Elisabetta Ottoz

Introduction

I am very glad that the Campus Luigi Einaudi and specifically the Department of Economics and Statistics Cognetti of the University of Turin are hosting the Conference for the 10th Giorgio Rota Best Paper Award.

I thank the organizers who asked me to address a short introductory speech on the issue chosen this year: labor, value and robots. A very challenging one.

First of all, I have to say that I am industrial economist and I approached the innovation economics by the means of intellectual property rights, patents and secrets.

What I'd like to do here is to draw your attention to what caught my attention while preparing this introductory speech on the effects of technological revolution we are undergoing: the so-called industry 4.0, characterized "by a fusion of technologies that is blurring the lines between the physical, digital, and biological spheres". See *The Fourth Industrial Revolution* (Schwab, 2017) and its effects not only on the manufacturing sector, but on services.

We are talking about interconnected processes, organizations and machines, decentralized decision-making enabled by nine main trends: big data, autonomous robots, simulation, additive manufacturing, the Internet of Things, cloud computing, augmented reality, horizontal and vertical integration, cyber security.

Despite the fact that negative prophecies on technological unemployment in the past didn't realize, there is a worried concern that advances in robotics and artificial intelligence will lead to massive job losses as well as wage inequality and employment polarization.

Industry 4.0, affects employment by two distinct ways: a displacement effect by which workers are forced out from tasks they were previously performing and/or a productivity effect increasing the demand for labor in industries or jobs that arise or develop as a result of technological progress. The net effect on total employment depends on the balance between displacement and productivity effects (Acemoglu and Restrepo, 2019).

Frey and Osborne (2013), found that 47% of all persons employed in the US were working in jobs that could be performed by computers and algorithms within the next 10 to 20 year. Their results were overstated mainly for two reasons: they did not take into account how other sectors and jobs would respond to these changes and they considered whole occupations instead of single tasks, that could be differently automated, within an occupation. The result was that so they meant to be in the high-risk category workers who at least to some extent also performed tasks that are difficult to automate such as those involving face-to-face interaction.

Arntz *et al.* in 2016 re-estimated the share of jobs at risk of automation for 21 OECD countries including the US using a task-based approach. The share of jobs at risk of automation was found to be on average across OECD countries, 9%.

As Acemoglu and Restrepo (2020) state concentrating on the robotics industry in the United States, the two effects are at work: improvements in robotics technology negatively affect wages and employment owing to a displacement effect, as robots directly displace workers from tasks that they were previously performing, but there is also a positive productivity effect, as other industries and/or tasks increase their demand for labor.

They estimate a negative relationship between a commuting zone's exposure to robots and its post-1990 labor market outcomes. One more robot in a commuting zone reduces employment by about six workers; this estimate including both direct and indirect effects, the latter caused by the decline in the demand for nontradables as a result of reduced employment and wages in the local economy. However, this is not the end of the story as greater use of robots in a commuting zone generates benefits for the rest of the US economy by reducing the prices of tradable goods produced using robots and by creating shared capital income gains. The overall net effect on employment is still negative but weaker, one new robot reduces employment by about 3.3 workers.

Whether these technologies will increase, or (at least not decrease,) labor demand, employment, and wages is an open and important question that needs to be investigated using a number of approaches. Bessen (2019) stresses the role of demand in determining the effects of technological automation on employment: his analysis claims that "the rate of productivity growth determines the pace of employment change, but the elasticity of demand determines the sign".

Regardless of the different approaches, even the more optimistic analyses agree that the new productivity improving technologies will bring a disruptive reallocation of jobs; even if they do not permanently eliminate a large number of jobs, some form of temporary income support and retraining activities are needed. On balance, the range of empirical evidence suggests that the overall impact of robots on employment is not dramatic, so far is rather limited, and may actually be positive.

Here comes the point I'd like to raise. Hitherto the trend that we have witnessed has mainly concerned job displacement in manufacturing with a shift of workers from manufacturing to the service industries. With industry 4.0 is it still true that service jobs are protected from automation because they rely more on interpersonal interactions? Are service tasks going to be replaced by artificial intelligence and robotics?

This is a big question because the services sector is the largest component of the EU's economy (70% of GDP) and generates most of the jobs (90%), the figures in the US are analogous.

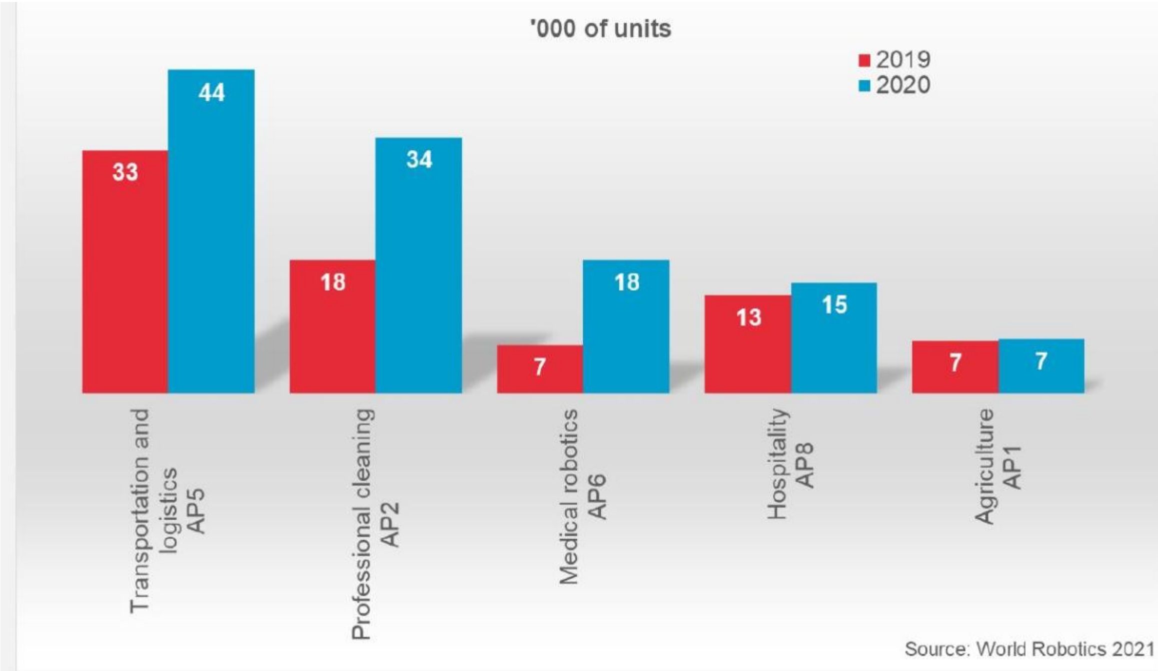
International standards now distinguish between industrial robots and service robots, defined as "physical, mobile devices with some degree of autonomy […] used to provide professional or consumer services, as opposed to manufacturing goods, performing useful tasks for humans or equipment excluding industrial automation applications.

Many technical advances in robotics, such as those presented at European Robotics Forum,[1] have applications in the service sector, including healthcare, logistics, inspection, and cleaning, entertainment, elderly or child care, hospitality.

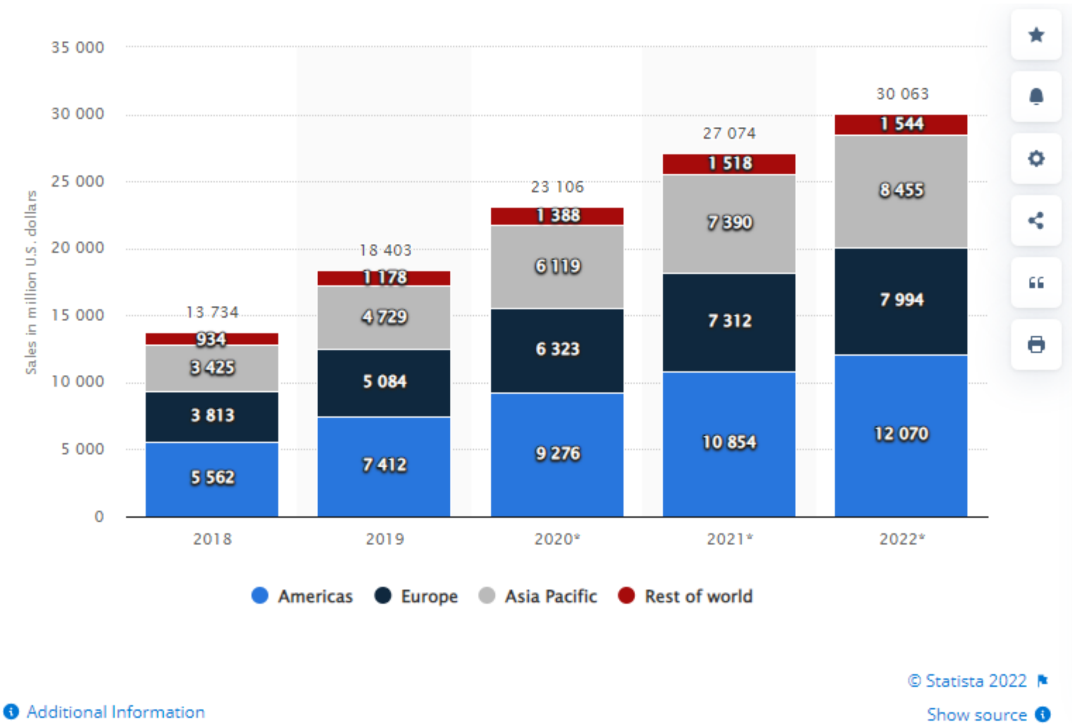
Many recent studies also cite advances in AI and robotics as a possible threat to white-collar occupations in the service sector, as the positive trend of sales value worldwide by 2018-2022 shows.

[1] https://ifr.org/ifr-press-releases/news/robot-sales-rise-again.

SERVICE ROBOTS FOR PROFESSIONAL USE TOP FIVE-APPLICATIONS
UNIT SALES 2019-2020



SERVICE ROBOTICS MARKET SALES VALUE WORLDWIDE 2018-2022, BY REGION



Despite the growing range of applications for robots in the service sector, the business case for adopting them is not always easy. For companies robots imply a relevant investment, requiring changes in the layout of their sites, adapting their organizational processes, and acquiring the necessary skills. Not all business models will find it worthwhile to make that investment. Automation in the service sector – in the form of service robots – is small but growing.

Depending on the nature of the service concerned different forms of intelligences are required: an interesting taxonomy is provided by Huang and Rust (2018) which distinguish four types of intelligences which can be mimicked with increasing effort by artificial intelligence: mechanical, analytical, intuitive and empathetic. As AI has reached a certain intelligence level, all lower types can coexist.

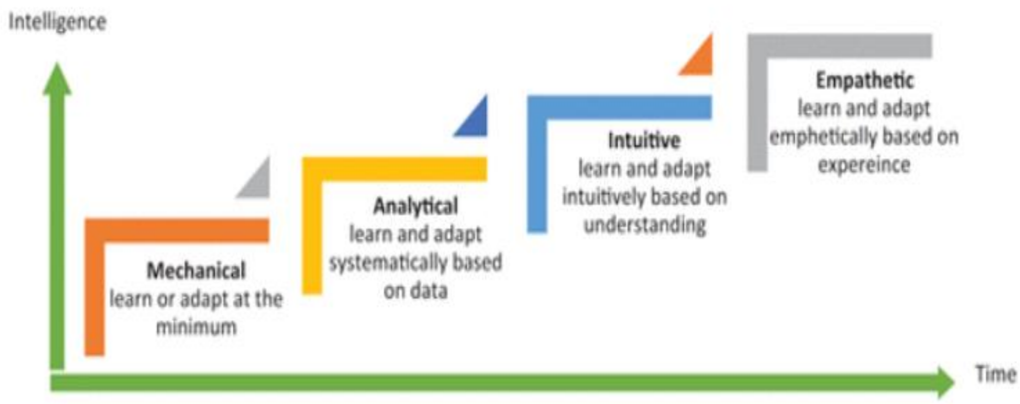
The mechanical intelligence refers to the ability to automatically perform routine, repeated tasks, which require limited training or education. At this level we find many AI applications such as McDonald's "Create you taste".

Analytical intelligence is the ability to process information for problem-solving and learn from it by a logical, analytical and rule-based learning. Tasks involved may be complex, yet systematic, consistent, and predictable. The setting refers to complete information: IBM chess player or problem diagnose in cars are examples of this level of achievement of AI.

Intuitive intelligence is the ability to think creatively and adjust effectively to novel situations; as such it includes hard thinking professional skills that require insights and creative problem-solving typical of lawyers, doctors, managers. As an example of AI application, we can mention Poker player Libratus capable of strategic thinking in settings of incomplete information.

Empathetic intelligence is the ability to recognize and understand other peoples' emotions, respond appropriately emotionally, and influence others' emotions. Specific skill examples include communication, relationship building, leadership, advocating and negotiating, work–life balance, whereas examples of feeling jobs are represented by politicians, negotiators, psychiatrists. An AI example is Sophia, so convincing that the Saudi government in 2017 has awarded her citizenship.

THE FOUR INTELLIGENCES (HUANG AND RUST, 2018)



This trend has very interesting and bewildering consequence on the instruction policies.

As we saw, regardless of the different approaches, even the more optimistic analyses agree that the new productivity improving technologies known as industry 4.0 will bring a disruptive reallocation of jobs and as we saw the service sector is a good candidate for it.

This calls for interventions to help people undergoing a job reallocation through income supporting and training and retraining policies.

More important is to gain awareness of the need to devote not only the first part of one's life to education and training, as this is not enough in a rapidly changing environment, either technologically and socially.

What is needed is a lifelong learning attitude based on a higher education system which develops basic skills making people capable of retraining quickly to meet the rapidly changing needs of the workplace. Obviously STEM disciplines are fundamental, but considering the way in which artificial intelligence develops, soft skills connected to the intuitive and empathetic areas are not to be neglected in education.

They are going to be the last and most lasting characteristics of humans in the confrontation between human intelligence and artificial intelligence: there might lie our advantage.

As it stared in Future of jobs Report (2018)[2]": the human' skills, such as creativity, originality and initiative, critical thinking, persuasion, and negotiation will likewise retain or increase their value, as will attention to detail, resilience, flexibility and complex problem-solving… Emotional intelligence, leadership and social influence as well as service orientation also see an outsized increase in demand relative to their current prominence."

This is well represented by the Applications of Soft skills In Engineering or STEM Programs.

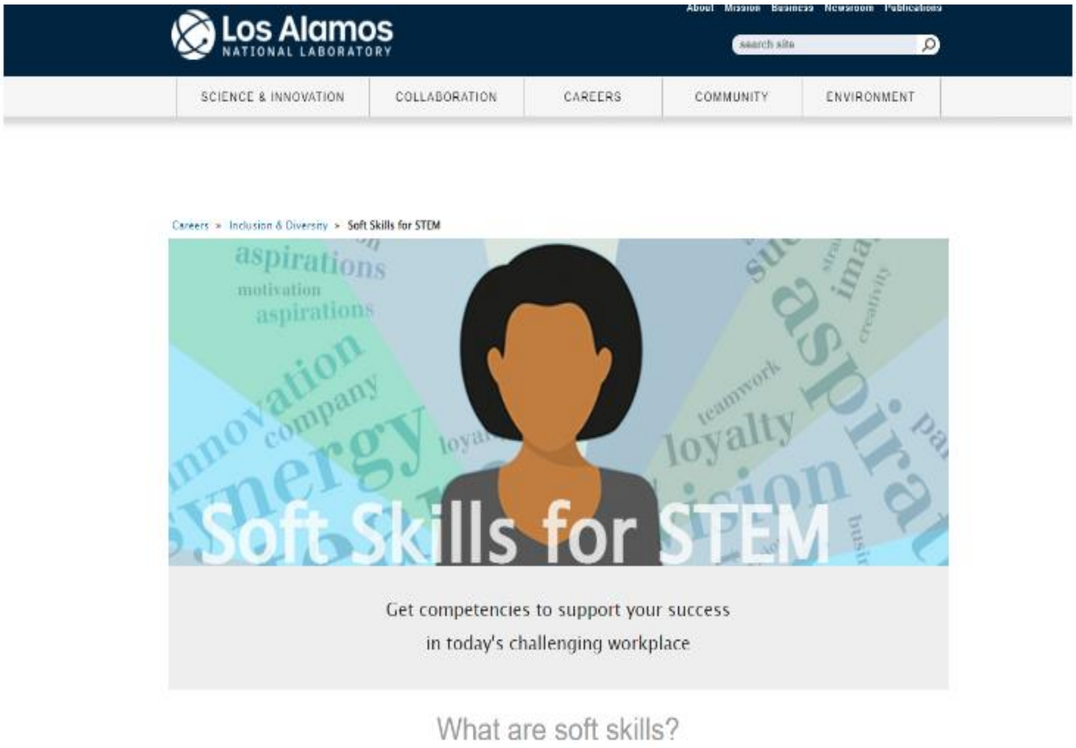
For instance, on the website of the Politecnico di Torino:[3]

> At the Doctoral School of Politecnico di Torino, doctoral candidates consolidate their scientific and technological background by taking supplementary doctoral courses on soft skills. These quality and innovative courses help them boost their skills in order to meet the needs of businesses and address the new challenges of the society of the future.
>
> They include:
>
> interacting with others, working in teams, working in open, multicultural and flexible environments, negotiating, managing conflicts; knowing how to make use of resources, optimizing time, managing projects; developing leadership skills, emotional intelligence and creative thinking; mastering the tools for communication, dissemination and public speaking; flexibility and adaptability in the workplace; ability to address work challenges; having the tools to manage change, develop innovation, work ethically with entrepreneurial spirit; managing career development and seizing professional opportunities.

Another example is the figure which refers to Los Alamos National Laboratory where the caption says: "Soft skills for STEM[4]: Soft skills are personal competencies that improve human performance, facilitate effective interactions, complement the technical requirements necessary to acquire and maintain employment".

[2] https://www.weforum.org/reports/the-future-of-jobs-report-2018/.
[3] http://dottorato.polito.it/en/soft_skills.
[4] https://www.lanl.gov/careers/diversity-inclusion/s3tem/index.php.

SOFT SKILLS FOR STEM



I may be a little biased being in a Department of Economics and Statistics which is part of a School of Law, Politics and Social-Economic Sciences, but I find it relevant, as a final message of this address, to recommend students not to forget to improve their soft skills through humanities. Not only low skilled workers can turn to a social job, even high skilled workers can benefit from having developed intuitive and empathetic skills.

REFERENCES

Acemoglu D. and Restrepo P. (2019), *Automation and New Tasks: How Technology Displaces and Reinstates Labor*, «Journal of Economic Perspectives, American Economic Association», 33, 2, pp. 3-30

– (2020), *Robots and Jobs: Evidence from US Labor Markets*, «Journal of Political Economy», 128, 6, pp. 2188-2244

Arntz M., Gregory T. and Zierahn U. (2016), *The Risk of Automation for Jobs in OECD Countries: A Comparative Analysis*, OECD Social, Employment and Migration Working Papers, n. 189, Paris, OECD Publishing, http://dx.doi.org/10.1787/5jlz9h56dvq7-en

Bessen J. (2019), *Automation and Jobs: When Technology Boosts Employment*, «Economic Policy», 34, 100, pp. 589-626

Frey C.B. and Osborne M. (2017), *The Future of Employment: How Susceptible Are Jobs to Computerisation?*, «Technological Forecasting and Social Change», 114, pp. 254-280

Huang M.-H., Rust R.T. (2013), *IT-Related Service: A Multidisciplinary Perspective*, «Journal of Service Research», 16, 3, pp. 251-258

Schwab K. (2017), *The Fourth Industrial Revolution*, New York, Crown Publishing Group