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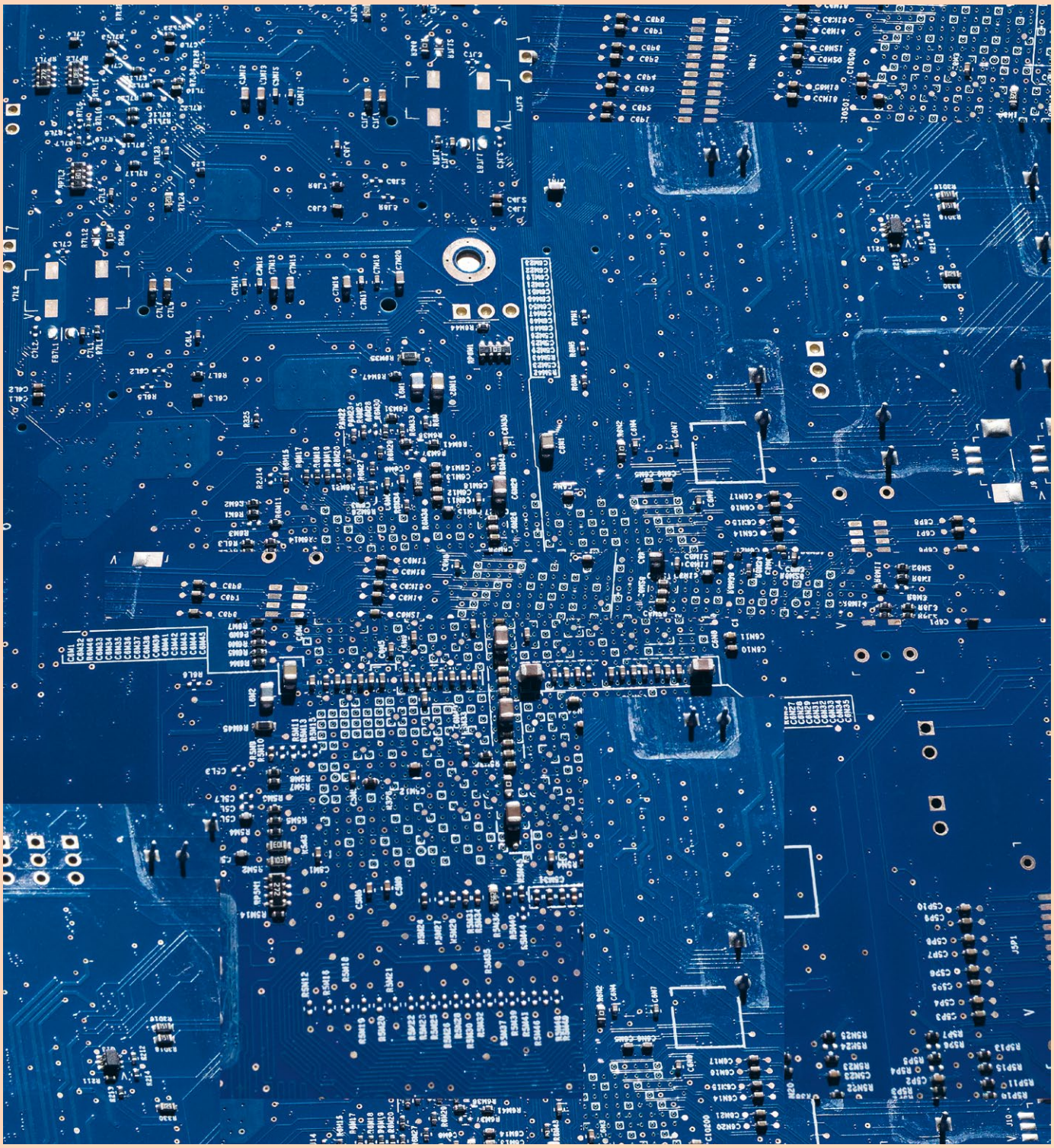

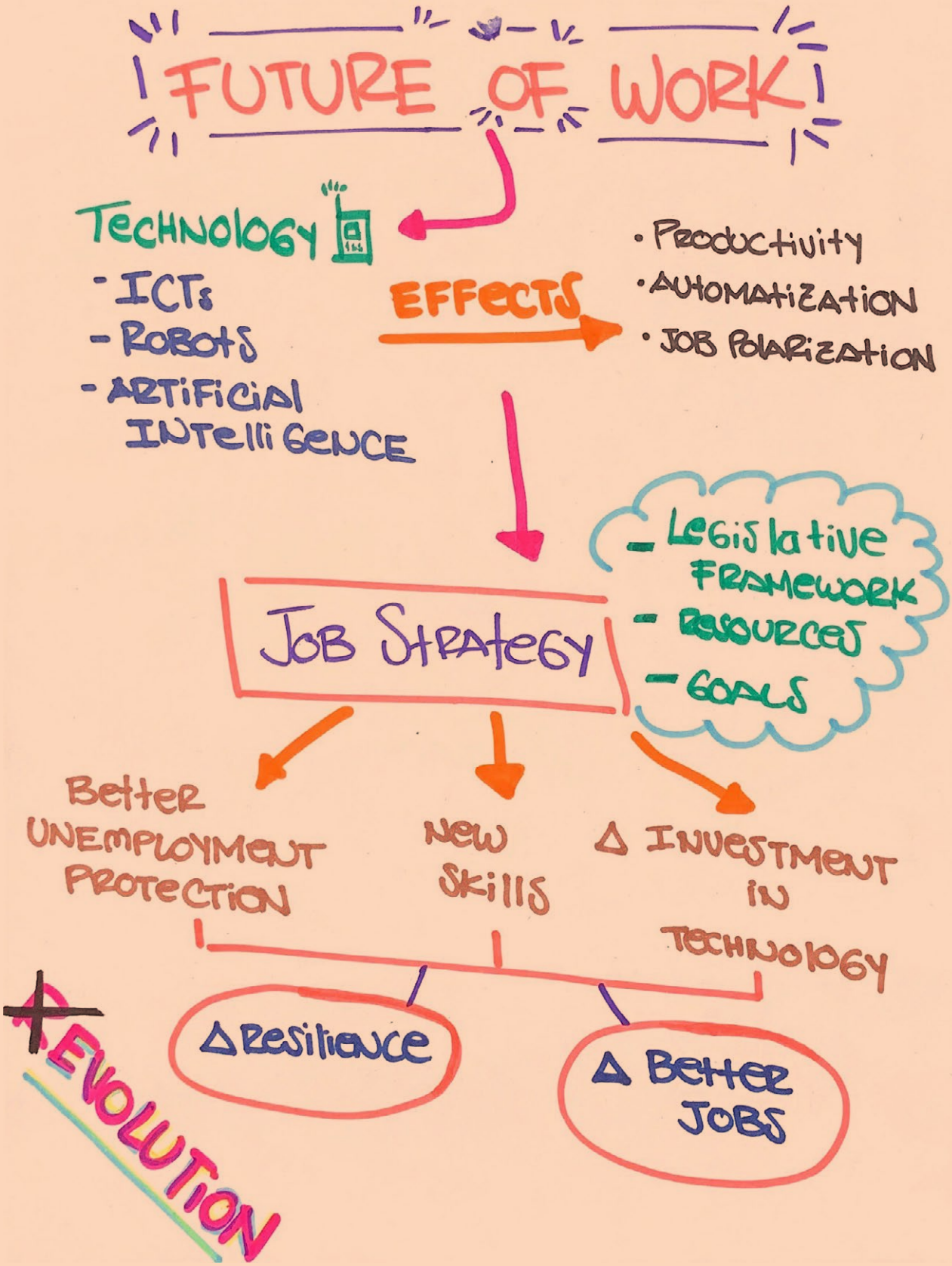
FUTURE OF WORK
TECHNOLOGY
- ICTs
- ROBOTS
- ARTIFICIAL INTELLIGENCE
EFFECTS
• PRODUCTIVITY
• AUTOMATIZATION
• JOB POLARIZATION
JOB STRATEGY
- LEGISLATIVE FRAMEWORK
- RESOURCES
- GOALS
BETTER UNEMPLOYMENT PROTECTION
NEW SKILLS
Δ INVESTMENT IN TECHNOLOGY
Δ RESILIENCE
Δ BETTER JOBS
EVOLUTION

Institutions, Policies, and Technologies for the Future of Work

Carmen Pagés Serra

In recent years, there has been a proliferation of publications about the future of work. Many of these adopt a somewhat sensationalist tone, predicting a dystopian future without employment; others point to our historical coexistence with technology to attest to our capacity to continue creating new occupations and tasks for humans. This paper goes deeper into this debate by looking at recent studies on the impact of artificial intelligence (AI) and robotics on labor markets. It predicts an acceleration of the ongoing labor market transformation, which in many countries is already putting pressure on society, polarizing the political discourse, and undermining democracy. The first part focuses on the need to develop a strategy that improves the resilience of workers and firms and increases the creation of quality jobs. The second part discusses the nature of this strategy and how to put it into practice.

Many studies, events, books, and articles in newspapers and social media draw our attention to the future of work. Most take a markedly pessimistic point of view, in which the world is on the brink of an unprecedented employment crisis: we humans will be replaced by robots, chatbots, and increasingly clever, capable, and intelligent algorithms that will do our tasks. Others, on the other hand, look for signs of what may come and find reasons for optimism in the past history of mankind: since the Industrial Revolution, humans have been able to find tasks and occupations that allow us to keep working while coexisting with technology.

This article explores this debate, searching for clues as to what awaits us in the future, analyzing what has happened in the labor market throughout history in response to the introduction of new technologies. From the introduction of information and communication technologies (ICTs) in the 1980s to the incipient use of robots and artificial intelligence (AI) today, we can draw interesting parallels to understand the impacts of the budding industrial revolution that will take place when the use of robots and AI becomes widespread.

Our analysis finds that the effects of technology are not imminent, they have, in fact, already begun. The Third Industrial Revolution, marked by the widespread use of ICTs, has had significant consequences in the labor markets of most countries around the world. Similarly, in places where robots are being used on a scale large enough to detect their effects, there are worrying signs of their potential future impact. All of this suggests that we are not facing a revolution, but rather the acceleration of a labor market evolution that began a few decades ago. In many countries, this evolution has led to increased inequality, the disappearance of a large number of jobs that allow a middle-class lifestyle, an increase in the proportion of insecure jobs without economic or social security, and a lower income and standard of living for many workers. All of this, in addition to other megatrends, such as globalization, offshoring, and migration, is placing pressure on societies, increasingly polarizing politics, and undermining democracies.

In this context, we argue that although we cannot expect the market to take care of this problem, there is no call for a defeatist attitude either. We discuss the need to shift

from the status quo to the implementation of a strategy designed to improve the resilience of workers and firms facing these changes, and to increase the percentage of "good jobs," which Dany Rodrik and Charles Sabel broadly define as "stable formal-sector employment that comes with core labor protections," including safe working conditions and collective bargaining rights.[1] This new pact seeks to restore a strong, empowered middle class as the engine for more inclusive growth. The second part of the paper discusses the nature of this strategy and how to put it into practice. In some countries, it means modifying or adjusting existing institutions or policies, in coordination with companies, workers' organizations, and educational centers. In others, it involves making greater efforts to reach consensus between governments and other stakeholders in order to create or strengthen the required institutions, policies, and tools. In all cases, it means harnessing the potential of new technologies so that they cease to be the source of the problem and instead became a significant part of the solution.

Evolution or Revolution?

Exponential Technological Change

Since the early 1980s, we have seen the introduction and rapid expansion of a range of technologies. The Third Industrial Revolution brought personal computers (whose computational power has increased exponentially as its costs fell), the Internet, cloud computing, and smartphones, allowing for the interconnection of billions of devices and the digitization and automation of countless processes. Yet, it has been the advent of the Fourth Industrial Revolution, and the spread in the use of robots and artificial intelligence (AI), driven by exponential advances in data availability, that has set off alarms in society. The evocation of science-fiction stories in which human-looking robots subjugate humanity may explain a greater apprehension toward these technologies. But aside from a potential overreaction, what does the available research allow us to say about the future impact of these trends on the labor market?

Our analysis gives rise to the conclusions discussed below.

The Third Industrial Revolution Had Lasting Consequences on the Labor Market

Analyzing the effects of the Third Industrial Revolution (ICTs) on the labor market provides insights into the potential impact of the Fourth. Like artificial intelligence, ICTs are all-purpose technologies that can be applied to any sector or industry. Most available studies find that the introduction of ICTs did not have adverse effects on employment levels, but it had an impact on the composition of employment. For example, James Bessen (2017) found that ICTs did not lead to a decline in employment. Instead, they favored its growth. In fact, Bessen shows that the greater the introduction of ICTs in a sector, the more employment is generated in that sector.

However, many studies also conclude that the introduction and spread of ICTs brought significant changes to the types of jobs generated in the labor market. In particular, they show that ICTs—which have a strong advantage over humans when it comes to performing easily codifiable, routine, repetitive tasks—have replaced workers in routine occupations, such as accountants, administrators, and operators. At the same time, ICTs have increased the demand for nonroutine jobs, such as university lecturers and hairdressers (Autor, Levy, and Murnane, 2003; Goos and Manning, 2007; Acemoglu and Autor, 2011; Darvas and Wolff, 2016).

The impact of ICTs by occupation type, however, was not as significant as the impact by economic class: researchers agree that the introduction of ICTs has led to a fall in middle-class employment. Many of the jobs classified as "routine" require medium-skilled workers and pay wages close to the average. Therefore, the decline in the proportion of routine jobs in overall employment as a result of technological change has been a blow to the middle class. Between 1993 and 2010, the share of medium-skilled employment in total employment fell between six and fourteen percentage points in all European countries (Goos, Manning, and Salomons, 2014).

At the same time, technology has led to an increase in the demand for workers in the upper and lower part of the wage distribution. To understand the reasons for this phenomenon, it is important to note that technology gives rise to various different effects. On the one hand, it generates productivity increases that allow prices to fall, resulting in a greater demand for goods and services. This, in turn, contributes to a greater demand for labor in occupations and tasks that cannot be replaced by machines. Many of the goods and services for which demand increased were either carried out by low-skilled workers in low-wage jobs (such as personal services) or else, by high-skilled people in occupations that pay high wages (such as engineering). This rise in the best- and worst-paid jobs, accompanied by a decline in the employment (and income) of the middle classes, is known as "job polarization", and is taking place in almost all OECD countries (Darvas and Wolff, 2016). Also, although to a lesser extent, in Latin America (Amaral et al., 2019), and other countries in the rest of the world (AfDB-ADB-EBRD-IBD, 2018).

Analyzing the Impact of the Introduction of Robots Brings up Worrying Signals Regarding Its Potential Future Effects

The available studies suggest that, to some extent, there is an ongoing replacement of human labor by robots. Most studies conclude that the incorporation of robots has been accompanied by a decline in employment or in salaries, particularly in the manufacturing sector. It is estimated that the introduction of one additional robot per thousand workers reduces the employment rate by 0.16 to 0.2 percentage points (Acemoglu and Restrepo, forthcoming, for the United States; Chiacchio et al., 2018, for a group of European countries) and that the introduction of robots also reduces wages by around 0.42 percent (Acemoglu and Restrepo, forthcoming). In a 2019 article, Borjas and Freeman also found that robots have a negative impact on employment and wages equivalent to the arrival of an additional two to three workers per thousand inhabitants (Borjas and Freeman, 2019). Nonetheless, not all studies find the same negative impact. In the case of Germany (which has one of the world's highest robot penetration rates), for example, no negative impact was found on overall employment, although findings did indicate a negative impact on employment in the manufacturing sector (Dauth et al., 2018). This study did, however, agree with the aforementioned ones in finding that the introduction of robots is accompanied by a significant reduction in wages.

It is important to emphasize that these are preliminary results, given that the adoption of robots is still at a very early stage in most countries. According to some estimates, the number of robots per worker

Two trainees in electronics and mechanics at the Opel training center in Ruesselsheim, Germany

could quadruple between now and 2025, which would be equivalent to adding 5.25 additional robots per thousand workers. In terms of jobs, the expansion of robots would reduce employment by around 1% of the workforce. A significant impact, certainly, but hardly the end of employment.

Studies on the Impact of Artificial Intelligence Suggest a Greater Potential Replacement of Work

Artificial intelligence is at an even earlier stage of adoption than robots. As this makes it impossible to rely on direct observation of the effects of its introduction into production, studies that attempt to predict its impact estimate these effects in much more tentative and less accurate ways. In particular, they analyze what occupations may be automated by AI and how many workers currently employed in these occupations would be affected in the case of such automation. The first studies along these lines came up with figures that made headlines around the world. According to one famous study by two Oxford researchers, Carl Benedikt Frey and Michael A. Osborne, 47% of employment in the US could be automated by artificial intelligence (Frey and Osborne, 2017). Other studies using a similar methodology came up with even higher figures: between 48% and 73% potential automation in various countries around the world, with the highest figures corresponding to developing countries (World Bank, 2016).

These terrifying figures were reanalyzed by later studies that argued about the need to account for the fact that not all tasks within an occupation are equally automatable. Taking this into account, this second wave of studies came up with lower, but still substantial figures: 9% of employment in the USA and 8% in Eastern European countries could potentially be automated by artificial intelligence in the next few years (Arntz et al., 2016). However, the fact that an occupation is automatable by AI does not mean that it will in fact be automated: this will depend on whether it is worth investing in the technology based on current wages. For example, there are now robots in the construction field that can install 250 bricks per hour, while a mason can only lay 250 per day. This machine costs around 400,000 dollars. The amount a company would need to invest in a machine like this would cover

ICTs had an adverse effects on workers with medium skills and wages, while the introduction of robots appears to negatively affect workers with both medium and low skills and wages

the wages of ten masons for ten years in a row in El Salvador, but only 7.5 masons for one year in the United States.

The Negative Impact of Robotics and AI Is Greater for Medium- and Low-Skilled Workers, Young People, and Workers in Routine Occupations

A large majority of studies find that the adverse impacts of technology have been (and will probably continue to be) greater for medium- or low-skilled workers, and that some, but not all, new technologies tend to stimulate greater employment growth for workers with a higher educational level.

For example, as noted above, the adverse effects of ICTs applied principally to workers with medium skills and wages. The introduction of robots, however, appears to adversely affect workers with both medium and low skills and wages, with some divergence between studies. In one study that analyzes the impact of the introduction of robots in seventeen developed countries, Georg Graetz and Guy Michaels (2018) found that the impact of the reduction in labor demand was concentrated on workers with low skills and low wages. Another similar study for a group of six countries from the European Union found that the negative impact of robots was greatest for workers of middle education and wages (Chiacchio et al., 2018). Similarly, in Germany, robots adversely affected medium-skilled workers most and low-skilled workers to a lesser extent, while they stimulated employment for high-skilled workers (Dauth et al., 2018). Conversely, a study based on US data found robots had adversely affected employment for workers at all levels (Acemoglu and Restrepo, forthcoming; Borjas and Freeman, 2019), while the negative effects on wages were concentrated on workers with a low or medium educational level.

Like ICTs, robots compete more directly with people employed in more routine—particularly manual—occupations (Acemoglu and Restrepo, forthcoming), and in occupations with a higher probability of automation (Borjas and Freeman, 2019). A study looking at data by occupation for Europe found that the introduction of robots increased employment rates for professionals, technicians, and service workers, and reduced them for clerks, agricultural workers, artisans, and plant and machine operators (Chiacchio et al., 2018). In the specific case of Germany, the introduction of robots generated a greater demand for managers, legal specialists, and technicians, while systematically reducing the demand for plant and machine operators.

A final point to note is that although studies also find that the introduction of robots increases labor productivity, this does not translate into wage increases for workers. For this reason, the growth of robotics has led to the decline of the labor income share (Dauth et al., 2018). All of this confirms that the incorporation of robots has resulted in greater inequality, both between low- and middle-income workers and high-income workers, and between workers and capital income.

Based on the foregoing, it seems highly probable that, without government intervention, the massive introduction of artificial intelligence and robots will continue to reduce employment opportunities for people with medium and low educational levels and increase inequality. The big difference with the past is that now, artificial intelligence makes it possible to automate activities carried out by highly educated people, such as radiologists and credit-card fraud-detection analysts, broadening the scope of impact.

The Evidence so far Indicates that the Decline of Employment Owes More to Less Hiring than to More Layoffs

A very small group of studies analyzes the way in which the adjustment to the introduction of technology takes place. If employment declines, is it due to an increase in layoffs, to more retirements, or to less hiring? Does unemployment go up, or do people leave the workforce? The available evidence suggests that the main means of adjustment is a reduction in the hiring of new staff in declining sectors, rather than an increase in layoffs of current employees.

In the case of ICTs, a study based on United States data found that the decline of routine employment has mostly occurred in two ways. On the one hand, the fall in employment has been due to a decline in the inflow of workers from unemployment to routine employment. And to a lesser extent, to an increase in the outflow from these routine occupations to unemployment (Cortes et al., 2014).

It appears that young people bear much of the burden of the adjustment. A study based on German data looks at how different generations are affected by robots.

When robots are introduced, firms freeze new hires rather than laying off existing middle-aged workers. Given that new hires principally tend to be young people joining the workforce for the first time, there is a decline in the recruitment of young people. At the same time, those who were already employed by the company gain greater job security, but in exchange for being reassigned to other tasks or divisions within the same firm and at the cost of lower wage growth (Dauth et al., 2018). The freezing of new hires has led to an increase in the average age of the workforce in the more roboticized plants. Other studies carried out in the context of the European Union also confirm that the introduction of robots principally reduces the employment of young individuals relative to that of adults (Chiacchio et al., 2018).

Further research is needed to confirm whether the results found by these two studies can be generalized to other studies and countries. It is particularly important to be able to draw on this kind of information for designing policies that increase worker resilience to changes in the labor market and increase the percentage of good jobs. Tentatively, studies seem to conclude that firms reduce the recruitment of new hires, and possibly send some workers into early retirement, rather than increasing mass layoffs. Young people with medium and low educational levels suffer the greatest impact, given that their opportunities to find a job that secures them a place in the middle class have significantly decreased. Another part of the adjustment appears to take place through a drop in participation levels by those who abandon the search for work given the declining opportunities.

Technology also Creates Inequalities at the Local Level

The technological revolution also has significant effects at the local level. The type of employment in a particular area influences the future development of employment. Studies indicate that rural and semi-rural areas with a higher prevalence of medium- and low-skilled workers have suffered most from the effects of polarization, while cities have tended to have higher-than-average increases in employment and income (particularly the subset of cities with more human capital at the start of the introduction of ICTs). The evidence for the United States indicates that human capital has tended to concentrate in places that already had a higher share in the early 1970s and 1980s (Austin et al., 2018).

The Creation of New Tasks and Occupations for Humans Is Key to Restoring Employment

Throughout history, technology has destroyed jobs, but the employment-to-population ratio has continued to increase. How can these two trends be reconciled? The explanation is that the introduction of new technologies does not just destroy jobs, it also creates them through two different channels. Firstly, the introduction of new technology generates productivity gains that then lead to increased revenue and consumption, stimulating labor demand in nonautomated tasks. Secondly, new technologies create new tasks and occupations (Acemoglu and Restrepo, 2018). The Internet, for example, has given rise to social networks which, in turn, produced a new occupation: social media manager. In fact, about one third of the jobs created in the US in the past twenty-five years, including computer programmers, fitness instructors, and medical technicians, did not exist (or were only just starting to exist) twenty-five years ago (McKinsey, 2015).

Thus, even when the replacement of humans by technologies has adverse effects on employment in the short term, it is difficult to predict the medium- and long-term effects that will result from these two forces, and whether it will be different this time. In the case of ICTs, as noted above, the impact has been neutral or positive, but it is too early to know whether robots and AI will produce a different effect. One cause for concern is that, as Daron Acemoglu points out, the bulk of investment in artificial intelligence seems to be geared toward replacing workers, not toward generating new tasks that create more jobs.[2] Moreover, even if new technologies do not affect employment in the medium term, their effects on income and employment distribution may last for decades (judging by the lasting distributional consequences of the introduction of ICTs).

Institutions, Policies, and Solutions for Successfully Addressing Technological Change

The future of work is already the present. The changes described above make it clear that technology is inexorably transforming

The freezing of new hires has led to an increase in the average age of the workforce in the more roboticized plants

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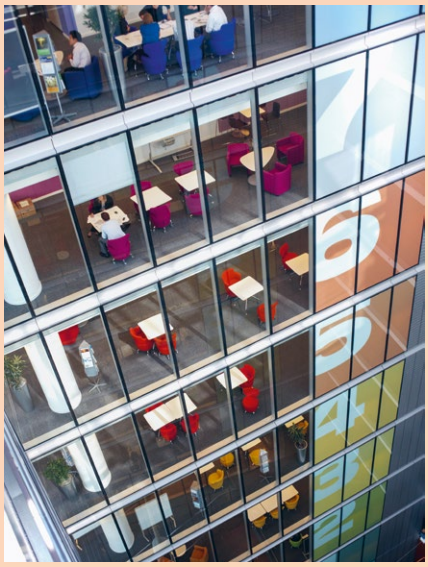

The European headquarters of Ernst & Young at the More London development, London

the labor market. These forces are contributing to increasing inequality and decreasing employment opportunities and income, particularly for medium- and low-skilled workers, and even more markedly for the younger cohorts. At the same time, many firms are finding it difficult to adapt to the increasingly rapid waves of technological change (McKinsey, 2015). Firms that fail to successfully incorporate new technologies run the risk of dying. The lack of workers with the right skills is a key factor hindering the adjustment. According to a recent Manpower report, 45% of small firms and 67% of large firms report difficulty finding candidates with the skills they need, and these figures have been growing in recent years (Manpower, 2018).

In this scenario, where both workers and firms find it difficult to successfully address the changes that the future of work brings, public policy has two choices: to continue with the status quo, or to follow a much more active strategy developing policies, institutions, and technological tools to enhance the resilience of individuals and firms in the face of these changes, as well as promote greater growth of good jobs.

Traditionally, economists have not been in favor of pro-employment policies on the grounds that employment is driven by economic growth and, as such, the priority should be to promote the latter. However, the opinion of the profession seems to be changing. Several recent studies draw attention to the negative effects on society of the disappearance of "good jobs" and to the fact that the market, on its own, does not produce a sufficient number of good jobs. Researchers find, for example, that a decline in good jobs leads to an increase in the impact of numerous social problems, such as addictions, deaths resulting from these addictions, child poverty, and mental illness (see, for example, Rodrik and Sabel, 2019, and Austin et al., 2018). The loss of good jobs also involves high costs for governments. In the United States, for example, the fiscal cost of the loss of employment ranges from 21% to 36% of the wages earned by low-income workers (Austin et al., 2018). In addition, there is the loss of social insurance coverage and the protections associated with formal employment, which have to be financed by the government through social protection programs. The studies also find that the loss of good jobs is linked to political polarization (Autor et al., 2017) and to a loss of confidence in democracy (Ballard-Rosa et al., 2018). Effects of this kind have been found in the US, Sweden, the United Kingdom, and other EU countries (Rodrik and Sabel, 2019). As such, the creation of good jobs will not only keep people in the middle class, it is also crucial to the health of democracies.

Remedying this situation requires a public policy response—in coordination with other actors, such as companies and workers' representatives—to the growing polarization of labor markets and the insufficient creation of good jobs. Technology is advancing rapidly and we must quickly decide what kind of society we want. Adapting a concept developed by Danny Rodrik and Charles Sabel in a recent article (Rodrik and Sabel, 2019), we propose that governments should develop a deliberate strategy to increase both the resilience of workers and firms in the face of these changes and the number of "good jobs." This strategy should comprise *an appropriate regulatory framework* for the creation or strengthening of a series of *institutions, policies, and technological solutions designed for this purpose*, the *resources* required to carry the plan forward, and a series of *milestones and a timetable* for its implementation.

The *regulatory framework* establishes the parameters and incentives for the public-private collaboration in order to ensure that: firms adapt to the technological challenges and retrain their employees to carry out new tasks/roles in the same firm or others; employees affected by downsizing have sufficient financial security for a period that allows them to train to perform new occupations; appropriate training programs are developed to build the skills required by the labor market; and technological tools are designed and made available to workers to guide them through their many transitions.

More specifically, and by way of illustration, this framework could establish the elements described below.

A. Instruments that Allow Firms to Adapt to New Technologies and Workers to Retrain in order to Transition to New Tasks and Occupations

The successful adoption of technologies that already exist in the world or in a particular country is the main engine driving the growth of countries (McKinsey, 2015). Continuing to introduce information technologies, such as broadband, and to make progress with the digitalization of processes, in conjunction with an increasing use of artificial intelligence and robotics, will lead to productivity gains that are key to sustaining high growth in a rapidly aging world. However, as noted above, this technological progress must *coincide with the development of new activities for humans*. There are various examples of successful public policies around the world that can speed up the introduction and use of new technologies, as well as the development of new roles, tasks, and occupations for workers. An interesting example is competitive public funds, which allow firms to submit investment proposals to public bodies and compete for funding to finance them. Submissions must include the description of the company's plan to invest in new technologies and programs to develop new skills, specifying the amount of co-financing that they are prepared to provide and the good jobs they can create. These proposals are assessed by a technical committee that decides on financing based on the quality of the proposals. Instruments of this kind have been used successfully in developed countries such as the United Kingdom, Australia, and the United States, and are also starting to be used in some Latin American and Caribbean countries. They can be scaled relatively quickly. Also, financing priorities can be adjusted flexibly over time to meet the changing needs of firms, workers, and governments. To be useful, these programs must establish fast, transparent mechanisms for the allocation and disbursement of funds. Governments should focus on financing training that promotes the development of skills that are transferrable to other firms or industries. In addition, government should ensure the quality and relevance of the training and the portability of skills between companies by means of industry-recognized certifications.

Another way to protect people from the risk of obsolescence, complementary to the mechanism outlined above, is to expand social insurance to cover workers from the depreciation of their skills. This can be done through the creation of individual training accounts financed by payroll contributions (see, for example, Fitzpayne and Pollack, 2018). The accumulated amounts can be used to finance the training chosen by workers, as long as it meets standards of quality and relevance.

B. Adequate Protection from Dismissal, Combined with Sufficient Unemployment Insurance to Allow Laid-Off Workers to Acquire New Skills to Carry Out New Tasks or Occupations

The right mix of unemployment insurance and employment protection (in the form of severance pay) is the most efficient combination to insure workers against the risk of losing their jobs (Blanchard and Tirole, 2008). On the one hand, making layoffs more difficult or expensive means that firms can internalize the aforementioned harmful effects of unemployment on society. It also creates more incentives for firms to retrain employees to perform other roles or occupations within the company. At the same time, unemployment insurance means that firms laying off workers do not have to bear the entire cost of the adjustment, which is particularly important for small or less productive firms that are not able to cover the total cost. However, it should be noted that if the cost of payroll tax or of laying off workers is excessively high, the opposite effect may occur: it could disincentivize the shift from "old" to "new" activities, and promote the creation of bad jobs.

Technological obsolescence places workers who lose their jobs in a particularly complex situation. Technological change permanently reduces employment opportunities for laid-off workers, often forcing them to choose between accepting a lower-quality job in a different sector or leaving the job market. As such, it may be worth establishing supplementary unemployment benefits—for a sufficient period of time—to allow workers who lose their jobs to embark on training or retraining processes in order to be able to transition to occupations on the rise. These benefits should cover the cost of training as well as a living allowance for the person and his or her family. Payment could be subject to workers performing well in their training, and choosing to train for an occupation that is in demand. To ensure this last point, it is important to provide information on labor market trends and appropriate counseling to guide workers' training decisions (see point D).

C. Incentives and Financing for the Development of Flexible, High-Quality Training Programs

Technological change leads to the rapid obsolescence of some skills, particularly technology-related skills (see, for example, Deming and Noray, 2019), and creates demand for new ones. Jeremy Augur, cofounder of the training company D2L, points out that the average lifespan of a skill in the tech world is now only eighteen months.[3] Studies have found an increasing demand for advanced digital skills (Amaral et al., 2018), advanced cognitive skills such as critical thinking and problem-solving, and social skills such as the ability to work in a team and strong communication skills (Deming, 2017). But many of these skills are scarce in the workforce. On the one hand, technological skills change rapidly and the training system is unable to keep up. On the other, the educational system in many countries has not placed enough emphasis on developing advanced cognitive and social skills.

In this context, it is essential to promote the development of flexible, modular training programs that allow people to acquire new skills and certifications or to retrain for new occupations, without necessarily having to do so through long educational programs designed for young, recent, high-school graduates. These new programs may be online, blended, or face-to-face. An example is the "digital bootcamp" model, intensive programs that train people as software developers and for other roles within the digital industry (Cathless and Navarro, 2019).

Just as the industrial revolution led to the public financing of secondary education, our new labor environment requires a commitment to financing this new kind of flexible, modular training that allows people to engage in lifelong learning and to earn post-secondary education credentials. This is particularly important in the case of young people who dropped out of high school and now have fewer opportunities to find a good job than their parents or grandparents did.

Instead of directly funding training centers (in the traditional way), funding could be offered directly to workers or firms through the mechanisms suggested in the previous sections. Past experience with occupational training systems shows that training programs are more likely to be attuned to labor market needs when the financing mechanisms are aimed at the demand rather than the supply of training. However, in order to achieve a system that is truly relevant to the needs of people in this new world of work, it is essential to ensure the provision of quality learning that genuinely leads to improvements in

The loss of good jobs is linked to political polarization and to a loss of confidence in democracy

An interesting example of public policies is competitive public funds, which have been used successfully in developed countries such as the United Kingdom, Australia, and the United States, and are also starting to be used in some Latin American and Caribbean countries

An unemployed woman receives career advice during a jobs fair in Washington, DC. In 2010, when the photograph was taken, the unemployment rate in the US rose to 9.9 percent

people's living and working conditions. This can be done by setting up a system of quality assurance to monitor the results in terms of employability and the career paths of the training recipients, and by processing and disseminating this data so that it can inform the decisions of firms, workers, and training centers. Likewise, the government should encourage experimentation among training providers to develop the programs that best meet the needs of various target groups (young, middle-aged, older adults, people with certain disabilities, and people with a low initial educational level, to mention a few).

D. Technological Tools to Guide Workers and Support Their Transitions

Employment services have traditionally been government bodies with the role of providing information and guidance to job seekers and to people who want to improve their employment prospects. These actors are gaining relevance in an increasingly changing world where people go through more transitions in the course of their working lives and have less linear career paths (AMSPE-BID-OCDE, 2015). New technologies offer a unique opportunity to expand the range and enhance the effectiveness of employment services. Digital tools based on big data processing and visualization, together with administrative and survey data, can provide near real-time data to firms, workers, and training institutions on the skills and occupations that are most rapidly growing in demand, the occupations in decline, and the skills workers need in order to shift from a declining occupation to one that is on the rise (Amaral et al., 2018; 2019). Tools based on artificial intelligence can help people find the jobs that best fit their skills. Governments can directly integrate these tools as part of their services, or make data available and set up agreements with third parties to develop tools to guide career transitions. Other key digital tools to guide transitions include maps to help people navigate through the increasingly diverse supply of credentials (see, for example, credentialengine.org), and career advisors to provide guidance on training options (such as the Fundación Telefónica training advisor chatbot).[4]

The four lines of action described above do not cover some important issues. For

instance, given that our focus is on responses to increasing automation, we have not discussed how to improve working conditions of workers in the gig economy, even though this issue must be of central importance in strategies that seek to increase good jobs.

We have also not mentioned how to reorient educational policy to ensure the education that future citizens receive in the first stage of their lives is in line with future needs. In this sense, the educational system faces a much more complex task than the vocational training described in this paper, because it is obviously more difficult to predict the skills that will be needed in ten or fifteen years than to do so for a much shorter time frame. Given the uncertainty of how to educate the generation of children and young people who will have to repeatedly reinvent themselves throughout their working lives, the best strategy is to ensure they have a good grounding in the basic skills (mathematics, reading and writing, and sciences) as well as advanced digital, social-emotional, and cognitive skills as a foundation for lifelong learning (Mateo Diaz, 2019).

Finally, we did not touch on how to restore the balance in the bargaining power of workers in this new world of work. This is a key issue in a labor market that is increasingly dominated by large firms. Some opportunities in this field include incorporating new technologies in labor inspection and in trade union management and intervention. And we did not mention a subject that has been extensively discussed in the literature on the future of work: universal basic income (UBI). This was not an accidental omission. We believe that the mechanisms proposed here have distinct advantages over the UBI. The transfers we propose are aimed at those who are affected by automation, not at everybody, regardless of whether they need it or not, and this significantly reduces their cost. The support is offered in exchange for investment in human capital that yields productivity gains and makes it possible to cover the cost of the policies. And lastly, the proposals set out here are based on the conviction and the fact that work has an intrinsic value, in that it gives us an identity and a purpose. The institutions, policies, and technological tools outlined here actively help people to find and rediscover their place in the labor market.

Who Foots the Bill?

This new social pact for resilience and good jobs will require additional resources, which will not be easy to obtain in the context of financial restrictions. However,

To avoid a future characterized by authoritarian, protectionist governments, it is necessary to move toward an agenda that promotes good jobs. In developed countries, this means strengthening the existing social safety net to adapt it to the needs of the twenty-first century

Donald Trump speaks to a group of engineers specializing in heavy equipment at a center in Richfield, Ohio, March 2018

it can be argued that the costs of not acting will be even higher. These include the costs associated with unemployment, low productivity growth, and social protection, as well as those that could arise from increasing protectionist policies, economic and political polarization, and the decline of democracies.

Conclusion

In recent years there has been almost universal discussion and a great deal of anxiety concerning the potential effects of artificial intelligence, robots, and digital platforms in the labor market. But the fact is that we still know little about how labor markets will adjust to these new technologies. As McKinsey researcher Susan Lund is quoted as saying in an article in *The New York Times*: "The lesson is, change is evolutionary, not revolutionary."[5] We are seeing the evolution of something that has been taking place since at least the early 1980s, with the start of the widespread introduction of personal computers and other ICTs in production. And while it has not brought the dreaded effects of mass unemployment, the impacts of these new technologies have led to increasing polarization and inequality. Rather than reassuring us and making us choose to take no action, this realization should lead us to study the lessons arising from the last few decades and to act decisively.

Unlike the previous industrial revolutions, the technological change associated with information technologies, combined with other megatrends such as globalization, has created opportunities for those who are best prepared to take advantage of them, leaving the rest behind. Early studies of the impact of robotics point to the same conclusions, and there is no reason to think that the impact of artificial intelligence will not follow suit. If anything characterizes the impact of these technologies, it is their effects on the erosion of "good" jobs that allow a middle-class lifestyle, while enlarging the lower tail of the curve of bad-quality, precarious, low-income jobs. All of which has undermined citizens' trust in institutions, politicians, and democracy.

To avoid a future characterized by authoritarian, protectionist governments, it is necessary to move toward an agenda that promotes good jobs. In developed countries, this means strengthening the existing social safety net to adapt it to the needs of the twenty-first century (Furman, 2017). In developing countries, it means prioritizing the construction of that net, which is often incomplete or does not exist. And it means promoting the responsible introduction of technology at the same time. As noted in the first article in the Inter-American Development Bank's series on the future of work (Bosh et al., 2018), technology is not destiny; destiny is in our hands. Let us take on the task of creating a better future as soon as possible.

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Notes

1. See Rodrik and Sabel, 2019.
2. See https://www.weforum.org/agenda/2019/04/the-revolution-need-not-be-automated/.
3. See https://www.weforum.org/agenda/2019/05/soft-skills-are-hard-to-measure-and-in-demand-can-they-be-taught.
4. See https://credentialengine.org/ and https://planetachatbot.com/chatbot-fundacion-telefonica-orientador-e742929548d5.
5. See https://www.nytimes.com/2019/09/27/business/economy/jobs-offshoring.html?smid=nytcore-ios-share.

Select Bibliography

—Acemoglu, D., and Autor, D. 2011. "Skills, Tasks and Technologies: Implications for Employment and Earnings." *Handbook of Labor Economics* 4: 1043–1171.
—Acemoglu, D., and Restrepo, P. 2018. "Artificial Intelligence, Automation and Work." NBER Working Paper no. 24196.
—Acemoglu, D., and Restrepo, P. Forthcoming. "Robots and Jobs: Evidence from US Labor Markets." *Journal of Political Economy*.
—AfDB-ADB-EBRD-IDB. 2018. "The Future of Work: Regional Perspectives." Washington DC. Available at https://publications.iadb.org/en/future-work-regional-perspectives.
—Amaral, N., Eng, N., Ospino, C., Pagés, C., Rucci, G., and Williams, N. 2018. "How Far Can Your Skills Take You? Understanding Skill Demand Changes due to Occupational Shifts and the Transferability of Workers Across Occupations." Washington DC, Technical Note no. IDB-TN-O1501.
—Amaral, N., Azuara, O., González, S., Ospino, C., Pagés, C., Rucci, G., and Torres, J. 2019. "El futuro del trabajo en América Latina y el Caribe: ¿Cuáles son las ocupaciones y las habilidades emergentes más demandadas en la región?" Available in English at https://publications.iadb.org/en/what-are-most-demand-occupations-and-emerging-skills-region-interactive-version.

—AMSPE-BID-OCDE. 2015. "El Mundo de los Servicios Públicos de Empleo." Washington DC: Inter-American Development Bank.
—Arntz, M., Gregory, T., and Zierahn, U. 2016. "The Risk of Automation for Jobs in OECD Countries: A Comparative Analysis." Paris: Organization for Economic Co-operation and Development, OECD Social, Employment, and Migration Working Paper no. 189
—Austin, B., Glaeser, E., and Summers, L. 2018. "Jobs for the Heartland: Place-Based Policies in 21st Century America." *Brookings Papers on Economic Activity*. Spring 2018.
—Autor, D., Levy, F., and Murnane, R. J. 2003. "The Skill Content of Recent Technological Change: An Empirical Exploration." *The Quarterly Journal of Economics* 118(4): 1279–1333.
—Autor, David, Dorn, David, Hanson, Gordon, and Majlesi, Kaveh. 2017. "Importing Political Polarization? The Electoral Consequences of Rising Trade Exposure." NBER Working Paper no. 22637.
—Ballard-Rosa, C., Jensen, A., and Scheve, K. F. 2018. "Economic Decline, Social Identity, and Authoritarian Values in the United States." *American Political Science Association*. October 2018.
—Bessen, J. E. 2017. "Automation and Jobs: When Technology Boosts Employment." Boston University School of Law, Law and Economics Paper no. 17-09.
—Blanchard, O., and Tirole, J. 2008. "The Joint Design of Unemployment Insurance and Employment Protection: A First Pass." *Journal of the European Economics Association* 6(1): 45–77.
—Borjas, G., and Freeman, R. 2019. "From Immigrants to Robots: The Changing Locus of Substitutes for Workers." NBER Working Paper no. 25438.
—Bosch, M., Pagés, C., and Ripani, L. 2018. "El Futuro del trabajo en América Latina y el Caribe: ¿una gran oportunidad para la región?" Inter-American Development Bank. Available at https://www.iadb.org/es/trabajo-y-pensiones/el-futuro-del-trabajo-en-america-latina-y-el-caribe-una-gran-oportunidad-para.
—Cathless, A., and Navarro, J. C. 2019. "Disrupting Talent: The Emergence of Coding Bootcamps and the Future of Digital Skills." Washington DC: Inter-American Development Bank.
—Chiacchio, F., Petropoulos, G., and Pichler, D. 2018. "The Impact of Industrial Robots on EU Employment and Wages: A Local Labour Market Approach." Bruegel Working Paper.
—Cortes, G., M., Jaimovich, N., Nekarda, C. J., and Siu, H. E. 2014. "The Micro and Macro of the Disappearing Routine Jobs: A Flows Approach." NBER Working Paper no. 20307.
—Darvas, Z., and Wolff, G. B. 2016. "An Anatomy of Inclusive Growth in Europe." Bruegel Blueprint Series. Available at http://bruegel.org/2016/10/an-anatomy-of-inclusive-growth-in-europe/.
—Dauth, W., Findeisen, S., Suedekum, J., and Woessner, N. 2018. "Adjusting to Robots: Worker-Level Evidence." Opportunity and Inclusive Growth Institute Working Paper no. 13.
—Deming, D. 2017. "The Growing Importance of Social Skills in the Labor Market." *The Quarterly Journal of Economics* 132(4): 1593–1640.
—Deming, D., and Noray, K. 2019. "STEM Careers and the Changing Skill Content of Work." NBER Working Paper no. 25065.
—Fitzpayne, A., and Pollack, E. 2018. "Lifelong Learning and Training Accounts: Helping Workers Adapt and Succeed in a Changing Economy." The Aspen Institute Future of Work Initiative.
—Frey, C. B., and Osborne, M. A. 2017. "The Future of Employment: How Susceptible Are Jobs to Computerisation?" *Technological Forecasting and Social Change* 114: 254–280.
—Furman, J. 2017. "Should We Be Reassured if Automation in the Future Looks Like Automation in the Past?" In A. Agrawa, J. Gans, and A. Goldfarb (eds.), *The Economics of Artificial Intelligence: An Agenda*, National Bureau of Economic Research.
—Goos, M., and Manning, A. 2007. "Lousy and Lovely Jobs: The Rising Polarization of Work in Britain." *The Review of Economics and Statistics* 89(1) 118–133.
—Goos, M., Manning, A., and Salomons, A. 2014. "Explaining Job Polarization: Routine-biased Technological Change and Offshoring." *The American Economic Review* 104(8) 2509–2526.
—Graetz, G., and Michaels, G. 2018. "Robots at Work." Centre for Economic Performance Discussion Paper no. 1335.
—Manpower. 2018. "Solving the Talent Shortage. Build, Buy, Borrow and Bridge." 2018 Talent Shortage Survey.
—Mateo Diaz, M. 2019. "El futuro ya está aquí." In M. Mateo Diaz and G. Rucci (eds.), *El futuro ya está aquí. Habilidades transversales en América Latina y el Caribe en el siglo 21*, Washington DC: Inter-American Development Bank.
—McKinsey Global Institute. 2015. "Global Growth: Can Productivity Save the Day in an Aging World?" McKinsey & Company.
—Rodrik, D., and Sabel, C. 2019. "Building a Good Jobs Economy." Mimeo Working Paper.
—World Bank. 2016. *Digital Dividends. World Development Report 2016*. Washington DC, The World Bank Group.

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