detriment of labor. Specifically, service work is being transformed by digital optimization. On the consumer side, mobile apps provide on-demand taxi, cleaning, and homecare services. On the supply side, software allows employers to schedule on-call retail and service shifts. In 2015, 14% of new jobs created involved some sort of on-call scheduling.[69] While on-demand technologies like these solve for market inefficiencies, drastically increasing profitability for capitalists and providing value for consumers, they come at a qualitative cost to workers, hampering their ability to hold multiple jobs, plan stable working hours, and pursue education.[70] Service worker unions in the private sector are also not particularly strong; they suffer from the classic balkanization of trade versus industry unions and exist within a dispersed industry of medium sized enterprises.[71]

Policy

Because on-call scheduling almost exclusively benefits the capitalist and the consumer, there ought to be serious regulations on the use of on call scheduling within the retail and service

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[68] Pfluger. "The Jobs Americans Do."
[69] Golden, "How On-Call and Irregular Scheduling Harm the American Workforce."
[70] Ibid.
[71] Meyerson, "The Seeds of a New Labor Movement."

spheres, perhaps with special labor classifications and provisions for overtime pay. Equally as important, however, is the job security of workers who choose not to opt into on-call scheduling, which should be protected through legislation.

As tech companies increasingly turn to the independent contractor model over traditional modes of employment, the definition of a 1099 worker has become blurred. While the premise of independent contracting is that workers choose freedom and flexibility over security and traditional workplace benefits, sharing economy companies like Handy and TaskRabbit have created an environment that demands uniformity and on-call availability from its legally independent workers at risk of poor ratings, probation, and punishment.[72] Furthermore, 1099 workers' "self-employed" status precludes their ability to file class-action lawsuits and collectively assemble against their companies.[73] Going forward, legislation will have to not only clarify the role, rights, and protections of independent contractors, but also consider the consequences of a self-employed workforce. Because healthcare and insurance in the United States are currently tied to employment, an increasingly self-employed middle class could result in a startling lack of stability and basic protections for a core labor demographic. In the long run, federal regulators must decide to either permanently decouple healthcare and insurance policies from employment, or significantly incentivize traditional employment models by reducing payroll taxes.[74]

Skill Biased Technological Change and Inequality

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[72] Roose, Kevin. "Does Silicon Valley Have a Contract-Worker Problem?" Daily Intelligencer. September 18, 2014. http://nymag.com/daily/intelligencer/2014/09/silicon-valleys-contract-worker-problem.html.
[73] McCormick, Rich. "Uber Settles Lawsuits to Keep Drivers as Independent Contractors in California and Massachusetts." The Verge. April 21, 2016. http://www.theverge.com/2016/4/21/11485424/uber-suit-california-Massachusetts-drivers-employee-contractor.
[74] Brynjolfsson, Erik, and Andrew McAfee. "Chapter 13: Policy Recommendations." In *The Second Machine Age: Work, Progress, and Prosperity in a Time of Brillant Technologies.* New York: W. W. Norton & Company, 2016.

Today's jobs, rather than being created in trades that are widely accessible to a broad set of middle class workers, are being created in highly skilled engineering fields that require significant education and human capital. In their most recent paper on inequality, Murphy and Topel from the University of Chicago argue that due to the rise of digital technologies, globalization, and automation, the relative earning power of skilled labor in the workforce has far outpaced that of unskilled labor.[75] This skewed earning potential disproportionately benefits the middle and upper classes, as well as white and Asian tech industry workers.[76]

Policy

A significant short-term cause of income disparity comes from unreasonably high executive pay. In 2016, the ratio of the average CEO's pay to the average worker's in the US was 340, more than twice that of the second highest country.[77] To reduce inequality, legislators should raise taxes to provide for the policies proposed in the Service section or work with industries to either limit pay scales for executives or increase equity distributions among employees in a company.

In the long run, however, countering the inequality resultant from skill-biased technological change requires investment in human capital, from more equitable access to early childhood education to community retraining programs for former manufacturing industry workers. The US government should overhaul and improve the quality of public education, with

[75] Gold, Howard R. "How Piketty Is Wrong-and Right."
[76] Kroll, Andy, Tasneem Raja, Sarah Zhang, and Josh Harkinson. "Silicon Valley's Awful Race and Gender Problem in 3 Mind-Blowing Charts." Mother Jones. June 6, 2013. http://www.motherjones.com/mojo/2013/06/silicon-valley-race-gender-problem-income-inequality.
[77] Kasperkevic, Jana. "America's Top CEOs Pocket 340 times More than Average Workers." The Guardian. May 17, 2016. https://www.theguardian.com/us-news/2016/may/17/ceo-pay-ratio-average-worker-afl-cio.

a particular focus on the computer and cognitive skills that will facilitate gainful employment in a rapidly changing, technologically dependent labor market.[78]

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[78] Brynjolfsson, Erik, and Andrew McAfee. "Chapter 13: Policy Recommendations."

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