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# 1

## Introduction

Politics in democratic countries is today in a state of turmoil. Trust in national institutions has reached a historical low. In advanced industrial economies, slightly over one in three people express confidence in their governments. Only twenty percent of Americans think that politicians care about their opinions—a number sharply down from almost four in five in the late 1950s. In France, Germany, and the United Kingdom, the proportion is even lower, at around ten to fifteen percent. Such a wave of disaffection has, in turn, given way to growing disengagement from traditional party politics. In Western Europe, electoral abstention has doubled since the 1970s, mainly among the youngest cohorts. Among those electors who vote, close to one-quarter are casting their ballots for far-right and far-left parties. Populist and nationalist alliances now govern a handful of European countries. And, in a context of increasingly polarized politics, in 2016 close to half of American voters elected a president intent on challenging, if not overturning, the very liberal democratic order of global cooperation and open economies that the United States designed and built after World War Two.

Not coincidentally, those political trends follow a set of momentous economic transformations across the world. Since the

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1980s, the invention of the personal computer and, more generally, of modern information and communication technologies—as well as the globalization of trade and the offshoring of production, which have been fostered by those technological advances—have reshaped both the workplace and the overall structure of the labor market, intensifying the demand for highly educated individuals in the advanced world and the employment of manufacturing workers in emerging economies while reducing the number of blue-collar and white-collar jobs in North America and Europe. Salaries have behaved likewise. Over the two decades preceding the last Great Recession of 2007, the (household) per capita income of the richest ten percent in advanced economies rose more than sixty percent in real terms (that is, once we take into account changes in prices). The urban and rural middle strata of China and Southeast Asia saw their income grow by almost eighty percent in the same period. By contrast, the income of the bottom half of the income distribution in countries like Germany, Japan, and the United States has remained flat for close to four decades.

There is nothing to indicate that those economic transformations or the political turbulence that accompanies them will stop in the near future. If anything, the pace of technological and employment change may accelerate in the next few decades. According to some recent estimates, almost half of all current jobs may end up being automatized in the next twenty to thirty years. Most of that substitution by computer algorithms and robots will first affect the least qualified individuals. But it may not be limited to them, hitting, at some point in time, relatively creative, nonroutine jobs that today still appear hard to robotize.

Unsurprisingly, the extent and consequences of automation have become the object of a heated debate in the academic and political arenas. Technological pessimists foresee a brave new world where, once artificial intelligence makes its final breakthrough into the so-called “singularity moment,” workers will become completely redundant or will draw, at most, a meager salary. Sitting at the top of a mass of unemployed and underemployed individuals,

there will be a small creative class—a thin layer of inventors, top managers, and highly educated professionals—enjoying the benefits of automation and globalization. The system of democratic capitalism that has so far prevailed in the advanced world will crumble under the weight of so much economic inequality. Policy makers will not be able to reconcile free markets with representative elections and deliver both economic growth and a generous welfare state in the way they did during the better part of the twentieth century. The new technologies of information and communication invented in Silicon Valley will take us back to the contentious politics of nineteenth-century capitalism, finally vindicating Karl Marx, who, more than 150 years ago, predicted the eventual substitution of machines for workers, the immiserization of the masses, and the collapse of capitalism at the hands of a horde of angry men, armed with pitchforks and torches, marching down on the wealthy few—now huddled in their Manhattan and Bay Area mansions.

On the other side of the aisle, technological optimists concede that automation will disrupt the labor market and hurt the wages of the least educated, alienating them from politics and elections. Yet, they contend, those costs will be temporary—the transitory pangs associated with the birth of any new technological and social order. In due time, an overabundant economy will free the great majority or even all of us from both the bondages of work and ruthless interpersonal competition, and allow humankind to hunt in the morning, fish in the afternoon, and read poetry after dinner.

In this book, I take a different approach. The consequences of today's technological changes, I will claim, are not set in stone. They will work their way into the economy through their direct (although, at this point, still uncertain) impact on the demand for different types of labor and on the cost and ownership of capital. Yet they will also depend on the institutional and political strategies we follow in response to those technological transformations. During the last two hundred years, in their quest for profits and wealth, the entrepreneurs and industrial captains of modern

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capitalism have always pushed for the rationalization and automation of production. That “process of industrial mutation”, to employ Schumpeter’s renowned words, “incessantly revolutionize[d] the economic structure from within, incessantly destroying the old one, incessantly creating a new one”—modifying the relationship between capital and labor, the patterns of employment, and the distribution of income over time (Schumpeter 1950, 83). In doing so, it periodically generated a (changing) number of critical political challenges that were then met with a particular set of policy responses.

The same logic applies to today’s technological innovations. Because they have already heightened economic inequality and may result in an even more extensive robotization of substantial numbers of (low- and semiskilled) jobs, they could put an end to the broad social consensus around democracy and capitalism that prevailed during most of the twentieth century—particularly in the advanced world. That does not necessarily mean, however, that they will—and that they will make us travel back in time to the nineteenth century, when the industrial capitalism invented in Manchester and its cotton factories turned out to be incompatible with the construction of fully democratic institutions. The reason is simple. The growing economic and political tensions we are witnessing today are happening in very affluent societies: their average per capita incomes are more than ten times higher than at the beginning of the first Industrial Revolution. So much wealth, jointly with the presence of stable democratic institutions and relatively well structured bureaucracies, should give us much more maneuvering room than any generations before us ever had to respond to the technological and economic challenges of today. Therefore, the task ahead of us is to think about how to harness those economic and institutional assets to the advantage of the many.

With that goal in mind, we should understand, first, how technology has shaped capitalism and, second, when and how the latter has coexisted, sometimes in a delicate, uneasy balance, with democracy. I explain this, necessarily in a sketchy manner, in this

introduction by describing how modern capitalism has evolved in terms of its structure of production (i.e., the level of automation and the role of labor) and its relationship to politics—from the first Industrial Revolution born in Manchester through the twentieth-century capitalism invented in Detroit’s assembly plants up to the new information era that emerged in Silicon Valley. In the rest of the book, I develop that argument more extensively, mainly focusing on the nature of twentieth-century democratic capitalism and, above all, on the challenges and opportunities brought about by today’s technological revolution.

### **Richard Arkwright**

The first Industrial Revolution, set in motion in Manchester by entrepreneurs such as Richard Arkwright, the designer of the spinning frame and one of the first businessmen to set up a modern factory, led to higher rates of economic growth than had been enjoyed by the old agrarian societies it replaced. Nonetheless, the newly generated wealth was anything but equally distributed. Putting an end to a system of production that had taken place in small artisanal shops, British industrialists reorganized the manufacturing process as a sequence of routinized tasks done in large factories, mechanizing them with the aid of a growing number of machines. The preindustrial skilled craftsman, who often made an entire product by hand, was replaced with unskilled individuals who were each in charge of a very specific action in the chain of production. Dragged by low factory salaries, overcrowded housing, and bad sanitation conditions, living standards experienced a sharp decline in the new industrial towns—at least for the first decades of the Industrial Revolution. By contrast, profits rose and capital accumulated steadily.

In that context of growing inequality, labor and the owners of industrial capital were locked in a protracted economic and political conflict. Businessmen as well as conservative and liberal politicians fretted about the potential entry of the masses into the

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political arena, the triumph of socialism, and the eventual abolition of private property. In the words of John Stuart Mill, Britain's foremost political philosopher of the nineteenth century, everyone may have had an interest in the "due representation" of the workers, but only "so long as [they were] not admitted to the suffrage so indiscriminately as to outnumber the other electors." Indeed, the introduction of "equal and universal suffrage" was, he warned, a "violent remedy" because it implied "disfranchising the higher and middle classes . . . who comprise the majority of the most intellectual in the kingdom" (Mill, "Recent Writers on Reform," quoted in Selinger and Conti 2015, 291). Full democracy, with its strictly egalitarian one-man-one-vote rule, looked incompatible with the philosophy of economic laissez-faire that defined nineteenth-century liberalism and with the inequalities generated by the first Industrial Revolution. At the opposite extreme of the political spectrum, support for some kind of political settlement that could reconcile democracy and capitalism was equally tenuous. Socialist unions and parties, growing in popularity since the end of the nineteenth century and loosely organized in an international cartel, rejected any form of "bourgeois democracy" as a political and economic empty shell. Instead, believing Marx's forecasts about the eventual collapse of capitalism, many of them advocated assaulting the state through revolutionary means, nationalizing the economy, and establishing a "dictatorship of the proletariat."

### **Henry Ford**

As World War One was drawing to a close, one hundred years ago, few observers would have predicted that democracy and capitalism would reign uncontested a few years later. Just before World War One, parliaments elected by male universal suffrage were in place only in a handful of countries—and, even there, they were usually checked by unelected upper houses or powerful monarchs. Then, after the war armistice in the fall of 1918, a revolutionary wave, pushed by militant workers and demobilized

soldiers, threatened to engulf Europe. Russia had already fallen under the control of Lenin and the Bolshevik faction of the Russian Social Democratic Labor Party a year before. In the first days of November 1918, the German and Austro-Hungarian monarchies collapsed. The Hungarian Communist Party took over the state a few weeks later. In Germany, the Spartacist movement attempted to proclaim a dictatorship of the proletariat in January of 1919.

The latter's failure, however, marked a political turning point in the industrial world. With the support of a broad coalition including Christian democrats, social democrats, and liberals, Germany enacted one of the most democratic constitutions of the time. At around the same time, Britain, Belgium, the Netherlands, and the Scandinavian countries conceded the right to vote to all adult men. In turn, Western social democratic parties accepted elections as the means to allocate power and signaled their willingness to respect some regulated version of the market economy. A little over a decade later, Franklin D. Roosevelt's "New Deal" institutionalized the concept of a "mixed economy," according to which capitalism was to operate embedded in a regulatory framework aimed at stabilizing the market, and where the state was to protect its citizens from the poverty associated with unemployment, sickness, and old age.

The implementation of that new political and economic blueprint—often met with ideological skepticism, if not down-right hostility—was at times riotous. In the United States, for example, Roosevelt threatened an uncooperative Supreme Court with a plan to expand the number of justices to almost double its size only to encounter considerable backlash from public opinion and the Congress. In continental Europe, interwar governments faced business lockouts, general strikes, and military unrest. Democracy collapsed in Austria, Germany, and Eastern Europe in the 1930s. In France, Left and Right came close to clashing violently just before World War Two. Over time, however, the institutional arrangements of democratic capitalism—that is, free markets, full democracy, and a generous welfare state—took root everywhere.

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After the war, they did in France and Germany under the direct leadership of Christian democratic parties—the Mouvement Républicain Populaire and the Christian Democratic Union (CDU), respectively. Four decades later, they came into place in nations formerly controlled by the Soviet Union.

The United States and the United Kingdom extended the same logic of limited public intervention to the international arena after World War Two. In the Bretton Woods Conference, held in a hotel in New Hampshire in the summer of 1944, officials from forty-four nations, led by Harry Dexter White, a senior official at the US Treasury, and British economist John Maynard Keynes, reaffirmed their countries' commitment to the goals of currency stability and convertibility and to the principle of trade openness that had characterized the international system before 1914. At the same time, however, they agreed to design an international set of rules and institutions that could give enough autonomy to each country to respond to the particular economic and social demands of its voters. After reestablishing an international monetary system of fixed exchange rates, they called for the introduction of capital controls to enable governments to adjust their economies without sacrificing the goals of full employment and growth. In addition, they accepted the possibility of orderly currency realignments and, to minimize economic crises across the world, they provided for direct short-term financial support to domestic authorities from a newly created International Monetary Fund. Last but not least, the General Agreement on Trade and Tariffs restored a philosophy of open borders, nesting it within a framework of multilateral negotiations in which national governments had de facto veto power over trade policy.

The roots of that new political order, which implied the successful conciliation of the demands of democracy and the logic of capitalism, were economic. By the turn of the twentieth century, a sweeping wave of technical innovations had transformed the production system of Manchester capitalism, with momentous consequences for the economy and the labor market and,

eventually, for politics. The invention of the assembly line and of mass-production techniques by Henry Ford and the Detroit car industry and their extension to a broad range of industries, resulting in the automation of whole parts of the manufacturing process, as well as the use of electricity and electric motors to power hauling and conveying operations, generated large productivity gains and fueled a period of unprecedented economic growth.

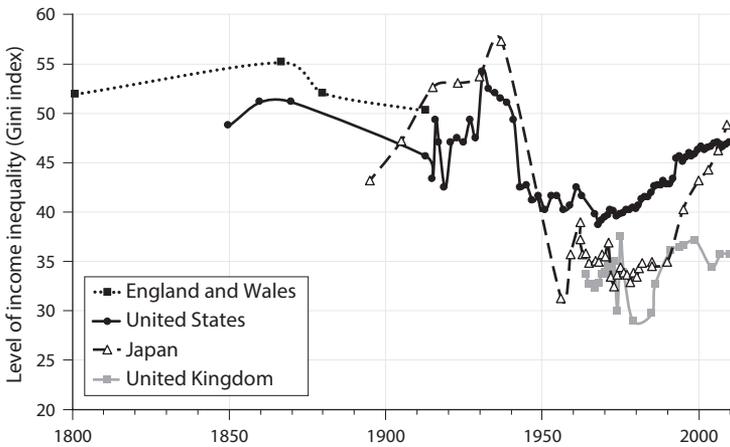
From 1900 onwards, the economy expanded on average at an annual rate of about 2.5 percent in the United States and almost 3 percent in Western Europe—a pace two times faster than in the previous century. Per capita income doubled in the forty years that preceded World War Two. It then doubled again during the Cold War. More crucially, labor markets changed in two fundamental ways. First, the demand for unskilled workers, whose brawn power had fed the first wave of industrialization, declined sharply. Instead, twentieth-century factories needed individuals capable of reading the operating instructions of machines as well as installing, repairing, and improving them. Second, a secular fall in communication and transportation costs, due to the invention of the telegraph and the railway and the naval application of the steam engine, led to the rise of global markets, the formation of large corporations, and, as a result, the growth of new layers of white-collar jobs needed to manage those firms. As semiskilled and skilled workers became central to the process of production—that is, as they replaced the very unskilled labor toiling in the Manchester factories to become the main type of labor complementary to machines and capital—wages grew across the board, particularly among middle social strata. Accordingly, the general distribution of earnings became more equal.

Growth and the equalization of labor and income conditions gave rise to a relatively affluent working class. The number of working households living under conditions of absolute poverty declined precipitously over the first half of the twentieth century. Buying food and clothing, which had absorbed two thirds of the budget of the average American family just after the Civil War, dropped

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to about a third of its expenditure on the eve of World War Two. The number of goods (from furniture to phones and automobiles) owned by a growing middle class expanded exponentially. By the 1960s, life expectancy had almost doubled with respect to that of the middle of the nineteenth century. Average height, which is a relatively good proxy of access to food and good health habits, rose by about four inches in Europe over the span of a century. The overall quality of health and lifestyle of seniors became extraordinarily high in developed countries. We only have to compare the photographs of forty-year-old men and women in poor countries with those seventy-year-old individuals in the United States or Europe to realize how much better off the latter are today.

Economic inequality is often measured through the Gini coefficient, developed by the Italian demographer Corrado Gini a century ago. In a perfectly equal society where everyone has the same income, the Gini index scores 0. In an economy where one person receives all the country's income, it reaches its maximum, 100. Figure 1.1 shows the evolution of the Gini index over the nineteenth and twentieth centuries for three major economies—the United States, the United Kingdom, and Japan. During the first stage of the Industrial Revolution, the Gini coefficient was high—at around 50—and rising. In both the United Kingdom, which spearheaded the Manchester model of capitalism, and the United States, which followed England closely, it increased until the last third of the nineteenth century. In Japan, a late industrializer, it rose until World War Two. Roughly coinciding with the expansion of Detroit capitalism, inequality declined everywhere throughout the middle decades of the twentieth century.<sup>1</sup> Other ways to measure the distribution of income tell a similar story. In England and Wales, the fraction of total income in the hands of the top ten percent of the population fell from slightly below fifty percent in 1914 to less than thirty percent in the late 1960s. In Australia, the United States, and France, to name just a few countries, it dropped by about fifteen percentage points to around thirty percent.



**FIGURE 1.1** Two centuries of income inequality. Sources for the US data: for the nineteenth century, Lindert and Williamson (2016); for 1913–63, Plotnick et al. (1998, fig. 2); after 1963, Milanovic (2016). Sources for the United Kingdom: up to 1913, Lindert and Williamson (1983); after 1960, Milanovic (2016). Sources for Japan: before World War Two, Minami (2008); after World War Two, United Nations University-WIDER (2015).

Detroit capitalism, characterized by its efficiently run assembly lines and spotless factories, balanced power relations between corporate management and union bosses, and well-paid and well-fed employees, eventually tempered the politics of the twentieth century. The “red scare” of the end of World War One and the electoral contentiousness or outright civil conflict of the 1920s and 1930s gave way to the middle-of-the-road electioneering of the 1950s and 1960s. Moderating their electoral platforms to compete for the center of the political space, the mass parties founded at the end of the nineteenth century turned themselves into “catch-all” parties that strove to attract all kinds of voters, regardless of the latter’s class or income. Liberal, Christian democratic, and conservative parties pivoted to the center first. Spearheaded by the German Social Democrats’ decision to drop the use of Marxist doctrine in their Bad Godesberg party congress of 1959, socialist parties shifted to the right over the next two decades. Extreme, antisystem

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parties collected few votes in Europe, with the exception of post-war France and Italy, which had large communist parties. By the late 1960s or early 1970s, however, they had formally renounced the use of revolutionary violence. In that context, it did not take long for European left-wing intellectuals to deride democratic elections as meaningless events contested by politicians acting as Tweedledum and Tweedledee, the twins of Lewis Carroll's tale, or as a choice between "gin and tonic and tonic and gin."<sup>2</sup>

The combination of economic growth and the presence of stable democratic elections resulted in the construction of fully fledged welfare states. Even though the creation of an insurance system to cover industrial accidents and employment shocks and of modest pension schemes took place in several countries in the early decades of the twentieth century (Flora and Heidenheimer 1981), it was the traumatic experiences of the Great Depression of 1929 and World War Two that ushered in the construction of formidable social programs on both sides of the Atlantic. Roosevelt signed the Social Security Act in 1935, creating a broad old-age-pension system as well as unemployment insurance, old-age assistance, and programs of aid to families with dependent children. In Scandinavia, the union-business agreements of the 1930s opened the door to even more comprehensive welfare states. In Britain, the Beveridge Report, published in November of 1942, called for the extension of social rights to every citizen in the form of universal health care, a general pension scheme with compulsory retirement ages, subsidized public housing, and free schooling.

In Europe, socialist and Christian democratic parties set up most of those programs. Once in office, however, conservative and liberal parties maintained and occasionally expanded them. As a result, the role of government in the economy grew dramatically. In 1870, public spending was less than ten percent of the total economy in the United States and Europe—with most of it directed to the police and military. Transfers and subsidies accounted for less than one percent of the total economy. By the 1970s, public spending had risen to around forty percent of gross domestic

product (GDP) in large economies and to over fifty percent in small countries—with half of the spending devoted to health, pensions, education, and labor-market programs. Although modern welfare states were mainly designed as insurance mechanisms to alleviate individual risks, such as the loss of employment or old-age infirmity, their impact on income inequality was substantial—reinforcing the wage-compression trends of twentieth-century capitalism. Before taxes, the Gini index of industrial democracies fluctuated around 40. After public transfers, it was less than 30 (Pontusson 2005).

### **Steve Jobs**

What many have come to label the golden age of democratic capitalism started to unravel in the 1970s—as the big productivity gains spawned by the great inventions of the late nineteenth century and early twentieth century, from electricity to the steam engine and the assembly line, tapered off. The annual average growth rate in Organization for Economic Cooperation and Development (OECD) economies, which had reached 6.6 percent during 1945–60 and fluctuated around 5 percent until the mid-1970s, fell to about 2 percent afterward. Economic growth picked up in the 1990s, lifted by the invention of the personal computer and the democratization of its use thanks to entrepreneurs like Steve Jobs, the creation of internet, email, and mobile phones, as well as promising steps in robotics and biotechnology. But that improvement proved short-lived. By the 2000s, per capita income growth had fallen to 1.4 percent in the United States (Gordon 2014).

More fundamentally, those new information and communication technologies began to reshape the structure of employment—in a way reversing the effects that the second Industrial Revolution had on labor markets. In the big factories and large corporations of the first half of the twentieth century, capital and semiskilled labor had been complementary to each other. Now, the rapid diffusion of automatized processes—the result, in

turn, of having extraordinarily fast microprocessors—was making a substantial fraction of qualified blue-collar workers redundant, in a way similar to what had happened to artisans in the early part of the nineteenth century. The number of US factory workers shrunk from a postwar peak of nearly 19.5 million in 1979 to about 12 million in 2014, even though total manufacturing output (in real dollars adjusted for inflation) roughly doubled in the same period of time.<sup>3</sup> Europe experienced a similar downward trend: manufacturing jobs accounted for over one-fifth of all employment in 1970 but less than one-tenth in the middle of the 2010s.

The impact of automation was not limited to industrial jobs. Complex software programs can now perform an increasing number of the routinary tasks that used to be part and parcel of a wide range of traditional white-collar jobs, from accounting and administrative support to travel agency. Routine occupations, that is, those jobs composed of tasks that imply following a well-defined number of procedures (and that can be reproduced by machines fed with appropriate rules and algorithms), employed almost forty-five percent of the working-age population in the United States until the mid-1980s. By 2014, that share had declined to around thirty-one percent (Cortes, Jaimovich, and Siu 2017). By contrast, the number of professional and managerial jobs, which are low in routinized tasks and highly reliant on abstract, relatively creative thought processes, has risen steadily. In the United States, the share of high-skill occupations (managers and professionals) over total employment grew from almost twenty-eight percent of all civilian employment in 1980 to thirty-nine percent in 2010 (L. Katz and Margo 2014). Similar changes have taken place in Europe.

In combination with a sharp drop in transportation costs, the information and communication revolution globalized trade at a truly worldwide scale after the late 1970s, intensifying, as a result, the direct employment effects triggered by the invention of the personal computer. The rise of newly industrialized countries, such as the so-called East Asian Tigers, and the growing practice of job offshoring put an end to the international division of

labor prevalent during the postwar period, characterized by a rich core of industrial economies, tightly interconnected through intra-industry trade, and a southern periphery specialized in exporting raw materials. An increasing number of American, European, and Japanese companies—from toy- and other consumer-goods makers in the 1970s to electronics companies in the 2000s—unbundled their production operations across the world, maintaining highly paid tasks in their national headquarters while moving low-wage jobs to developing countries. The hyperglobalization of the late twentieth century eroded the job status and wages of blue-collar industrial workers and the administrative middle class in advanced industrial economies. Recent estimates attribute about one-third of all employment losses in the last few decades to trade and the relocation of production abroad.

Those divergent trends in the structure of employment—with demand falling for manual and clerical positions and rising for highly educated individuals—translated into a wider wage structure and a more unequal distribution of incomes. Since the middle of the 1970s, median male earnings—that is, the income received by men at the fiftieth percentile of the earnings distribution—have remained stagnant in the United States—once we adjust them for inflation. In Japan and Europe, median salaries have performed slightly better, but they have still risen much less than the overall economy. Wages for those in the bottom quintile of the earnings distribution have done much worse—dropping in real terms in the United States and the United Kingdom and barely increasing in the other advanced economies. In the meantime, earnings have doubled for individuals with postgraduate education and grown by almost fifty percent for those holding bachelor degrees in the United States in the last half century. Less dramatic but similar wage dynamics have taken place in the majority of advanced industrial economies, so that by 2010 the earnings of an individual in the ninetieth percentile of the wage distribution were three to five times greater than the earnings of an individual at the tenth percentile of the same distribution. In those European countries

where earnings inequality has remained unchanged, the cost has often been very tepid employment growth.

The unwinding of the Detroit economic model eventually shook the social and political consensus of the postwar period. Dissatisfaction with political institutions and the political establishment grew across almost all countries. In the United States, the share of people believing that government is run for the benefit of a few big interests doubled to over seventy percent in two decades (Dalton 2004, figs. 2.2, 2.3). In most European countries, the proportion of respondents trusting politicians dropped from about one-half in the early 1970s to less than one-third in the late 1990s. Much of the growing mistrust was concentrated among those most hurt by economic change. In 2012, almost forty percent of British respondents with no educational qualifications and a third of working-class respondents agreed strongly with the statement “people like me have no say in government”—more than twice the rate for university-educated respondents (R. Ford and Goodwin 2014). In the United States, individuals with a high-school diploma were (and are) much less likely to trust the federal government than those with a graduate or postgraduate education. Over time, political disaffection morphed into political disengagement. The rate of electoral abstention in Europe rose from seventeen percent in 1974 to thirty-three percent in 2016. Most of the drop in turnout took place among the social strata most affected by economic change. Abstention rates among low-income voters have become two to three times higher than among high-income individuals. Young cohorts, who have borne a good share of the costs of a changing labor market, are now abstaining at twice the rate of senior voters.

The political and electoral landscape has become more heterogeneous—marked by increasingly divergent interests between business owners (particularly those in high-tech firms with huge stock valuations and minimal workforces) and the rest of society, and between highly educated individuals, able to benefit from the spread of computational technologies and hyperglobalization, and the rest of the workforce. American politics has become much

more polarized than in the past. The broad bipartisan consensus that was a feature of American politics in the 1950s and 1960s has given way to highly ideological and strict party-line voting behavior. In Europe, support for liberal, Christian democratic, and social democratic parties, who had dominated the political landscape since the interwar period, fell by twenty-five percentage points between 1975 and 2015—mostly to abstention. Then, in the wake of the Great Recession, the share of voters casting their ballots to either anti-immigration, anti-European Union right-wing platforms (mostly in northern Europe) or radical, populist left-wing movements (particularly in southern Europe) grew to almost one-quarter in 2015.

## **Machine Learning**

The defeat in 1997 of Garry Kasparov, then reigning world chess champion, at the hands of Deep Blue, a powerful chess-playing machine developed by IBM, was hailed as the definitive sign that machines would replace humans in either all or a broad swath of intellectual and economic activities. The rise of robots could take several decades to happen—after all, the first person to suggest a “computing routine or ‘program’” to play chess was the American mathematician Claude Shannon back in 1949 and the first chess-playing computer had been tried, with little success, in the Los Alamos National Laboratory in 1956—but, many claimed, it would eventually come to fruition.

Today’s state of chess playing points to a less dramatic, even if still highly challenging, future in the relationship between machines and humans. Less than a decade after the victory of Deep Blue, the game was transformed by the invention of “centaur chess”—matches where human players team up with computers to exploit the latter’s ability to retrieve and examine thousands of chess moves and countermoves. As it turned out, the combination of humans’ creativity and strategic insights with machines’ tactical acumen allowed simple amateurs to beat the strongest

chess-playing machines—sometimes with more success than grandmasters, who often thought they knew better than computers.<sup>4</sup> Hence, if chess playing has any predictive value about the future of the economy in general, even though extremely sophisticated computational and information technologies (of the kind that are still in the making) may take over many of the jobs currently done by humans, they will be also likely to enhance our ability to work and produce. In other words, machines and humans will remain complementary to, rather than strict substitutes for, each other.

That complementarity will differ, however, across individuals. At this point in time, only a fraction of the labor force seems to enjoy the skills, talents, and flexibility to work with and take advantage of these new technologies—to succeed, as it were, in “centaur jobs.” As a result, the process of employment dislocation and economic polarization that we are witnessing will probably accelerate in the medium term. If so, the democratic capitalist deal that defined a good part of the twentieth century could find itself at a major political crossroads—one where our societies could be torn apart between the employment and wage dislocations brought about by technological progress and the equalizing tendencies and demands inherent to a democratic system.

The rise of those political and social tensions does not imply, however, that there is a unique, predetermined social and political outcome ahead of us—one where the key institutions of twentieth-century democratic capitalism will buckle under the weight of mounting joblessness and growing wage inequality. Although Silicon Valley capitalism and Manchester capitalism may resemble each other in terms of their disruptive impact on employment, the stagnation of wages they brought to certain social strata, and their level of economic inequality, they differ, at the very least, on two critical dimensions: first, we are now much wealthier; second, fully democratic institutions and relatively capable bureaucracies have been in place in the richest parts of the globe for several decades.

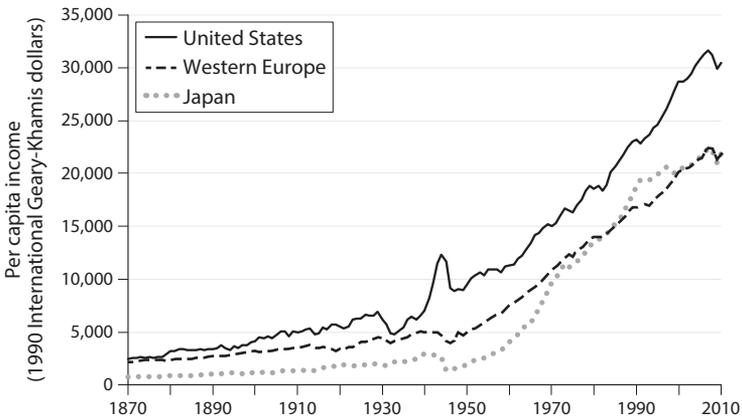


FIGURE 1.2 Per capita income, 1870–2010. Source: Bolt and van Zanden (2014).

As shown in figure 1.2, average income per person (reported in constant dollars of 1990) is about ten to fifteen times larger today than 150 years ago in North America, Europe, and Japan. It should therefore be possible to use our representative institutions to harness this massive buildup in wealth to smooth the technological transformations of the present and, in the process, to pursue the main collective objective—guaranteeing relatively equal life chances to all—that defined the middle and late decades of the twentieth century. That arguably calls for two types of interventions: firstly, providing everyone with the kinds of talents and skills that are complementary to the new technologies of production; secondly, compensating and protecting those individuals who may become underemployed or directly unemployable.

In the world of Manchester capitalism, formal skills were of little importance. All that counted was having cheap workers who could manipulate, in a mechanical way, rather rudimentary machines: children and illiterate adults. Neither businesses nor the state had much of an interest in “wasting” money funding educational schemes that were irrelevant to factory jobs. As a matter of fact, working families did not either: any year “lost” by their children attending school implied taking less money without any

certainly that they would get better jobs and higher wages later on. By contrast, the diffusion of “Detroit” technologies coincided, for a good reason, with the expansion of school enrolment and the corresponding broadening of the American and European middle classes. States, corporations, and individuals had strong incentives to fund primary and high schools and/or vocational training institutions because Detroit capitalism led to the rise of occupations that required labor to have some basic literacy and numeracy competencies. In the future, as the Silicon Valley technological revolution progresses, the utility of some—the most basic and “routinizable”—skills will continue to decay, precisely because algorithms and computer programs are good at reproducing them. By contrast, other types of competencies, which are generally associated with relatively long educational processes and with “soft” abilities such as creativity or interpersonal skills, will rise in value. Investing in the generation of “centaur-like” aptitudes will be necessary to spread the benefits of the new technological revolution.

Producing that kind of human capital, however, may not be possible for everyone, or even sufficient in the long run. Up to this point, the process of automation has relied on feeding a computer (such as Deep Blue) with a program or set of strictly defined rules that imitate the actions and calculations of humans. Yet, in the last few years, programmers have developed new techniques, broadly defined as “machine learning,” that allow computers to program themselves. After being instructed with the general rules of a game and/or fed with data, machines build up their own procedures to solve the problem at hand. In December 2017, for instance, the artificial-intelligence company DeepMind released AlphaZero, a generic algorithm that, with no chess knowledge at all, trained itself for a few hours, and went on to beat the world-champion chess program, Stockfish 8, in a one-hundred-game matchup. With these new technologies already succeeding at more complex games and tasks than chess, such as Go or image recognition, there is a distinct possibility that humans will become superfluous in a broader set of tasks at some point in the future. That, some claim,

may involve reinforcing or setting up mechanisms to guarantee some basic income for the unemployed or unemployable. It may even entail “socializing” the ownership of those new technologies to ensure that their profits are shared as widely as possible.

## **Plan of the Book**

Examining the challenges raised by technological change and its effects on employment, wages, and politics, as well as discussing how we may respond to them, requires exploring the interplay of economic and political institutions since the first Industrial Revolution. That is what I do in the rest of this book, which is structured as a kind of funnel—paying widening attention and space to those events, institutions, and problems that are closer to us in time. Although the chapters are organized, when we consider them together, to support the main claims of the book (about the impact of technological change on the structure of production and on the kind of labor that is complementary to machines, and, as a result, on wages, inequality, and political institutions), the reader should be able to read each one of them as a separate, self-contained piece of information on the puzzle of the interaction between democracy and capitalism for each one of the periods under analysis.

The next chapter, “Manchester,” sketches in relatively broad strokes the nature of nineteenth-century capitalism and its relationship to its contemporary political institutions. As such, the chapter provides information about the new technologies of the first Industrial Revolution, their consequences on overall growth and the welfare of labor, and their ultimate political effects. Nevertheless, “Manchester” is mainly written as a conceptual exploration of the two building blocks of the book: modern (industrial) capitalism and representative democracy. With that goal in mind, the chapter often relies on the contributions of key intellectual witnesses of that historical period, such as Adam Smith, Karl Marx, and John S. Mill, whose ideas have come back in force in current debates about the future of both capitalism and democracy. More

## 22 CHAPTER 1

specifically, the chapter introduces the main narrative arc of the book to the reader: how industrial entrepreneurs, in their search for higher profits (the engine of capitalism), push for higher levels of automation in the production process; how a specific level of automation makes a particular type of labor complementary to the new technology of production and, therefore, especially sought after by businesses; how that complementarity affects, in turn, wages and living standards across the entire workforce; and how those changes give rise to a fresh set of political challenges. During the first phase of the Industrial Revolution, the growing mechanization of manufacturing and the creation of the factory resulted in the substitution of unskilled workers for a traditional class of craftsmen employed in artisanal shops. That complementary between machines and an illiterate or minimally educated labor informed, in turn, the low wages and poor living conditions of the working class. It was for that reason that conservatives and liberals, as well as socialist intellectuals and politicians, despaired of reconciling capitalism with democracy.

Chapter 3, “Detroit,” examines, at much more length and with more fine-grained data than the previous chapter, the production revolution brought about by the assembly line and related technologies, its employment and income consequences, and the ways in which those changes laid the foundations for the triumph of the system of democratic capitalism during the best part of the twentieth century. As automation progressed, semiskilled and skilled individuals replaced unskilled workers as the main type of labor complementary to capital. The demand for lower-middle- and middle-class jobs, jointly with the expansion of secondary education, resulted in the formation of a broad affluent working class. In turn, fast economic growth and the relative equalization of incomes made social peace and universal suffrage possible. That new model was so successful, at least relative to Manchester, that many came to see democracy and capitalism as fostering, together, a virtuous political and economic cycle: capitalism produced the wealth that sustained political freedom

and made governmental turnover at the polls acceptable to elections' losers; democratic states provided both accountable political institutions and a well-fed, healthy, and well-trained labor force—which together incentivized capital investment and more technological progress.

The core of the book, formed by its last three chapters, addresses the present and future of the emerging capitalism of the late twentieth and early twenty-first centuries. Chapter 4, "Silicon Valley," describes how the information and communication technologies of the last few decades, by making highly skilled labor the main complement of capital in the production process and fostering the current process of globalization, have broken the equalizing tendencies of Detroit and confronted governments in advanced economies with a growing trade-off between employment and inequality. Chapter 5, "Dire Straits," moves on to explore the electoral and political effects of those transformations. It provides fresh data on the rise of political disenchantment and electoral abstention among voters in advanced industrial economies. It shows the erosion of popular support for the old parties that constructed the democratic capitalist deal during the Detroit period. And it examines, employing simple but useful tools developed by current scholars of politics, the causes, nature, and prospects of so-called "populist" parties.

Chapter 6, "Robots vs. Democracy?," discusses the overall impact of future automation as well as the economic and political responses we should develop to exploit its benefits and tame its potential threats. I consider, in the first place, the effects of automation on the demand for particular types of labor and on our ability to meet those changes by training our workforce. I then reflect on its impact on the ownership of capital, mostly questioning a rather extended thesis that asserts that robotization will ineluctably result in the "hyperconcentration" of wealth in a few hands. Next, I consider the political consequences of the computer revolution. Contrary to some catastrophizing claims, I find little support for the idea that it will jeopardize democracy and

holding regular elections per se. Still, I identify a potential decline in the level of political accountability of policy makers vis-à-vis public opinion, and I suggest, accordingly, a range of legal and political reforms to avoid it. Making sure that democratic institutions remain as representative and as close to citizens as possible will be crucial to ensure that governments administer the gains of the ongoing technological revolution to the advantage of the great majority. The policies that they deploy will depend on the (still uncertain) intensity of technological change—and will range from aggressive educational investment through antitrust measures to, exceptionally, some socialization of the ownership of capital. I close the book by warning about the future (not necessarily positive) effects of Silicon Valley capitalism on both newly developed economies and developing countries—the full automation of production may stop or even undo their recent economic growth—and on the evolution of globalization and transnational migration flows.

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