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Contribution of articles

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Vikram Chand,* Svetislav Kostić** and Ariene Reis***

Taxing Artificial Intelligence and Robots: Critical Assessment of Potential Policy Solutions and Recommendation for Alternative Approaches – Sovereign Measure: Education Taxes/Global Measure: Global Education Tax or Planetary Tax

In recent years, investments in technology have resulted in an exponential growth of AI/robots. It is argued that some of these innovations are able to outperform and replace humans in various types of jobs. Accordingly, concerns regarding government revenues have been raised, as AI/robots could trigger widespread unemployment with the result that less tax revenue will accrue to the government. This contribution, as a start, analyses whether or not this is truly a concern. In order to do so, the authors map the Industrial Revolution(s) that humankind has witnessed and then conduct a literature review of economic and demographic studies relevant to the debate. The economic studies indicate two different directions, that is, some argue that AI/robots (Industry 4.0) will increase human jobs whereas others argue that jobs could disappear. At the same time, the demographic perspective indicates that a purely economic employment-focused view of AI/robots is bound to lead to inconclusive results. Assuming that this is a probable concern, the authors summarize selected measures taken by governments as well as the various options that have been considered in academic literature to introduce taxes on AI/robots. Subsequently, the authors analyse the various "taxing" options from the perspective of commonly accepted tax policy principles applicable to electronic commerce (Ottawa Taxation Framework conditions). This analysis indicates that several proposals (e.g. proposals that treat AI/robots as independently taxable subjects or proposals that attribute income to owners of AI/robots) breach the principles of (i) neutrality; (ii) simplicity and certainty; (iii) efficiency; (iv) effectiveness and fairness; and (v) flexibility. Thus, such measures should not be pursued. The authors also conclude that, at this stage, targeted taxes on AI/robots should not be introduced, as this would also be contrary to the measures taken by governments globally to promote research and development (R&D) (input or output incentives). The present contribution therefore suggests that governments need to be proactive rather than reactive in this area. This could be achieved by monitoring the impact of AI/robots on a regular basis, and if the trend indicates that

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jobs are disappearing or revenues are declining, then the article suggests that states raise funds from an earmarked education tax. The funds raised from this tax, among other objectives, should be used to finance and foster professional educational programmes to reskill workers, besides assisting and guiding them to transition into new roles. However, a national measure may not be sufficient to tackle the issue (issues) at stake, especially in light of the demographic perspective discussed in the contribution. Thus, considering some jurisdictions may not be in a position to implement or fully benefit from an education tax, the authors also discuss the possibility of implementing a global fiscal redistribution mechanism (multilateral solution) from developed (surrender jurisdictions) to developing countries (recipient jurisdictions). The latter, depending on its scope, could be in the form of a global education tax or more broadly a planetary tax.

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1. Introduction

Since time immemorial, individuals have represented the workforce. Although individuals have many unique skills that machines, at least for now, are unable to replicate, it cannot

be denied that AI/robots are being improved to play a role that is as similar as possible to human beings. Some factors may encourage the use of AI/robots over humans,[1] such as, for instance: (i) robots can increase productivity, especially with respect to repetitive tasks;[2] (ii) robots can mitigate mistakes, as they can be more precise and consistent than humans regarding some functions;[3] (iii) working conditions for humans can be improved by avoiding workers performing arduous tasks (for example, heavy movements), which would then promote a safer work environment. Also, using robots could avoid accidents, for example, by keeping humans away from exposure to toxic substances;[4] (iv) robots could also address worker-related shortages;[5] (v) labour and production costs can be reduced,[6] etc. Furthermore, it is a fact that some routine tasks can be eliminated through automation, and hence individuals can dedicate more time to non-routine tasks or leisure.

Common examples of the widespread use of AI and robots include the use of (i) industrial robots in assembly lines and manufacturing in general; (ii) self-check-out machines at grocery stores; (iii) self-check-in machines at airports; (iv) self-payment vending machines for personal goods consumption, such as cigarettes, beverages and snacks; (v) self-order machines, such as those found at McDonald's; (vi) self-driving cars; (vii) drones that can be used to take photographs or carry out deliveries and so on; and (viii) voice-activated assistants.

Moreover, some forms of AI/robots are becoming extremely popular for their performance, which can be on a par with or better than that of humans. Examples of service robots

1. E. Lundström, *8 Reasons Why Companies Buy Robots – and No, It's Not Just About Replacing People*, Gain & Co (22 Mar. 2019), available at https://gainco.dk/en/8-reasons-why-companies-buy-robots/.
2. Based on a McKinsey Survey, from 2015 to 2065, the productivity growth due to automation will increase from 0.8% to 1.4%. J. Manyika et al., *Harnessing automation for a future that works*, Mckinsey Global Institute (12 Jan. 2017), available at https://www.mckinsey.com/featured-insights/digital-disruption/harnessing-automation-for-a-future-that-works.
3. Robots can maintain high standards when they perform repetitive tasks, which can then directly impact product or production quality. Especially in the food sector, the use of robots can reduce contamination that could be spread by human errors thereby exposing companies to high costs, waste of time and reputation. *See* M. Shatford. *Reducing Contamination in the Workplace with Robotics*, Universal Robots (4 Sept. 2017), available at https://blog.universal-robots.com/reducing-contamination-in-the-workplace-with-robotics.
4. Based on a study presented by Universal Robots, the most common injuries in the workplace are: contact with harmful objects and chemicals, overworking, slips and falls, as well as accidents pertaining to repetitive movements. The same report indicates that, according to studies conducted by Travelers Insurance, cobots ("collaborative robot" that work hand-in-hand with humans without offering risks of injury) can help to reduce the incidence of workplace injuries by up to 72%. See Universal Robots, *Automation: How Manufacturing Automation can Reduce Workplace Injuries and Improve Morale* (May 2019), available at https://www.assemblymag.com/ext/resources/White_Papers/2019/sep/UR_Workplace-Injuries-White-Paper-Final_May2019.pdf.
5. For example, in the United States, there is a huge gap pertaining to employability in the construction sector in the sense that there are not enough workers available to execute contracts or projects. In view of that, contractors and developers have invested in robots. *See* J. Cilia, *The Construction Labor Shortage: Will Developers Deploy Robotics?*, Forbes (31 July 2019), available at https://www.forbes.com/sites/columbiabusinessschool/2019/07/31/the-construction-labor-shortage-will-developers-deploy-robotics/#761d631b7198.
6. For instance, according to a Eurostat report, hourly labour costs ranged from EUR 6.0 to EUR 44.7 across EU Member States in 2019. According to the report, labour costs comprised of wages and salaries, and non-wage costs (such as social security contributions). Eurostat Statistics Explained, *Hourly Labor Costs* (March 2020), available at https://ec.europa.eu/eurostat/statistics-explained/index.php/Hourly_labour_costs#Hourly_labour_costs_ranged_between_.E2.82.AC6.0_and_.E2.82.AC44.7_in_2019.

include: (i) the IBM Watson question-answering system and cognitive computing[7] as well as IBM Watson for Oncology, which aids in supporting cancer treatment;[8] (iii) Da Vinci, for medical and surgery purposes;[9] (iv) Ross, specialized in legal research;[10] (v) Milo, which provides education for autistic children;[11] (vi) Shimon, which plays music;[12] (vii) Motoman, which can be a chef and cook,[13] and so on.

Based on the examples above, it may well be possible that at some point in time, in the perhaps not-so-distant future, AI/robots may overtake the human workforce in many areas and thereby cause massive job losses. This probability/prediction has an important impact on tax revenues for governments. As an illustration, countries could lose a significant portion of their revenue collected from taxing regular employment income. Likewise, AI/robots, unlike humans, do not buy cars, clothes, food, electronic devices, nor contract services. Consequently, the production as well as consumption of goods and services may decline. A decline in consumption could affect VAT collection, that is, it could lead to lower VAT collection. In other words, employing AI/robots could cause tax distribution effects beyond employment-related tax collections.

Against this backdrop, the present contribution aims at analysing whether or not AI/robots should be taxed. In order for the authors to proceed with their analysis, this article is structured as follows. In section 2., the authors map out the Industrial Revolution that we have been through to understand its impact on society, in particular, employment patterns. In section 3., the authors conduct a literature review of economic studies that are relevant to the debate, while adding a demographic perspective to it. In section 4., the authors summarize selected targeted options that have been considered for taxing AI/robots. The authors also analyse the various options from the perspective of relevant tax policy principles applicable to electronic commerce (Ottawa Taxation Framework conditions). In light of the assessment and discussion in the article, the authors put forward the idea of a sovereign measure, that is, an education tax (section 5.). Moreover, given the fact that a sovereign measure may not be sufficient to tackle the issue at stake, especially, in light of the broader demographic perspective discussed in the contribution, the authors discuss the possibility of implementing a global fiscal redistribution mechanism (multilateral solution) from developed (surrender jurisdictions) to developing countries (recipient jurisdictions). One such solution is to create a global education tax to foster education or awareness in developing or low-income countries. A much broader solution would be to introduce the so-called planetary tax, which would assist developing or low income countries in dealing with a wide range of planetary issues (section 6.).

2. Mapping the Stages of the Industrial Revolution

The Fourth Industrial Revolution, also known as Industry 4.0, deals with automation as well as data exchange and encompasses cyber-physical systems, cloud computing, cognitive

7. For further details, *see* https://developer.ibm.com/dwblog/2017/best-practices-developing-question-answer-solutions-watson-conversation-discovery/.
8. For further details, *see* https://www.ibm.com/products/clinical-decision-support-oncology.
9. For further details, *see* https://www.davincisurgery.com/.
10. For further details, *see* https://www.rossintelligence.com/.
11. For further details, *see* https://robots4autism.com/milo/.
12. For further details, *see* https://www.shimonrobot.com/.
13. For further details, *see* https://www.motoman.com/en-us/products/robots/industrial/assembly-handling/sda-series/sda10d.

computing, the internet of things (IoT), advanced robotics, big data, artificial intelligence, smart factory, and so forth.[14] Since its inception, some studies, for example those carried out by Oxford University[15] and PwC,[16] have proposed that automation threatens the future of jobs done by humans. This is because new technologies have impacted all disciplines, industries and economies and in some cases have caused an abrupt change in the way people live, work and interact. To illustrate, according to a press release from the International Federation of Robots (IFR), as of 18 September 2019, the global turnover from the sale of service robots for professional use increased to USD 9.2 billion. The largest portion of these sales was represented by autonomous robots (vehicles) used for logistics, and this was followed by robots used for inspection and maintenance. These two categories represent 80% of the marketshare of professional services robots. At the same time, the sale of service robots for personal use, in particular vacuum cleaning and lawn mowing robots, also increased.[17] This development could indicate that a major disruption is on its way. However, the authors would like to point out that all industrial revolutions faced by society have in one way or another caused disruption.

If we look at history to understand how society organized itself after implementing innovative changes, the First Industrial Revolution, which took place in the mid-1700s, marked the transition from blue-collar work to mechanical power. This transition, which started using machines, impacted many sectors, especially the textile manufacturing sector. Moreover, the innovation of the steam engine brought revolutionary changes in the iron and steel industry as well as the chemical, agriculture and transportation sectors.[18] As it has been stated, "the first industrial revolution was accompanied by 70 years of economic stagnation. People were not prepared for the change that was taking place".[19]

Although it is difficult to analyse data from that time, some experts affirm that during the pre-industrial society, hours of work used to depend on natural conditions (for example, climate circumstances and daylight) apart from limited opportunities of paid jobs. Conversely, after the First Industrial Revolution, with the implementation of machinery and new sources of power, work-related activities performed by humans were carried out all around the year and also during night shifts, which then led to an increase in the employment rates.[20]

The Second Industrial Revolution began in the late 19th century and targeted the steel, automobile and electricity sectors in order to carry out mass production. The most significant change was the creation of moving assembly lines pioneered by Henry Ford, which

14. I-Scoop, *Industry 4.0: The Fourth Industrial Revolution – Guide to Industrie 4.0*, available at https://www.i-scoop.eu/industry-4-0/.
15. M. Osborne & C.B. Frey, *Automation and the Future of Work – Understanding the Numbers*, Oxford Martin School (13 Apr. 2018), available at https://www.oxfordmartin.ox.ac.uk/blog/automation-and-the-future-of-work-understanding-the-numbers/.
16. J. Hawksworth, R. Berriman & S. Goel, *Will Robots Really Steal our Jobs? An International Analysis of the Potential Long-term Impact of Automation*, PwC Report (2018), available at https://www.pwc.co.uk/economic-services/assets/international-impact-of-automation-feb-2018.pdf.
17. IFR, *Service Robots – Global Sales Value Reaches 12.9 billion USD Says IFR*, IFR Press Releases, (18 September 2019) available at https://ifr.org/ifr-press-releases/news/service-robots-global-sales-value-reaches-12.9-billion-usd.
18. H.K. Mohajan, *The First Industrial Revolution: Creation of a New Global Human Era*, 5 Journal of Social Sciences and Humanities 4, pp. 377-387 (2019).
19. Unil, *The Risks of Human Skills Obsolescence Due to the Rise of Artificial Intelligence*, Futures Lab, HEC Lausanne (30 Jan. 2020), available at https://wp.unil.ch/futureslab/2020/01/the-risks-of-the-human-skills-obsolescence-due-to-the-rise-of-artificial-intelligence/?lang=en.
20. D. Phyllis, *The First Industrial Revolution* pp. 285-295 (Cambridge University Press 1979).

allowed the mass production of an entire automobile. Prior to this invention, a single vehicle used to take 12 hours to build whereas after using the assembly lines, the time to assemble a vehicle took around 90 minutes.[21] At this stage, with the aim of avoiding long periods of stagnation, states already proposed education policies to reskill workers in order for them to adjust to the changes.[22]

This change led to other great innovations, for example the use of electricity for production and consumption purposes. Investments by companies to build research and development centres and investments in capital were encouraged due to the expansion of markets and studies regarding the management of personnel were designed in order to build and organize big corporations.[23] Also, besides creating new jobs and roles for workers, the revolution triggered several inventions to make our daily lives safer and more comfortable, such as electric lighting, elevators, radio, light bulbs and telephones, in addition to plumbing and medical instruments, which reduced diseases and deaths. Additionally, the stock market, private banks and transportation systems were improved, and consequently lots of new businesses were developed.[24] Overall economic activity, especially in the industrialized countries, was on the rise.

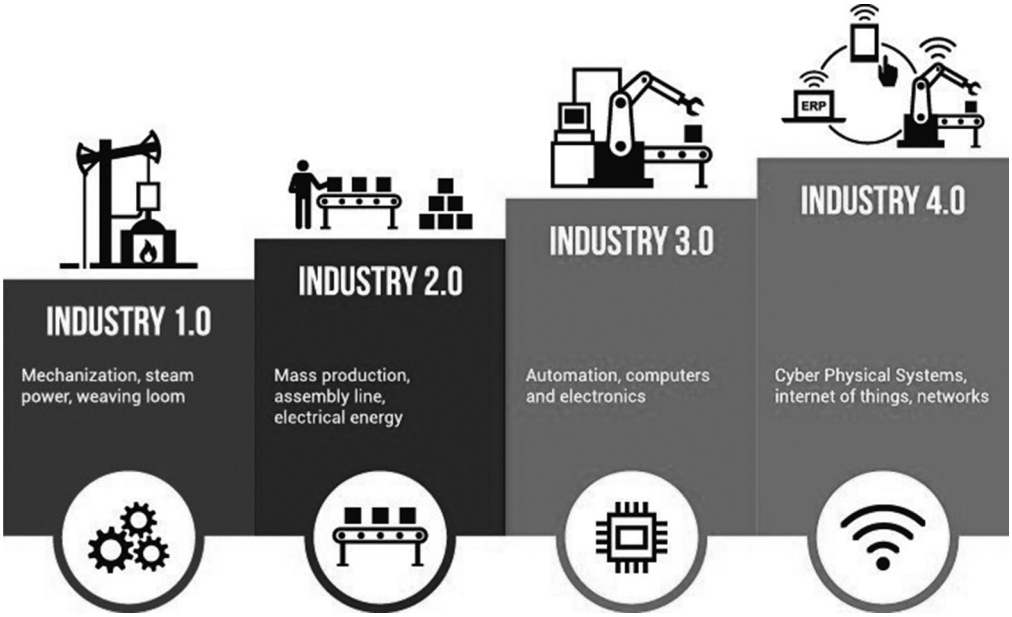
During the 1960s and 1970s, the Third Industrial Revolution started bringing digital change. This was brought on by means of the development of electronic data processing capability in combination with mainframe computers. This development already led to a higher level of automation of routine office tasks.[25] In the 1990s, desktops and personal computers connected with each other for the first time through Tim Berners-Lee's World Wide Web. This era marked the beginning of a new world,[26] as technological development impacted several sectors. It created new businesses especially in the fields of computing, IT, electronics and communications, and also led to the improvement of mobility, in particular transportation and logistics, which thus made distances shorter and increased velocity.

As can be seen throughout history, the previous industrial revolutions brought specific technologies that deeply changed society, shown in Figure 1.[27] It also taught us how important those revolutions were for the development and growth of the economy, as well as how individuals, besides benefiting from them, adapted themselves to the various changes.

According to what we have seen so far, the main impact of the industrial revolutions was on the industry sector. To understand the employment pattern or rates post-Industry 3.0, statistics provided by the World Bank indicate, after the emergence of the Internet, the following. If we consider the period from 1991 to 2019, the statistics indicate that the total employment reached rates lower that the employment rate established in 1991 (starting

21. Ford, *New Goals for Advanced, Flexible Manufacturing*, 100 Years of the Moving Assembly Line (2020), available at https://corporate.ford.com/articles/history/100-years-moving-assembly-line.html.
22. Unil, *supra* n. 19.
23. D. Collucia, *The Second Industrial Revolution (late 1800s and early 1900s)* p. 52 (Springer 2012).
24. H.K. Mohajan. *The Second Industrial Revolution has Brought Modern Social and Economic Developments*, 6 Journal of Social Sciences and Humanities 1, pp. 1-14 (2020).
25. R.N. Khan. *The Third Industrial Revolution: an Economic Overview*, in *The Third Industrial Revolution – Impact of Science on Society*, No. 146, UNESCO Taylor & Francis, p. 115 (1987).
26. Tim Berners-Lee is a British computer scientist who made the first web page on the open internet. For further details, *see* World Wide Web Foundation, *History of the Web* (date), available at https://webfoundation.org/about/vision/history-of-the-web/.
27. Simio LLC, *Simio's 8 Reasons to Adopt Industry 4.0*, Cision PR Newswire (12 Apr. 2018), available at https://www.prnewswire.com/news-releases/simios-8-reasons-to-adopt-industry-4-0--300629039.html.

Figure 1 – Industrial revolutions throughout history



point) only during the period from 1992 to 2006. However, after 2006, those employment rates increased considerably.[28] The one-off statistic might demonstrate that, after a technological revolution, society needs an "adjustment" period for its own reorganization and then it starts benefiting from the new technologies. In other words, employment levels increase after the "adjustment" period.

Arguably, this conclusion may also indicate that employment levels could also increase during or after Industry 4.0 after an initial "adjustment" period. While this would be a guess at this stage, the main question that arises is whether individuals will adapt or adjust in the same manner with the changes that Industry 4.0 might or will bring. In this regard, a scholar remarks that "people are naturally anxious about the effects of such technology".[29] In fact, because of this, some groups defend policies to slow or even ban the development of AI/robots.[30] Thus, people have legitimate concerns about the impact that automatization, in particular AI/robots, may have on their jobs. The next part of this article will survey economic literature to determine whether the concern is legitimate or not. To this, the authors will add a demographic perspective.

28. World Bank, *Employment in Industry (% of total employment) (modeled ILO estimate)*, International Labour Organization, ILOSTAT database (21 June 2020), available at https://data.worldbank.org/indicator/SL.IND.EMPL.ZS.
29. M. James, *Here's How Bill Gates' Plan to Tax Robots Could Actually Happen* (20 Mar. 2017), Business Insider, available at https://www.businessinsider.com/bill-gates-robot-tax-brighter-future-2017-3?r=US&IR=T.
30. D. Castro & M. McLaughlin, *Ten Ways the Precautionary Principle Undermines Progress in Artificial Intelligence*, ITIF – Information Technology & Innovation Foundation (4 Feb. 2019), available at https://itif.org/printpdf/8235.

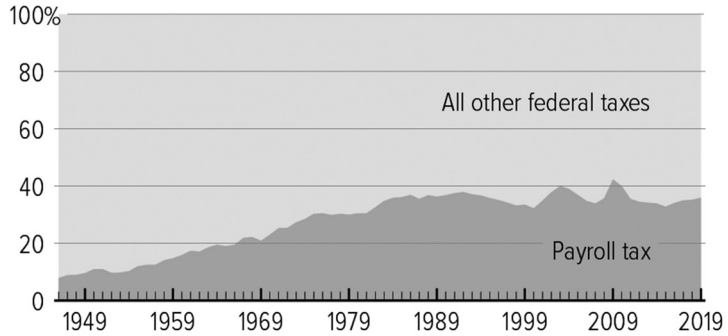
3. Survey on the Impact of AI and Robots on Jobs

3.1. Economic literature relevant to the debate

Due to the fast pace at which technology improves, the world has experienced the ability of AI/robots to assume tasks that were once done only by humans. Numerous analyses have been made to envisage the economic impact this revolution will bring and the authors will highlight a few of them.

First, it would be interesting to measure how much revenue states collect from payroll taxes on wages and self-employment income (social security contributions). As an example, research carried out by the Center on Budget and Policy Priorities (an American non-partisan research and policy institute) indicates that, in 2019, 35.9% of US federal revenue was derived from payroll taxes,[31] as it can be seen in Figure 2:

Figure 2 – Payroll taxes as a share of federal revenues



Note: "Other federal taxes" include individual and corporate income taxes, estate and gift taxes, excise taxes, profits on assets held by the Federal Reserve, customs duties and fees, and other smaller revenue sources.
Source: Office of Management and Budget (Center on Budget and Policy Priorities, cbpp.org)

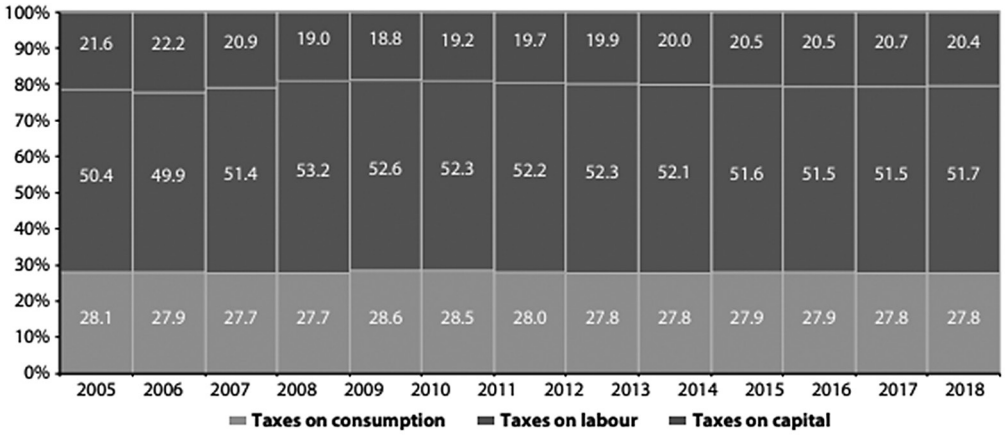
Moreover, data released by the European Union in 2020[32] shows the significance of revenues derived from taxing wages: in 2018, 51.7% of the tax revenue of the European Union was obtained from taxes on labour (which is broader than the one discussed in Figure 2), as per the middle row of the graph seen in Figure 3.

In light of the above, it seems that tax collection from formal employment is a high and relevant source of revenue for governments. Thus, the second question arises as to what the extent is of the impact of AI/robots on the workforce. Specifically, the question is whether jobs will increase or decrease.

This question is surely not new. Almost a century ago, in 1927, James Davis, Secretary of Labor who used to work with President Calvin Coolidge, stated that "we must ask ourselves, 'Is automatic machinery …going to leave on our hands a state of chronic and increasing

31. CBPP, *Federal Payroll Taxes*, Policy Basics (17 Apr. 2019), available at https://www.cbpp.org/research/federal-tax/policy-basics-federal-payroll-taxes. It should be mentioned that "payroll taxes" as used in the United States do not encompass individual income tax.
32. European Commission Taxation and Customs Union, *Taxation Trends in the European Union – Data for the EU Member States, Iceland and Norway* p. 21 and pp. 264-265 (European Union 2020), available at https://ec.europa.eu/taxation_customs/sites/taxation/files/taxation_trends_report_2020.pdf.

Figure 3 – EU-27 tax revenues according to type of tax base, 2006-2018 (% of total taxes)



unemployment?'".[33] Interestingly, in 1962, President John F. Kennedy remarked "I regard it as the major domestic challenge to maintain full employment at a time when automation, of course, is replacing men".[34]

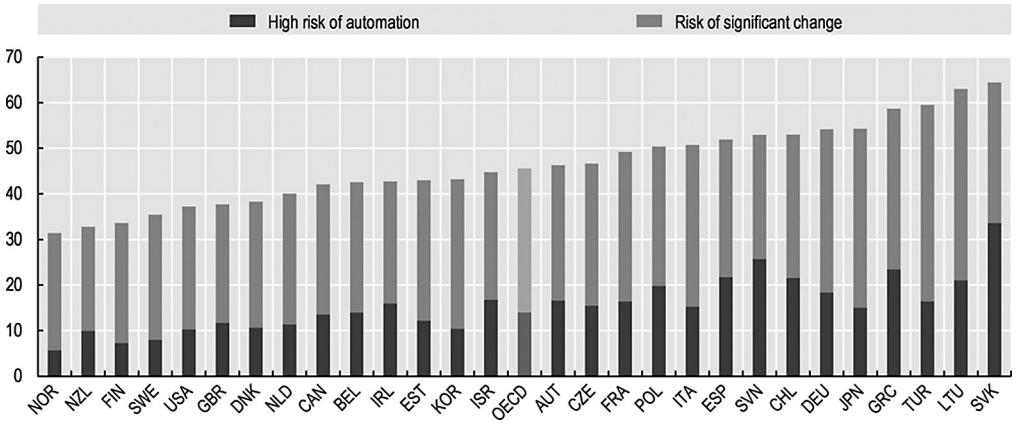
In this regard, the OECD's latest data (2019) on "The Future of Work" affirms that "the risk of automation is real but varies across countries". The data highlights that 14% of jobs could be completely automated, while 32% could change significantly. In addition, six out of ten adults have no information communication technology (ICT) skills nor computer experience.[35] The data goes on with its finding that automation will have a major effect on the manufacturing industry as well as the agriculture sector, as several jobs within these sectors require low skills.[36] In fact, towards this end, the data indicates that orders for industrial robots have tripled over the last decade. The chart in Figure 4 shows the percentage share of jobs at risk due to automation in countries that are considered economic powers.[37]

The European Commission indicates that, based on studies, in a worldwide context around 2 billion jobs will be lost by 2025/30. However, 375 million new positions will be generated.[38]

Moreover, McKinsey believes that, depending on the speed of adopting automation, anywhere between 10 million and 800 million jobs worldwide could be displaced by 2030. Regarding the creation of new jobs, the same organization considered that as global consumption may grow around USD 23 trillion between 2015 and 2030, jobs could also

33. J.J. Davis, *Productivity of Labor and Industry*, 25 Monthly Labor Review 3 (Sept. 1927), available at https://www.jstor.org/stable/41860549?seq=1; and Atkinson, *infra* n. 50, at p. 17.
34. *See* the former US President being interviewed. John F. Kennedy Presidential Library and Museum, News Conference 24 (14 Feb. 1962), available at https://www.jfklibrary.org/archives/other-resources/john-f-kennedy-press-conferences/news-conference-24; and Atkinson, *infra* n. 50, p. 17.
35. OECD, *Data on the Future of Work*, The Future of Work (2019), available at http://www.oecd.org/future-of-work/reports-and-data/data-infographics.htm.
36. OECD, *Putting Faces to the Jobs at Risk of Automation*, Policy Brief on the Future of Work (Mar. 2018), available at https://www.oecd.org/employment/Automation-policy-brief-2018.pdf.
37. OECD, *Employment Outlook 2019*, The Future of Work (2019), available at https://doi.org/10.1787/9ee00155-en.
38. European Commission, *Impact of Automation on the Number of Jobs*, Knowledge for Policy (2018), available at https://ec.europa.eu/knowledge4policy/visualisation/impact-automation-number-jobs_en.

Figure 4 – Share of jobs at high risk of automation or risk of significant change (%)



Note: Jobs are at high risk of automation if the likelihood of their job being automated is at least 70%. Jobs at risk of significant change are those with the likelihood of their job being automated estimated at between 50 and 70%. Data for Belgium correspond to Flanders and data for the United Kingdom to England and Northern Ireland.
Source: OECD calculations based on the Survey of Adult Skills (PIAAC) (2012), http://www.oecd.org/skills/piaac/; and L. Nedelkoska & G. Quintini, Automation, skills use and training, OECD Social, Employment and Migration Working Papers, No. 202 (2018), https://doi.org/10.1787/2e2f4eea-en.

increase. It indicates that potential jobs created from seven catalysts of labour demand could amount to anywhere between 555 million and 890 million. Moreover, several million new jobs (which do not exist currently) are expected to be created.[39]

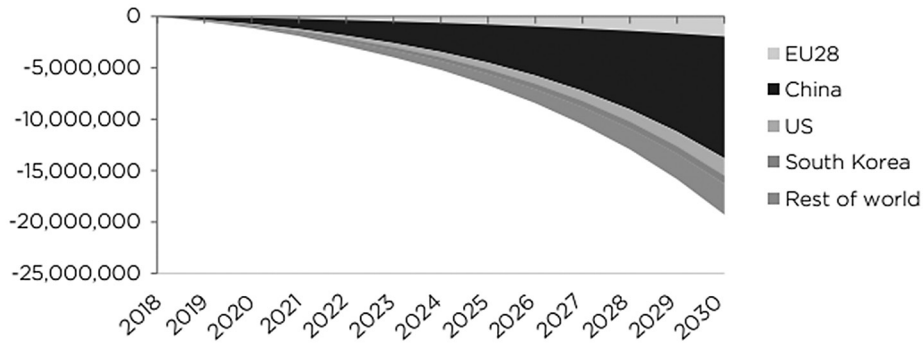
Similarly, a study conducted by the Asian Development Bank, which analysed the period from 2000 to 2015, concluded that by adopting more industrial robots, positive changes are verified in the employment portion of non-routine analytic jobs, while a negative transformation occurs in the share of routine manual tasks.[40]

Also, Oxford Economics' research found that, by 2030, 20 million manufacturing jobs worldwide could be replaced by robots (*see* Figure 5).[41]

At the same time, the report indicates that "it would be simplistic to characterise robotization as only a destroyer of jobs. While certain sets of workers lose their jobs to robots, many in the wider population benefit from a 'robotics dividend'". In particular, the report states that "[w]e found that a 1% increase in the stock of robots per worker in the manufacturing sector alone leads to a 0.1% boost to output per worker across the wider workforce. This confirms our hypothesis: that by displacing automatable jobs in manufacturing, robots free

39. J. Manyika et al. *Jobs Lost, Jobs Gained: What the Future of Work will Mean for Jobs, Skills, and Wages*, Mckinsey Global Institute, pp. 10-11 (28 Nov. 2017), available at https://www.mckinsey.com/featured-insights/future-of-work/jobs-lost-jobs-gained-what-the-future-of-work-will-mean-for-jobs-skills-and-wages.
40. G.J. de Vries, E. Gentile, S. Miroudot & K.M. Wacker, *The Rise of Robots and the Fall of Routine Jobs*, Economics Working Paper (2020), available at http://dx.doi.org/10.22617/WPS200236-2.
41. Oxford, *How Robots Change the World – What Automation Really Means for Jobs and Productivity*, Oxford Economics (June 2019), available at https://cdn2.hubspot.net/hubfs/2240363/Report%20-%20How%20Robots%20Change%20the%20World.pdf?utm_medium=email&_hsenc=p2ANqtz--K7kgPhJ7k-o3CX7f029ZmeMO_oDTNrwYYxrrVYFjKjh_0Oa3Wnz-U42mRNLGTqPLPd7TCgmS6n-ype13-3wEh-thBQw&_hsmi=74013545&utm_content=74013545&utm_source=hs_automation&hsCtaTracking=07b1855a-24f4-4b99-bcb8-b0d2a13b715e%7C53b7a48e-9591-4179-8eab-694443190b4f.

Figure 5 – Projected cumulative job losses to automation, up to 2030



Source: Oxford Economics.

up many workers to contribute productively elsewhere in the economy, as they meet the demands generated by lower prices for manufactured goods". The report further states that "jobs are both created and destroyed through the increased use of automation and industrial robots".[42] Moreover, it concludes that "we found that a faster adoption of robots has a positive impact on both short- and medium-term growth. For example, boosting robot installations to 30% above the baseline forecast by 2030 would lead to an estimated 5.3% boost in global GDP that year. This equates to adding an extra $4.9 trillion per year to the global economy by 2030 (in today's prices) – equivalent to an economy greater than the projected size of Germany's".[43]

In relation to the future employment outlook, the World Economic Forum has estimated that 75 million jobs will disappear due to the division of labour between individuals and machines, while 133 million new positions may be created. However, the forum informs the reader that such data should be used cautiously.[44]

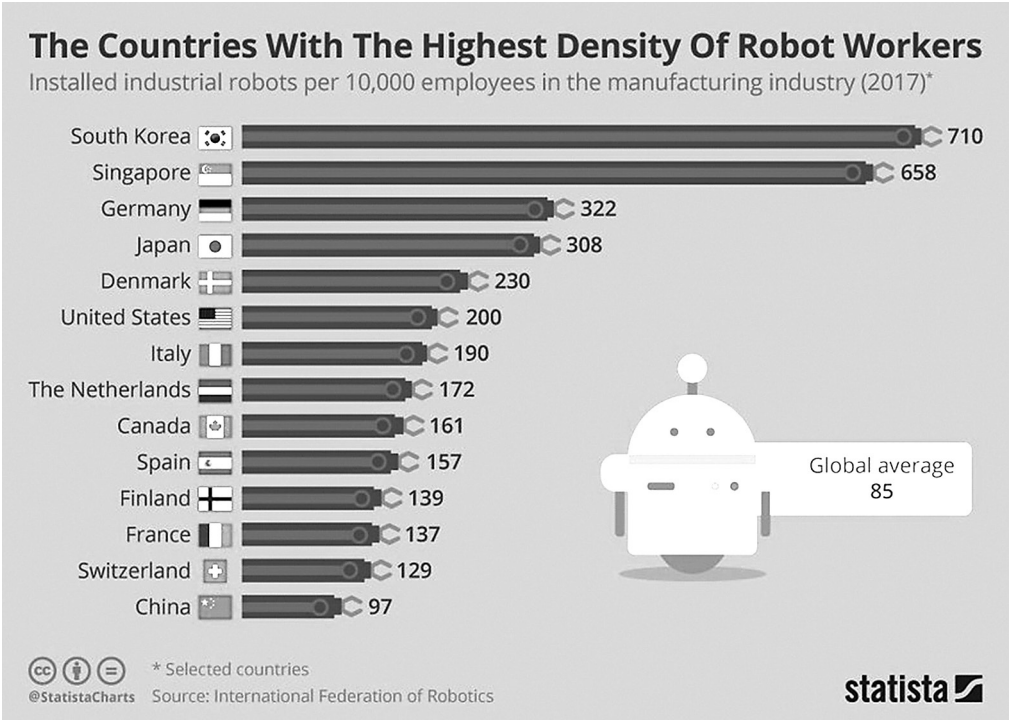
In a similar vein, Katja Mann and Lukas Püttmann recently demonstrated that an industry with more automation-related patents – which can be defined as a proxy for the creation of new types of robots and similar technologies – tends to create more jobs rather than drop them. In view of that, their research indicates robots can complement the human workforce instead of displacing them, even in case those robots are supposed to change the type of work performed by humans.[45]

This analysis resonates with the statement made by Senator Paul H. Douglas year 1930, who affirmed that "the improved machinery and greater efficiency of management do not throw workers permanently out of employment. Instead they raise the national income and enable the level of earnings and of individual incomes to rise".[46]

42. Id., at pp. 34-37.
43. M. Simon, *What is a Robot?*, Wired (24 Aug. 2017), available at https://www.wired.com/story/what-is-a-robot/. Id., at p. 6.
44. WEF, *The Future of Jobs Report 2018*, Insight Report of the Centre for the New Economy and Society, pp. 8-9 (2018), available at http://www3.weforum.org/docs/WEF_Future_of_Jobs_2018.pdf.
45. K. Mann & L. Püttmann, *Benign Effects of Automation: New Evidence from Patent Texts*, SSRN Working Papers (15 Aug. 2018), available at https://ssrn.com/abstract=2959584.
46. J.R. Commons, *Institutional Economics: Its Place in Political Economy*, Vol. I, p. 550 (Transaction Publishers 2009); and R. Atkinson, *infra* n. 50, at p. 18.

Another category of data that is important for analysing the issue at stake is the unemployment rate in countries where automation can be found at higher levels. Based on a study conducted by the World Economic Forum,[47] in 2017, South Korea[48] was considered the most automatized country in the world (710 industrial robots per 10,000 employees, especially in the electronics and electric sectors). The second place was occupied by Singapore, which had 658 industrial robots per 10,000 employees, also mainly in the electronics sector. Germany (322 industrial robots per 10,000 employees) and Japan (308 industrial robots per 10,000 employees) ranked third and fourth respectively, mostly in their automotive industries. The information regarding other countries can be found in Figure 6 as follows:

Figure 6 – Countries with the highest density of robot workers



That said, it is also appropriate to verify the unemployment rates in the aforesaid countries during the same year (2017). Data indicates that (the unemployment rates) are as follows: in South Korea (3.7%), Singapore (2.2%), Germany (3.8%), Japan (2.8%), Denmark (5.8%), the United States (4.3%), Italy (11.3%), Netherlands (4.9%), Canada (6.3%), Spain (17.2%), Finland (8.8%), France (9.4%), Switzerland (3.1%) and China (3.9%).[49] The statistics may

47. N. McCarthy, *These Countries Have the Most Robot Workers*, World Economic Forum (1 May 2019), available at https://www.weforum.org/agenda/2019/05/infographic-the-countries-with-the-highest-density-of-robot-workers.
48. IRF, *South Korea reached in 2018 a new record: about 300,000 operational industrial robots*, IFR Press Releases (12 Dec. 2019), available at https://ifr.org/ifr-press-releases/news/korea-hits-new-record.
49. The data provided, regarding unemployment rates in 2017, was extracted from International Monetary Fund Website. IMF, *Unemployment Rate*, IMF DataMapper, available at https://www.imf.org/external/datamapper/LUR@WEO/OEMDC/ADVEC/WEOWORLD/KOR.

indicate that, apart from some exceptions, the majority of the most automated countries had low unemployment rates. This in turn could probably (not definitely) imply that automation may not trigger widespread unemployment (since there could be other reasons).

Another interesting economic point to analyse is how governments react to unemployment with the aim of reducing it. Robert Atkinson[50] argues that the persons who bear the cost of the contributions paid by the employer are the employees themselves, not the employer, although empirical literature demonstrates this conclusion as far from unanimous. According to Fuchs et al.,[51] a survey conducted by 40 leading universities in the United States demonstrates that employers bear around 20% of costs regarding social contributions, while employees bear approximately 80% by means of lower net wages. A more recent survey conducted by Ángel Melguizo and José Manuel González-Páramo[52] concluded, after analysing 52 empirical papers, that "a 1.0% increase in taxation reduces wages by 0.66%", which means that employees bear around 2/3 of social security contributions. Additionally, Atkinson illustrates that the overall rate of employment is largely determined at the macroeconomic level (not the microeconomic one) by providing the following example: A company, Joe's Pizzeria, has hired workers to serve clients, prepare and deliver food, take care of administrative tasks and so on. In case the government fixes a higher minimum wage, prices at Joe's Pizzeria will increase (since Joe has higher costs to pay his workers), which will consequently reduce the quantity of pizzas sold (due to high prices). Thus, based on the demand decrease, Joe does not need to employ as many workers, and because of that some people will be unemployed until they find new positions. As a result, the national unemployment rate will be higher. In that situation, usually, the first measure taken by most governments is to reduce interest rates, which will encourage spending and investing. This protective measure continues until the nation has good rates of employment again. Thus, even in the case of a one-time economic "shock" from a higher minimum wage, such an effect would be easily neutralized by federal monetary policy, and the economy would recover to full employment.[53] Transposing this analysis to the issue at stake may perhaps indicate that if automation triggers unemployment or if the cost of hiring humans increases, then governments could intervene and use monetary policy tools to stimulate economic growth.

As depicted, there is no consensus regarding how many jobs would be replaced in the future nor how many would be created as a result of automation.[54] In the next section, the authors will discuss demographic data that is intrinsically related to employment matters.

50. R.D. Atkinson, *The Case Against Taxing Robots*, ITIF – Information Technology & Innovation Foundation, p. 16 (8 Apr. 2019), available at https://itif.org/publications/2019/04/08/case-against-taxing-robots.
51. V.R. Fuchs, A.B. Krueger & J.M. Poterva, *Economists' Views About Parameters, Values and Policies: Survey Results in Labor and Public Economics*, 36 Journal of Economic Literature 3, (Sept. 1998), available at https://economics.mit.edu/files/19900.
52. A. Melguizo & J.M. González-Páramo, *Who Bears Labour Taxes and Social Contributions? A Meta-analysis Approach*, SERIEs 4 (2013), available at https://link.springer.com/article/10.1007/s13209-012-0091-x.
53. Atkinson, *supra* n. 50.
54. For a similar conclusion, *see* O. Mazur, *Taxing the Robots*, 46 Pepperdine Law Review, pp. 279-295 (2019) available at https://scholar.smu.edu/cgi/viewcontent.cgi?article=1369&context=law_faculty; and M. Barros, *Robots and Tax Reform: Context, Issues and Future Perspectives*, 2 Intl. Tax Stud. 6, pp. 2-6 (2019), Journal Articles & Papers IBFD.

3.2. The demographic perspective

Despite the importance of the economic considerations previously presented, the debate illustrated above may be somewhat out of touch with the true challenges we are witnessing in our modern world, and reflects the notable (and maybe justified) fear from stepping outside the line of thinking which can be supported by previous historical experiences.

Namely, it was not just during industrial revolutions that humankind had to face the consequences of innovation on labour. The invention of the wheel, the discovery of the physics of simple leverage and the domestication of pack animals all had profound effects on humanity and our surroundings. In other words, one can say that perhaps the challenges of this latest industrial revolution are nothing out of the ordinary but are just a common step in our path of development.

Furthermore, the potential political and societal consequences of the increasing reliance on AI and robots can also be deduced from the past. For example, reliance on slave labour in ancient Rome led to the emergence of the proletariat class, the poor, but free, urban masses without meaningful employment, as their potential jobs were performed by slaves. The Roman government needed to find ways to politically appease the turbulent proletariat class, wherein its approach can be summed up in the famous Latin proverb *panem et circenses* – (free) bread and games (entertainment).

The analogy with ancient Rome is even more relevant today as that society tends to resemble ours in terms of cosmopolitanism. Namely, just as in those days, our wealthy metropolises today are a magnet for people all over the world and we sometimes truly feel as if the world has become one global village. However, as the ongoing COVID-19 pandemic has poignantly reminded us, perhaps the world as a global village is just an illusion where our mindsets are still firmly based in the national state framework, particularly in times of strife, despite the fact that our problems cannot be solved within the national boundaries that our threats are blind to. The notable lack of solidarity in difficult times seen within several countries during the COVID-19 pandemic significantly testifies to a need to take on a more cynical position when analysing world affairs and to remind ourselves that different societies will have a different attitude to common global problems.

To illustrate this claim, it can be shown that reliance on AI/robots leads to completely different outlooks depending on the country paradigm we consider.

For example, let us view the problem of the potential adverse effect of AI/robots on employment from the perspective of the Republic of Korea (South Korea), Asia's fourth-largest economy[55] and one of the innovation drivers of the planet. The UN predicts that the population of South Korea, one of the few leading economies that has not been reliant on immigration to fill the ranks of its workforce so far, now reaching 51.3 million, is at its peak or close to that number, and it will shortly start to decline. Under a moderate scenario, by the end of the century, South Korea is predicted to have under 30 million inhabitants, the same number as it had in 1966.[56] Currently, in 2020, some 35 million people in South Korea are in the productive phase of their lives (ages 15 to 64), while in 2100 this number is predicted

55. South Korea follows China, Japan and India respectively as Asia's fourth largest economy in terms of GDP.

56. United Nations, Department of Economic Affairs, *World Population Prospects 2019 – Vol. II: Demographic Profiles*, p. 943.

to stand at under 15 million.[57] On the other hand, while 15.8% of the population of South Korea is of the retirement age (65 and above) in 2020, by the end of the century, pensioners will account for 38% of the total population, with the young (those under 15) making up the remaining 12%.[58] In other words, not only will an economy such as South Korea lose the potential to fill 20 million jobs in comparison to today relying only on internal resources (the drop in the active population from 35 to under 15 million), but actually, its demographic shift to the elderly (with the average age expected to surpass 90 in the same time frame)[59] will require more resources being transferred to nursing and health care needs, which exponentially rise in the older strata of the society, it being precisely in the domain of nursing and tending to the needs of the elderly where it is predicted that we will still have to rely on the *human touch*.[60]

Japan, currently the world's third-largest economy is expected to suffer a similar fate to that of South Korea, with its population almost halving by the end of the century (from a peak of 128.5 million in 2010 to approximately 75 million in 2100, and even as low as 60 million by some estimates), with those over 65 accounting for close to 40% of the population already by 2050.[61]

Finally, in Asia, China, currently the industrial powerhouse of the planet, is expected to lose at least 400 million people by 2100 (with some projections as high as 700 million), with the decline accelerating after 2050.[62] As in the case of Japan and South Korea, China will have to seriously consider how to care for its increasingly aging population.

On the other side of the Eurasian land mass, there is Europe, a continent as a whole facing identical demographic challenges as those described in the case of Japan and South Korea, but which is managing to stem the pace of the fall in population numbers by way of immigration. However, in Europe we see notable differences in the ability to maintain population numbers (and thus that of the workforce) by relying on immigration inflows.

In the case of Italy, in the absence of immigration, the country's population would shrink by some 20 million already by 2050, from approximately 60 to 40 million people, with those of retirement age making up more than a third of the population (the number of people above the age of 65 would increase by some 5 million in the same period within which the population would fall by 20 million). Just in order to maintain its population level by 2050, Italy would need to welcome more than 12.9 million immigrants (measuring from 1995 until 2050), which would lead to post-1995 immigrants and their descendants making up 29% of the population by 2050. However, even in the case of such an influx, the aging of the domestic population would lead Italy to have less active people (those aged 15 to 64) by 2050 than it had in 1995. In order to maintain the same number of its active population, Italy would need almost 20 million immigrants by 2050, by which time the post-1995 immigrant

57. Id.
58. Id.
59. Id, at p. 942.
60. *See* M. Chui, J. Manyika & M. Miremadi, *Where Machines Could Replace Humans – And Where They Can't (Yet)*, McKinsey Digital (8 July 2016), available at https://www.mckinsey.com/business-functions/mckinsey-digital/our-insights/where-machines-could-replace-humans-and-where-they-cant-yet.
61. United Nations, *supra* n. 56, at pp. 673-676.
62. Id., at p. 385.

population would account for 39% percent of the total population.[63] Current immigration flows will allow Italy to maintain a population of 40 million by the end of the century, almost 7 million less than it had in 1950.[64]

Without immigration, Germany would have seen a population decline since the 1970s when the number of deceased overtook the number on newborns in that country,[65] while out of all children born today in Germany approximately one quarter have mothers of foreign origin.[66] According to a UN study, in order to maintain the ratio of workers to pensioners from 2000, an indicator crucial for the survival of our current social contract based on the Bismarck pension insurance model, Germany would need to integrate 188 million new immigrants by 2050.[67] In comparison, this number stands at 533 million for Japan.[68]

From a political perspective, countries like Germany, Italy, Japan, South Korea and even China are faced with unique demographic challenges the likes of which they have not faced since the time of the great plagues that decimated their populations centuries ago (in Europe at least, we have not seen anything similar since the Great Plague from the mid-14th century, and perhaps in Central Europe, the Thirty Years War[69]). However, unlike pestilence, the demographic decline at the moment is primarily targeting their young, with the numbers of the elderly rapidly increasing due to higher life expectancy. AI and automatization of the economy may allow these societies to maintain their level of prosperity without the need to resort to such influxes of foreign migrants that may jeopardize the core of these societies, whose social cohesion has already been deeply shaken due to immigration.

At the same time when wealthy and prosperous countries are dealing with a steady demographic decline, impoverished parts of our planet are seeing a population explosion. Nigeria, the most populous African nation, whose population now stands at close to 200 million, is expected to see more than 700 million inhabitants by the end of the century, provided current fertility rates are maintained.[70] The same virtual quadrupling of the population is expected throughout Africa by 2100.[71] In the Democratic Republic of Congo, one of the poorest parts of the planet, the census now stands at approximately 90 million people.[72] Persons of retirement age make up less than 3% of the total population, while those aged 0 to 15 count for close to half of all inhabitants.[73] The GDP per capita of the Democratic Republic of Congo is virtually 100 times lower that of the most developed countries in the world (with that same nation's resources being the foundation of the wealth of many of those developed countries, such as Belgium) and thus this and similar societies

63. United Nations, Department of Economic Affairs, *Replacement Migration: Is It a Solution to Declining and Ageing Populations?* pp. 53-54 (United Nations 2001), available at: https://www.un.org/en/development/desa/population/publications/pdf/ageing/replacement-chap4-it.pdf.
64. United Nations, *supra* n. 56, at p. 999.
65. Federal Statistical Office (Destatis), *A Changing Population – Assumptions and Results of the 14th Coordinated Population Projection* p. 17 (2019), available at https://www.destatis.de/EN/Themes/Society-Environment/Population/Population-Projection/_node.html.
66. Id., at pp. 31-32.
67. United Nations, *supra* n. 63, at p. 42.
68. Id., at p. 54.
69. The Thirty Years' War, which was fought from 1618 until 1648, lead to the death of more than 20% of the German population.
70. United Nations, *supra* n. 56, p. 871.
71. Id., at p. 61.
72. Id., p. 464.
73. Id.

are quite often unable to provide their citizens with basic public services such as education and health care, nor are they capable of developing the infrastructure needed for attracting investment, other than that oriented towards the exploitation of natural resources. Similar circumstances combined with comparable population statistics may sometimes be found in countries of Central America (nations such as El Salvador, Guatemala and Nicaragua) and Central Asia (e.g. Afghanistan and Tajikistan) as well.

The aforementioned societies are not only technologically underdeveloped, but the abundance of freely available cheap labour and the lack of institutions to hold those abusing this labour to account make, similarly to ancient Rome, investments into technology economically unnecessary. Such a conclusion is best supported by the fact that mining for some of the world's rarest and most valuable (particularly with respect to modern telecommunications) minerals in Africa (primarily in the Democratic Republic of Congo) is conducted in a way reminiscent of the late Neolithic.[74] Unfortunately, the pure modernization of the processes currently handled by human labour would only lead to increased social strife in societies already engulfed in perpetual violence and political discontent. Therefore, in such societies, AI/robots can be seen as a completely unwelcome development as they are unable to find employment for their exploding populations, even with the current emigration outflows.

Herein the authors can present a rather troubling scenario of AI/robots being relied upon by wealthy countries to mitigate their own population decline and maintain prosperity levels, while avoiding fundamentally altering the national, ethnic, religious and cultural composition of their populations by way of immigration, as such changes may lead to grave turbulences with far reaching consequences. On the other hand, impoverished societies with rapidly growing populations need to find a way to employ their citizens, wherein they currently have limited need for AI/robots due to the abundance of labour within their borders. Emigration is currently serving as a valve to lower socio-political pressures in these countries, although it is also having a detrimental effect on their development potential due to the fact that it is the best and brightest who will as rule be welcomed first in foreign destinations.[75]

To make things even more concerning, it would be necessary to take into account the now undisputable consequences of global warming. The rising of the world's oceans, the increase in global temperatures and the decrease in the availability of fresh water are all expected to disproportionately affect poorer countries and are bound to trigger migrations towards places of refuge. Areas that will maintain endurable climate conditions and have sufficient freshwater supplies are those that can today be counted as the world's most prosperous (e.g. Europe and North America).[76] At the same time, climate change challenges will require

74. S. Kara, *Is your phone tainted by the misery of the 35,000 children in Congo's mines?*, The Guardian (12 Oct. 2018), available at https://www.theguardian.com/global-development/2018/oct/12/phone-misery-children-congo-cobalt-mines-drc; and H. Sanderson, *Congo child labor and your electric car*, Financial Times (7 July 2019), available at https://www.ft.com/content/c6909812-9ce4-11e9-9c06-a4640c9feebb.

75. B. Kristijai, *Tax and the Brain Drain: Justification, Policy Options and Prospect for Large Developing Economies*, 67 Belgrade Law Review 4, p. 40 (2019).

76. C. Xu, T.A. Kohler, T.M. Lenton, et al., *Future of the Human Climate Niche*, 117 Proc. Natl. Acad. Sci. U.S.A. 21, pp. 11350-11355 (2020).

planetary action of unprecedented proportions and will inevitably be a source of so far unaccounted employment.[77]

In summary, a purely economic, employment-focused view of AI/robots is bound to lead to inconclusive results. From a tax perspective, the same conclusion stands, as our tax policies have always been, or have at least tried to be, attentive to the broader implications of our social contracts. AI and the increasing use of robots in our economies may have a national as well as global perspective. On the other hand, the European migration crisis, climate change as well as the current COVID-19 epidemic painfully remind us that those focused on national boundaries will as a rule be flawed, as they have proved to be too porous to stop the spread of global threats. In other words, the equation that we need to solve is not as simple as the one of governments losing one of the key sources of tax revenue due to the disappearance of the individual taxpayer who will be replaced by AI/robots. The problem before us is how to adjust our tax policies to account for the technological, economic, demographic, climate and corresponding social changes that are already taking place, where the growing use of AI/robots present just one occurrence that cannot be viewed independently from the remaining novel elements of our brave modern world. Therefore, the issue may not be how to tax technology, but rather how to tax in a world where technology goes hand in hand with developments we have not witnessed for thousands of years (e.g. the prospective migrations of people, the stop in the global rise of population for the first time in history or climate change of a magnitude not seen since the end of the last Ice Age).

Putting aside the wider problem (to which we will return in sections 5. and 6.), the next section analyses the various proposals that have been contemplated in the literature or by governments to tax AI/Robots from the perspective of selected tax policy principles.

4. Taxing AI and Robots

4.1. Setting the assessment framework

Before considering the various options that have been contemplated to date, it should be noted that any option for taxing AI/robots should be built on a sound policy rationale and well-established tax policy principles, for instance, such as those agreed in the context of the Ottawa Framework. The authors choose the Ottawa Framework, as that framework has been accepted by the tax administrations of several countries.

According to the framework, the first principle deals with neutrality.[78] This essentially means that a tax should apply across the board and should not differentiate between electronic and conventional commerce. Absolute neutrality is always difficult to achieve, but the introduction of a new tax should be as little distortive as possible.[79] The second principle relates to certainty or simplicity, which in turn is linked to the third principle of efficiency.[80] The more complex the new tax is, the greater are the chances of it leading to higher com-

77. M.A. Brown & M. Ahmadi, *Would a Green New Deal Add or Kill Jobs*, Scientific American (17 Dec. 2019), available at https://www.scientificamerican.com/article/would-a-green-new-deal-add-or-kill-jobs1/.

78. OECD, *Taxation and Electronic Commerce – Implementing the Ottawa Taxation Framework Conditions* p. 10 (OECD 2001), Primary Sources IBFD; and OECD, *Addressing the Tax Challenges of the Digital Economy – Action 1: 2015 Final Report* p. 20 (5 Oct. 2015), Primary Sources IBFD [hereinafter Action 1 Final Report].

79. B. Peeters et al., *The Concept of Tax*, EATLP International Tax Series (Vol. 3), p. 31 (IBFD 2007), Books IBFD.

80. OECD, *supra* n. 78, at p.10; and Action 1 Final Report, *supra* n. 78, at p. 20.

pliance costs for both taxpayers and tax administrations.[81] Thus, aiming at being efficient, a new tax must also be simple, in the sense that its application entails overall low compliance costs. It should be noted that efficiency in this context should not be confused with efficient (neutral) outcomes associated with the location of production or output factors, as frequently discussed in economic literature. Fourth, effectiveness and fairness considerations will also need to be looked into.[82] Effectiveness implies that the government should be able to collect payment of the right amount of taxes at the right time. Fairness in this context implies that the potential for tax evasion and avoidance should be minimal. It could also imply that the opportunities for profit shifting should be as low as possible. Lastly, any proposals should be flexible.[83] The principle requires tax systems to be dynamic in the sense that they can meet current and future revenue needs of the government. It is important to note that one principle need not be favoured over another and a balance needs to be struck among all of them.

While the article will touch upon these principles, the focus is on the principle of simplicity or certainty. At the same time, within the analysis, the authors will also make reference to legal principles such as the ability to pay or benefits principle, as they are commonly accepted principles across the globe. Against this backdrop, the authors firstly summarize the selected targeted solutions that have been contemplated to date (*see* section 4.2.). Then the authors benchmark the solutions against the assessment framework (*see* section 4.3.) and then conclude with some remarks from an innovation perspective (*see* section 4.4.). It should be noted that general measures contemplated in the literature are discussed later (*see* section 5.3.).

4.2. Targeted measures to tax AI/robots

4.2.1. AI/robots as taxable subjects

The idea of taxing AI/robots has gained momentum quite recently. In 2017, Bill Gates, co-founder of Microsoft, heated up this tax debate. In an interview with Quartz, he stated that "right now, the human worker who does, say, $50,000 worth of work in a factory, that income is taxed and you get income tax, social security tax, all those things […] If a robot comes in to do the same thing you'd think that we'd tax the robot at the same level?".[84] Some commentators argue AI/robots should "receive", probably on a deemed basis, the income as a separate taxable subject. By doing this, state revenues would not be strongly affected.[85] For income tax purposes, one option would be to treat the AI/robot as an individual. Another option is to treat them as taxable legal entity type subjects.[86] Similarly, with respect to indirect taxation, more specifically VAT matters, suggestions have been made that once AI/robots are given legal personality and tax capacity, they can also be considered as taxable persons and, therefore, be subject to VAT.[87]

81. P. Pistone et al. eds., *Fundamentals of Taxation: An Introduction to Tax Policy, Tax Law and Tax Administration* sec. 2.1.3.4. (IBFD 2019), Books IBFD.
82. OECD, *supra* n. 78, at p. 10; and Action 1 Final Report, *supra* n. 78, at p. 20.
83. Id.
84. K.J. Delaney, *The Robot that Takes your Job Should Pay Taxes, Says Bill Gates*, Quartz (17 February 2017), available at https://qz.com/911968/bill-gates-the-robot-that-takes-your-job-should-pay-taxes/.
85. X. Oberson, *Taxing Robots – Helping the Economy to Adapt to the Use of Artificial Intelligence* p. 131 (Edward Elgar Publishing 2019).
86. Id., at p. 133.
87. Id., at pp. 87-110..

4.2.2. Measures which target use of AI/robots

4.2.2.1. Attributing income to the owner of the AI/robot

This proposal contemplates that the owner of the AI/robots should be responsible for paying the imposed taxes for using such technology. Those taxes would be levied on fictional salaries deemed to be attributed to the AI/robots that would be equivalent to the salary that an individual performing the same work would have received. The salary would be calculated by looking into comparable salaries.[88] As a result, a neutralization of the loss of revenue (taxes and social security) due to automation is achieved. In order for this to happen, it is also necessary that the legislation recognizes a relation between the owner of the AI/robot and the AI/robot itself, similar to the relation between an employer and an employee (consequently, for example, requiring a change to labour law).

Members of some political parties have made similar proposals to tax an imputed income attributable to robots. For instance, Bill Blasio, New York's mayor, defended the creation of a federal robot tax during his run as 2020 Democratic presidential candidate.[89] According to his proposal, when a company replaces a worker due to automation, it would have to pay an amount equivalent to five years of payroll taxes for each replaced worker. Besides, his idea was also to create a regulatory agency (the name suggested was Federal Automation and Worker Protection Agency – FAWPA), that would be authorized to regulate advanced robotics, including artificial intelligence. In Canada, the Green Party has also proposed taxes on robots.[90] The announcement, on 29 September 2019, proposes the idea that when a company replaces an individual with a machine, a tax equivalent to the income tax that would be paid by the laid-off employee will be charged.

4.2.2.2. Object tax

An object tax would be levied on the ownership of a robot and could be based on a flat rate or vary according to the type of robot; similar to what is done with assets in some jurisdictions.[91] The key challenge of this approach is that by taxing the property (that usually relates to tangible assets that have no autonomy or intelligence), this model conflicts with the underlying reason for taxing robots: since they are smart machines that can replace humans, they should be taxed as humans (subjects), not objects.

4.2.2.3. Business taxation measures

4.2.2.3.1. Restricting deductions on expenditure for automated businesses

Several jurisdictions nowadays grant tax advantages to companies who invest in technology and who acquire machines that improve efficiency and productivity. According to the OECD's latest data, several jurisdictions have reinforced incentives concerning corporate

88. Id., at pp. 114-116.
89. J. Marsh. *De Blasio Proposes 'Robot Tax' in Bid to Boost Failing 2020 Campaign*, New York Post (5 Sept. 2019), available at https://nypost.com/2019/09/05/de-blasio-proposes-robot-tax-in-bid-to-boost-failing-2020-campaign/.
90. Green Party of Canada, *Green Party Pledges to Fund AI Research, and Protect Workers from Jobs Lost due to* Automation (29 Sept. 2019), available at https://www.greenparty.ca/en/media-release/2019-09-29/green-party-pledges-fund-ai-research-and-protect-workers-jobs-lost-due.
91. Oberson, *supra* n. 85, at pp. 129-130 and p. 134.

tax incentives to encourage innovation.[92] For example, the deductibility of invested capital for tax purposes.[93] Such measures could be regarded as fostering the replacement of individuals. Accordingly, eliminating such tax advantages, based on a certain reported level of automation,[94] could be one possible solution to slow down the replacement of humans by machines.

Currently, South Korea, famous for being the most robotized country in the world, has changed its corporate tax code in order to provide disincentives for capital investments in technology by restricting certain deductions.[95] This could be seen as an indirect "robot tax" since no new tax was created.[96] Before the changes, a corporate tax deduction was allowed between 3% and 7% of the investment amount, according to the size of the business. From 2018 to 2019, the rate was reduced by 2%.[97] By studying the Korean system, *Dimitropoulou* recently discussed a measure to restrict tax incentives for businesses that use technology (AI/robots) that are close substitutes for the human workforce.[98]

Another proposal that restricts deductions was made by Vincent Ooi and Glendon Goh. Their proposal called "reverse depreciation" is based on the premise that companies that adopt a certain level of automation as complementary functions (it means none or low levels of human workforce replacement) would be allowed to deduct higher amounts in relation to capital expenditure, whilst companies that invest in automation causing more replacements of humans, would be authorized to deduct only a small share of the capital investment.[99]

4.2.2.3.2. Higher corporate tax rates for automated businesses

An alternative to the foregoing "robot tax" is a relevant increase in corporate income tax rates for automatized businesses.[100] In this sense, companies that replace the human workforce by AI/robots are expected to be more productive and consequently make higher prof-

92. OECD, *Tax Policy Reforms 2020: OECD and Selected Partner Economies* (OECD 2020), available at https://www.oecd-ilibrary.org/sites/7af51916-en/1/1/index.html?itemId=/content/publication/7af51916-en&_csp_=8a96f5eedbc1947f715e8fc47d48f410&itemIGO=oecd&itemContentType=book.
93. Various countries allow tax deductions for investment-related expenses. Those capital expenditures may be related to the purchase of assets such as computers, machinery, vehicles and robots, depending on the legislation of each state. In some cases, operational expenditures are allowed to be fully tax deducted, while capital expenditures are allowed to be depreciated or gradually deducted. *See*, for example, PWC, *United Kingdom – Corporate Deductions*, Tax Summaries (6 Jan. 2020), available at https://taxsummaries.pwc.com/united-kingdom/corporate/deductions.
94. R. Abbott & B. Bogenschneider, *Should Robots Pay Taxes? Tax Policy in the Age of Automation*, 12 Harvard Law & Policy Review (2018), p. 169 (15 Mar. 2017), available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2932483.
95. Barros, *supra* n. 54, at p. 12.
96. R. Kovacev, *A Taxing Dillema: Robot Taxes and the Challenges of Effective Taxation of AI, Automation and Robotics in the Fourth Industrial Revolution*, 16 Ohio State Technology Law Journal, p. 204 (26 May 2020), available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3570244.
97. M. Hammer, *Brave New World: Automation, Unemployment and Robot Taxes*, White Paper (3 July 2019), Journal Articles & Papers IBFD. For more information, *see also* C. Dimitropoulou, *Scaling Back Tax Preferences on Artificial Intelligence-Driven Automation: Back to Neutral?*, 12 World Tax J. 2, sec. 3.1.2. (2020), Journal Articles & Papers IBFD.
98. *See also* Dimitropoulou, *supra* n. 97, at sec. 4.
99. V. Ooi & G. Goh, *Taxation of Automation and Artificial Intelligence as a Tool of Labour Policy*, SMU Centre for AI & Data Governance Research Paper No. 2019/01 (2 Feb. 2019), available at http://dx.doi.org/10.2139/ssrn.3322306.
100. Abbott & Bogenschneider, *supra* n. 94, at pp. 172-173.

its. Therefore, a higher tax rate will be levied on a higher taxable basis, resulting in higher revenue collection for governments, besides increasing taxation on capital instead of labour.

4.2.2.3.3. Automation taxes

Another idea is the implementation of automation taxes. Such taxes are addressed to businesses/companies which engage fewer and fewer employees. In other words, these taxes aim at reducing the laying off and/or replacement of employees by AI/robots. A few options to introduce such taxes is discussed hereafter.

One option for introducing such taxes is to charge employers (businesses) for unemployment insurance in proportion to their human employment rate. This means that the higher the rate of layoffs or replacements made, the more the employer would contribute to government revenue by paying more taxes.[101] It would indeed work as a kind of compensation for layoffs. Therefore, businesses that decide to replace the workforce by using AI/robots would contribute more since the government would need more money to help those people who are out of the market, even temporarily. In this regard, an agency could be created to develop a system and control and collect all data concerning layoffs and replacement to inform tax authorities.

Another option is the idea of a corporate self-employment tax that would increase the tax burden for companies that produce goods or provide services without using a human workforce. This model could be compared to the self-employment tax for individuals enforced in some jurisdictions (situations where the owner of a small business is supposed to pay social security, similar to the social security that would be paid on their wages if they were an employee).[102] The main goal here is also increasing the collection to guarantee support to those who are unemployed due to automation. For calculation purposes, a ratio of corporate profits to gross employee compensation expense could be used. In case this ratio surpasses a threshold fixed by the government, additional taxes could be applied on corporate profits. These additional taxes would reflect the amount that the companies avoided paying because of implementing automation. Alternatively, instead of profit ratio, the sales ratio could also be contemplated for this purpose.

Lastly, an alternate proposal to curtail investment in technology is to extend tax benefits for companies that hire people. Those tax benefits, for example, could be granted by means of reduction or exemption from social contributions or contributions to Medicare systems levied on the payroll. Another tax benefit that could be given is the super-deduction of wages paid to humans.[103] These benefits would ensure that humans and machines are treated, for tax purposes from the employer standpoint, in the same manner or at least in a very similar way, since machines do not receive wages subject to taxation, and several jurisdictions grant accelerated tax deductions for the implementation of technologies that are presumably supposed to increase productivity.

Another solution presented is to introduce narrowly targeted taxes. In 2017, the Grand Council of the Canton of Geneva, in Switzerland, proposed a tax on each automated cashier installed in the retail sector – a tax on automated cashiers. The automated cashier

101. Id., at pp. 170-171.
102. Id., at pp. 171-172.
103. Id., at p. 171.

was defined as "any device for the payment of purchases that the customer can use without the intervention of store personnel".[104] This proposal was rejected. In 2018, San Francisco County and City enacted AB1184 establishing a new tax on rides made by autonomous vehicles.[105] According to the text, the tax will be levied "on each ride originating in the City and County of San Francisco provided by an autonomous vehicle, whether facilitated by a transportation network company or any other person, or by a participating driver in an amount not to exceed 3.25% of net rider fares, as defined, for a ride and 1.5% of net rider fares for a shared ride". Both models, instead of imposing taxes on AI/robots in general, chose to levy taxes on a specific new service or type of automation. Such taxes therefore intend to create a direct link between the tax imposed and remediation of job losses.[106]

4.2.2.4. VAT measure

Sam Mitha[107] suggests taxation on the valued added by the implementation of AI/robots. This proposal is based on the premise that, by adopting those technologies, companies are supposed to be more profitable. It is proposed, therefore, that businesses monitor the value that was aggregated due to the AI/robots and subject such amount to a higher tax rate (VAT rate). As an alternative, the author proposes that businesses whose ratio of turnover to the number of employees was above an established threshold could be subject also to a higher tax rate of VAT on their goods and services. Another option is to disallow input VAT on automation-related purchases.[108]

4.3. Assessment of the targeted measures

Policy rationale

All the proposals discussed above are based on the policy rationale that AI/robots can cause widespread unemployment and replace humans. However, the data put forward in section 3. indicates that there are different views on this issue and a purely employment-focused view will lead to inconclusive results. Hence, the policy rationale of all the above proposals is indeed questionable. The authors would thus be inclined to say that it is not advisable to implement changes on the basis of potential losses of tax revenues that have not been established.

Neutrality

Assuming the policy rationale can be justified, we start with neutrality. On the one hand, it could be argued that the tax system should be neutral in the sense that it should not incentivize businesses to engage AI/robots as compared to humans. In other words, as robots can perform tasks similar to those carried out by humans, the tax costs to engage AI/robots should be as high as the tax costs to hire the human workforce.

104. CH: Projet de loi 12064-A, Article 7, available at https://ge.ch/grandconseil/data/texte/PL12064A.pdf.
105. US: Assembly Bill 1184, available at https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201720180AB1184. Curiously, since 10 March 2020, Uber started testing autonomous vehicles in the city. A.J. Hawkins, *Uber has Resumed Testing its Self-driving Cars in San Francisco*, The Verge (10 Mar. 2020), available at https://www.theverge.com/2020/3/10/21172213/uber-self-driving-car-resume-testing-san-francisco-crash.
106. Kovacev, *supra* n. 96, p. 207.
107. S. Mitha, *Robots, Technological Change and Taxation*, Tax Journal (14 Sept. 2017), available at https://www.taxjournal.com/articles/robots-technological-change-and-taxation-14092017.
108. Barros, *supra* n. 54, at p. 13.

But the key fundamental question is: are AI/robots really comparable to human beings and workers? In our view, human beings, in comparison to AI/robots, have features such as free will, creativity, emotional experience, gut feelings, etc., and these attributes are relevant even in performing routine jobs. In light of these attributes, it seems that AI/robots and humans are not comparable and, therefore, the neutrality argument that considers AI/robots on an equal footing with humans is incorrect.[109] Consequently, any proposals that are built on the logic that AI/robots are perfect or close substitutes for humans are indeed questionable. Such proposals also do not factor in the possibility that a substituted individual, unlike AI/robots, can find alternate employment. Moreover, if businesses are taxed higher if they invest in AI/robots (e.g. if they are classified as capital assets and depreciation expenses are limited or restricted) as compared to other capital investments, then it is quite clear that the tax system gives preference to investments in the latter (e.g. capital expenses incurred for developing a new generic pharmaceutical product). There seems to be no justification for this.[110]

On the other hand, it could be argued that all the proposals made in sections 4.2.1. and 4.2.2. target taxpayers (especially businesses) engaged in electronic commerce, or businesses and industries in automation (for example, measures that deem AI/robots as taxable subjects or target the use of AI/robots).[111] In other words, taxpayers (especially businesses) who create or who own or use AI/robots are impacted by such measures. Thus, such taxes (including automation taxes) could be considered non-neutral[112] for businesses that create or use such technologies, as such businesses would need to comply with special rules. On a separate but related note, the OECD in the context of Action 1 of the BEPS Project has repeatedly stated that the digital economy cannot be ring-fenced. As a result, digital service taxes (DSTs) or digital permanent establishments (PEs) are widely criticized in academic scholarship, as they breach the principle of neutrality since they apply to selected electronic businesses or business models. In light of that logic, the targeted proposals highlighted above may amount to ring fencing due to their selected applicability or impact on automated businesses.

Simplicity and certainty

Moving on to simplicity and certainty, taxing AI/robots as independent taxable subjects (*see* section 4.2.1.) leads to several complications and surely creates an uncertain tax environment. To start with, the question arises as to how to define AI/robots.[113] Should the definition include a simple vending machine or an ATM, which has already been part of our daily lives for a considerable time, or a sophisticated self-driving car? How different is a self-driving car from an autopilot, which has been used in airplanes for a very long time?

Oberson, for example, suggests that AI/robots possess sufficient autonomy and a capacity to learn, progress and make decisions.[114] Englisch affirms that "a definition must reconcile the two potentially conflicting objectives of legal certainty, on the one hand, and flexibility, on the other hand. It must allow for a clear delimitation of the substantive – or personal – scope

109. Oberson, *supra* n. 85, at p. 133.
110. Mazur, *supra* n. 54, at p. 299.
111. Barros, *supra* n. 54, at p. 8.
112. M. Burton, *Economic Income and the Search for a Fair and Simple Income Tax* (1996), unpublished paper presented to the 1996 Conference of the Australian Tax Teachers' Association.
113. For a critique, *see also* Mazur, *supra* n. 54, at pp. 298-299.
114. Oberson, *supra* n. 85, at pp. 13 and 15.

of the tax, while at the same time it must be future-proof and comprehensive enough to take into account the relevant technological progress".[115] Also, Falcão recommends that a proper definition must consider the objectives of the robot tax, in addition to the socio-economic situation of the jurisdiction that aims at defining it,[116] as shown by the importance of the data and analysis done in section 3.

Even among roboticists, there is no consensus concerning this concept. A robot can be defined simply as "a machine controlled by a computer that is used to perform jobs automatically".[117] On the other hand, ISO 8373:2012 states that a robot is an "actuated mechanism programmable in two or more axes (4.3) with a degree of autonomy (2.2), moving within its environment, to perform intended tasks".[118]

Although the European Union rejected a proposal to implement a robot tax,[119] the Parliament drafted some recommendations related to Civil Law Rules on Robotics and approved the text on 16 February 2017. The Resolution does not define AI/robots, but provides in the Annex some common features, such as: (i) capacity to acquire autonomy through sensors and/or by exchanging data (inter-connectivity) and the analysis of those data; (ii) capacity to learn from experience and by interaction; (iii) form of robot's physical support; and (iv) capacity to adapt its behaviour and actions to the environment.[120]

In light of the above differences, consider the following example by William Weissman:

Take a calculator as an example: it can help workers to perform their calculation tasks quicker. Would it be considered a robot if formulas and algorithms are used? How can it be determined if the use of a calculator causes job losses or only slows hiring?[121]

Thus, the following proposals, as a start, would require a proper definition of the term AI/robots. Developing a definition for both non-tax law and tax law purposes could indeed be challenging.[122]

115. J. Englisch, *Digitalisation and the Future of National Tax Systems: Taxing Robots?*, SSRN Working Papers, p. 4 (5 Sept. 2018), available at http://dx.doi.org/10.2139/ssrn.3244670.
116. T. Falcão, *Should My Dishwasher Pay a Robot Tax?*, Tax Notes International (11 June 2018).
117. Cambridge Dictionary, available at https://dictionary.cambridge.org/dictionary/english/robot.
118. ISO, available at https://www.iso.org/obp/ui/#iso:std:iso:8373:ed-2:v1:en. This definition is also used by the International Federation of Robots (IFR), as it can be verified in its official website, available at https://ifr.org/industrial-robots. Moreover, the IFR has adopted a classification since 2004 based on robots' mechanical structure, which is divided into seven categories: (i) linear robots (including cartesian and gantry robots); (ii) SCARA robot (a robot which has two parallel rotary joints to provide compliance in a plane); (iii) articulated robot (a robot whose arm has at least three rotary joints); (iv) parallel/delta robot (a robot whose arms have concurrent prismatic or rotary joints); (v) cylindrical robot (a robot whose axes form a cylindrical coordinate system); (vi) others; and (vii) Not classified. (IFR, *WR Industrial Robots 2019*, p. 24 (2019), available at https://ifr.org/downloads/press2018/WR Industrial Robots 2019_Chapter_1.pdf.)
119. Reuters, *European Parliament Calls for Robot Law, Rejects Robot Tax,* Technology News (16 Feb. 2017), available at https://www.reuters.com/article/us-europe-robots-lawmaking/european-parliament-calls-for-robot-law-rejects-robot-tax-idUSKBN15V2KM.
120. EU: Resolution of 16 February 2017 with recommendations to the Commission on Civil Law Rules on Robotics (2015/2103(INL)), available at https://www.europarl.europa.eu/doceo/document/TA-8-2017-0051_EN.html.
121. W.H. Weissman, *Why Robot Taxes Won't Work*, Tax Notes Commentaries (5 Apr. 2018) Journal Articles & Papers IBFD.
122. On this issue, *see also* L.L. Carvalho, *Spiritus Ex Machina: Addressing the Unique BEPS Issues of Autonomous Artificial Intelligence by Using 'Personality' and 'Residence'*, 47 Intertax 5, pp. 430-433 (2019).

Despite the challenges associated with the definition, the first issue in attributing income to AI/robots is the recognition of "legal personality". It should be mentioned that "personality" does not involve a physical or natural concept, but the capability of being the subject of rights and obligations. This would involve the possible for AI/robots, for example, to hold assets, sue or be sued, enter into agreements and so on.

To illustrate, Sophia, a social humanoid robot, created by Hanson Robotics,[123] was given citizenship of Saudi Arabia (in 2017).[124] It means, in theory, that she has the same rights and obligations of any woman who has Saudi citizenship, regardless of what those rights and obligations consist in. In this sense, it may appropriate to state that no further information about specific rights and duties that could be attributed to Sophia has been published. This development raised several issues[125] with respect to the legal framework applicable to Sophia. Overall, the case was considered to be a publicity stunt, especially after Saudi Arabia announced being open to digital transformation.[126]

Although AI/robots may already have many features similar to human beings, such as the ability to communicate, knowledge with respect to itself and the external world as well as some level of creativity, as demonstrated by Sophia, it does not seem reasonable to equate them to an individual. This is because a human being behind the AI/robot could always "pull the plug" and deactivate such technology (unless judgement day has arrived and machines take over and start "pulling the plug" on humans as seen in the movie Terminator). Therefore, the only reasonable proposition would be to grant them a legal personality similar to legal entities (such as corporations). However, treating them as legal entities (corporations) would entail the creation of a "robotics law" (similar to company law) which would be responsible for governing such legal subjects (e.g. creation, capability of holding rights, assets incurring liabilities and expenses and so on). Moreover, changes will need to be made to other fields of law such as contract or commercial law, which would govern the commercial transactions entered into by such legal subjects. Also, it should be noted that companies are common forms through which individuals do business. It does not make any sense to set up "robotics law", as individuals cannot do business through such technology. At most, they can benefit from such technology. Given that a considerable amount of change will be required to the existing legal system, granting them legal personality seems a herculean task. Furthermore, to put it across bluntly, people who own or govern corporations and corporations employ people. It is hard to imagine AI/robots owing or governing corporations or AI/robots employing people themselves. Also, in the "real world", it is difficult to imagine at present AI/robots employing other AI/robots.

Additionally, the recognition of legal personality does not grant tax capacity, unless robots are identified and considered as taxable subjects and subject to fair and equitable taxation.[127]

123. Hanson Robotics, *Sophia*, available at https://www.hansonrobotics.com/sophia/. *See* Sophia's interaction with the author and life coach Tony Robbins, with an emphasis on "her" cognitive ability, available at https://youtu.be/Sq36J9pNaEo.
124. O. Cuthbert, *Saudi Arabia Becomes First Country to Grant Citizenship to a Robot*, Arab News (26 Oct. 2017), available at https://www.arabnews.com/node/1183166/saudi-arabia.
125. R.D. Hart. *Saudi Arabia's Robot Citizen is Eroding Human Rights*, Quartz (14 Feb. 2018), available at https://qz.com/1205017/saudi-arabias-robot-citizen-is-eroding-human-rights/.
126. BBC News, *Saudi Arabia to Lift Ban on Internet Calls* (20 Sept. 2017), available at https://www.bbc.com/news/world-middle-east-41332743.
127. Oberson, *supra* n. 85, at p. 21.

If we assume that AI/robots can be defined[128] for tax law purposes (for example, based on the aforementioned hypothetical "robotics law", which would be extremely difficult to design), the question is whether AI/robots have tax capacity. Two principles will be discussed here, that is, the benefit principle as well as the ability to pay principle.

It is quite obvious that AI/robots personally will not benefit from services financed by the state, among which education, health services, retirement, sick leave, social benefits and so forth. Neither will they personally benefit from public infrastructures such as roads, highways and so on. Moreover, they independently will not benefit from a state's legal framework. On a lighter note, Robert Atkinson asks "… If the robot is paying social security taxes, could it retire after 40 years and collect social security? If the robot breaks, does it get disability pay?".[129] It could be argued that corporations also do not benefit from the above infrastructure. However, there are a few differences here. Corporations benefit from a state's legal framework. Also, the people they employ benefit from the state's public infrastructure. Unless and until an appropriate legal framework is developed to govern and regulate AI/robots, it seems taxation of such technology as an independent taxable person conflicts with the benefit principle. Assuming a legal framework is developed, a state could be justified to charge a fee vis-à-vis this framework. This fee would work as the price paid in exchange for a public service such as toll fees or the taxes paid for the use of a public infrastructure, as occurs with airports. This kind of fee needs to have a direct link with the service covered by the state. According to Prof. Oberson,[130] by applying such a concept to robots, the government could charge a fee "as a compensation for specific surveillance, certification or public infrastructures installed for the use or control of robots". However, since the tax design only covers the cost of the provision of the service, it would not cover the possible deficit that uncollected payroll-based taxes would leave. Also, it would not cover the effect that robots may possibly cause on the labour market.[131] Even if a state manages to develop legal infrastructure to govern AI/robots, then the natural question is whether AI/robots have the capacity to pay any fees/taxes to the state.

In this regard, it is also quite obvious that AI/robots will not have the ability to pay their own taxes (lack of financial capacity). The ability to pay will only be present when they can make income/profits. As discussed previously in this section, unless and until AI/robots are allocated a separate legal personality, as well as financial capacity, with the effect that they can engage in commercial transactions and make profits, one would have to be quite oblivious to assume that they can pay their fair share of taxes. In this regard, Prof. Englisch states that "robots without an autonomously defined personal spending capacity could not even theoretically bear the intended income tax burden; instead, the incidence of the income tax would always fall on someone else (most likely primarily on their owner). Accordingly, as

128. With respect to this issue, Dr Falcão asks: "Is a robot a tangible asset? Can it be a process? Is a robot an asset capable of executing an action that would typically be executed by a human (is the definition of a robot intrinsically connected to its ability to perform human jobs), or is a robot also a process that can outperform human beings?". Falcão, *supra* n. 72. Moreover, Sam Mitha affirms that "given the range and sophistication of robots likely to come into development, the definition needs to be 'form neutral'; i.e. it should include all autonomous robots, bots and similar smart AI machines. Any proposed definition should be tested from not just from legal perspectives, but also from economic, technological and constitutional approaches". Mitha, *supra* n. 107.
129. Atkinson, *supra* n. 50, at p. 7.
130. Oberson, *supra* n. 85, at p. 130.
131. Barros, *supra* n. 54, at pp. 10-11.

long as robots do not have self-defined personal needs, making them liable to pay income tax cannot be justified on grounds of the ability to pay principle".[132]

Assuming that all the foregoing challenges can be overcome, one option is to treat AI/robots as individuals. However, as discussed previously, AI/robots are not comparable to human beings. In fact, the latter can "pull the plug" on the former. Thus, we will not venture into a discussion on treating AI/robots as deemed human beings and attributing income (e.g. deemed employment income) to them, as that concept is flawed in its entirety.

As a result, the only viable option is to treat them as taxable legal entity type subjects. However, our opinion is that AI/robots cannot be comparable to legal entities such as corporations. On the one hand, corporations are legal fictions created by commercial law and as a result they have to adhere to minimum capital requirements upon creation, ongoing requirements with respect to its functioning such as bookkeeping, board meetings, shareholding reporting and so forth. It is hard to imagine the development of similar requirements for AI/robots, for example, an autonomous vehicle. On the other hand, corporations are not autonomous like certain types of AI/robots. Corporations are always driven by individuals. Thus, venturing into developing a regime for AI/robots on the assumption that they are similar to legal entities is simply erroneous.

Assuming they are treated as separate legal subjects, several issues arise, and to keep this article within manageable proportions, the authors will analyse only a few selected issues. Considering that they are treated as opaque taxable subjects for direct corporate tax purposes, an initial question is how do you define "residency of such legal subjects"? Is it their place of registration or place of use or place of business? Can they trigger dual residence issues? The second question is, what are the taxable objects of this legal construction? In other words, will AI/robots receive active business income? How do you determine this income? For example, let us assume that Company X owns an autonomous vehicle Y. The vehicle is used to offer rides to customers (individuals). The income generated from such a vehicle, under current rules, is attributed to Company X. The proponents of this tax now argue that the income should belong to Y, but does this make sense? This could undoubtedly lead to economic double taxation when the owner is also taxed on the income derived by the AI/robots. Appropriate rules for avoiding such economic double taxation will need to be built in, which adds to the layer of complexity. Third, what is the taxable base of AI/robots? Are they entitled to any deductions? In this regard, Prof. Oberson[133] argues that AI/robots should be taxed on a gross revenue basis. The question is: how will this gross revenue be determined in a situation where Y spends 50% of its running time on providing services to customers and the balance time driving managers of Company X? Will the remuneration of this 50% (for self-usage time) be determined by using the arm's length standard, that is, carrying out a transfer pricing analysis?[134] Also, if AI/robots are allocated financial capacity, should they not pay taxes on a net basis? Deemed costs, in the example given, could include costs for paying registration fees to the state department that manages the "robotics law", hiring other AI/robots, car fuel expenses, etc. Fourth, what is the tax rate of this legal construction? Is it the same as corporate tax? Moreover, economic double taxation issues could arise if corporate tax is levied at the level of the AI/robot (Y) as well as the business that uses

132. Englisch, *supra* n. 115, at p. 4.
133. Oberson, *supra* n. 85, at p. 133.
134. Id., at p. 115.

them (Company X). How will these issues be mitigated? Lastly, the cross-border dimension will need to be considered. Can AI/robots access tax treaties? How will you determine their residence? How will you deal with dual residence? Which distributive rule will cover their income and so on? These are indeed challenging questions that will require a significant change to the current system.[135] While answers could be found to all these questions,[136] naturally, such changes will make the legislation complex and enhance tax uncertainty. So, the question is: do we really want to go down this path and make tax law much more difficult to understand and implement?

With respect to the discussion on treating AI/robots as independent taxable persons for VAT purposes, once again, to keep this article within manageable proportions, the authors will only discuss a few issues. First, can AI/robots be taxable persons? According to the EU VAT Directive[137] (article 9), such persons can be "any person who, independently, carries out in any place any economic activity, whatever the purpose or results of that activity". The issue here is with the term "independently". To what extent can an AI/robot that, for now, has some human control behind it, be considered independent? It is definitely necessary to develop this concept for VAT purposes. Arguably, if we allocate separate legal and tax personality then this step can be overcome. But this would not be enough, as sufficient financial capacity (funds) will need to be allocated to the AI/robots. Second, what are the taxable objects? Let us go back to our example on autonomous vehicles discussed before. Under the current rules, Company X is considered to provide a taxable service. The proponents of this tax now argue that the service should be attributed to Y and Y shall charge VAT. This is clearly a case of double taxation. Also, will Y be allowed to claim input VAT? How will this be done? How will all these issues be solved? The proponents of this proposal also argue that blockchain technology can be used to streamline input and output VAT that is applicable to AI/robots.[138] In this regard, it seems that blockchain technology's "use case" is overstated in indirect tax matters as this technology has many challenges. Dr Bal states

> every emerging technology goes through a hype stage, and then people start questioning whether it will withstand the test of time. Despite being in existence for over 10 years, blockchain technology still has not been widely adopted. Blockchain would solve problems such as fragmented information systems, limited supply chain visibility, and the need for real-time data traceability that are commonly encountered in the VAT system. However, in the author's opinion, there are still serious limitations to the widespread adoption of blockchain technology in the VAT sector, the most important of which are the cost and effort needed to implement the system and the lack of the requisite supporting innovation ecosystem. The technology itself also poses several challenges that are yet to be resolved. Finally, there are many regulatory difficulties — issues that are just as important to overcome as the technological ones.[139]

To summarize, the proposal does not seem feasible at all.[140]

Accordingly, taxing AI/robots as separate taxable subjects leads to several complications from a direct or indirect tax perspective, in particular, defining and allocating legal/tax

135. Id., at p. 149-155. The author highlights these issues but does not give sufficient answers.
136. For an answer to a few questions, *see also* Carvalho, *supra* n. 122, at pp. 440-443. However, due to the use of subjective terminology, the proposals of this author could trigger substantial tax uncertainty.
137. EU: Council Directive 2006/112/EC (28 Nov. 2006), available at https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=celex%3A32006L0112.
138. Oberson, *supra* n. 85, at p. 135.
139. A. Bal, *Between Hype and Disillusionment: Will a VAT Blockchain Ever Be Possible in the EU?*, Tax Notes International, p. 902 (24 Feb. 2020).
140. Barros, *supra* n. 54, at pp. 8-9.

personality as well as determining residency, taxable object streams, taxable base and so on, in particular, defining and allocating legal/tax personality as well as determining residency, taxable object streams, taxable base, etc.

The measures targeting the use of AI/robots (*see* section 4.2.2.) will need to define AI/robots in a general manner or will require differentiating between AI/robots that could complement humans or AI/robots that could substitute humans. As discussed previously in this section, this is indeed a challenging task.[141] Moreover, several proposals may require rules to calculate the taxable value linked to AI/robots or rules to identify levels of automation.

For example, the introduction of a robot usage tax, that is, attributing a deemed income to the owner (*see* section 4.2.2.1.) relies on allocating an arm's length salary remuneration to the owner for the usage of the AI/robot.[142] That said, determining the salary, nevertheless, is difficult, taking into account that AI/robots can replace combined functions.[143] Additionally, in some cases, AI/robots can work together with humans or other robots and, in such a case, a functional analysis, similar to what is done when carrying out a transfer pricing analysis will need to be undertaken to determine the taxable activities and taxable income that should be attributable.[144] Moreover, the proposal would involve looking into comparable salaries available in the public domain. It could be extremely difficult to find such comparables,[145] and when available, reasonably accurate adjustments will need to be made. We all know that using the arm's length principle to allocate profits to various establishments in a multinational enterprise is a challenging task, in particular performing a functional and comparability analysis.[146] Also, disputes with respect to the arm's length principle are increasing all over the world. Thus, it would not make any sense going down the "arm's length" path, which provides for subjective outcomes.[147] Professor Mazur argues that such a tax would be unworkable in practice.[148] Additionally, these rules lead to economic double taxation, and an appropriate framework will need to be developed to deal with resolving these matters, which would once again add to the level of complexity.

For similar reasons, introducing an object tax on AI/robots at the level of the owner (*see* section 4.2.2.2.) would be tedious, as it would be difficult to estimate their fair market values on an annual basis (for example, an autonomous car). Moreover, considering that some of the robots only have the artificial intelligence without having a physical body (chatbot, for instance, usually used for customer service), it would be difficult to implement this type

141. Mazur, *supra* n. 54, at p. 299.
142. Englisch, *supra* n. 115, at p. 20.
143. Barros, *supra* n. 54, at p. 8.
144. Oberson, *supra* n. 85, at p. 115.
145. IMF, OECD, UN and WBG, *The Platform for Collaboration on Tax – A Toolkit for Addressing Difficulties in Accessing Comparables Data for Transfer Pricing Analyses* (Apr. 2017), available at https://www.oecd.org/tax/toolkit-on-comparability-and-mineral-pricing.pdf.
146. R. Avi-Yonah, *Formulary Apportionment – Myths and Prospects: Promoting Better International Tax Policies by Utilizing the Misunderstood and Under-Theorized Formulary Alternative*, 3 World Tax J. 3, p. 377 (2011), Journal Articles & Papers IBFD. *See also* X. Oberson, *Taxing Robots? From the Emergence of an Electronic Ability to Pay to a Tax on Robots or the Use of Robots*, 9 World Tax J. 2 (2017), Journal Articles & Papers IBFD.
147. In this regard, *see* V. Chand, A. Turina & L. Ballivet, *Profit Allocation within MNEs in Light of the Ongoing Digital Debate on Pillar I – A "2020 Compromise"?: From Using A Facts and Circumstances Analysis or Allocation Keys to Predetermined Allocation Approaches*, 12 World Tax J. 3 (2020), Journal Articles & Papers IBFD.
148. Mazur, *supra* n. 54, at pp. 301-302.

of wealth or object tax apart from, again, how to delimit this concept for law and taxation purposes.[149]

Measures that restrict deductions could also be complex (and require anti-avoidance rules[150]). Consider the Korean example (*see* section 4.2.2.3.). Dimitropoulou indicates that this regime was full of complexity as the proposals scope was not well-defined, i.e. investments in technological equipment that would qualify for a tax credit and investments in technological equipment that would not qualify for such an incentive.[151] Moreover, any proposal that would require definitions of AI/robots that are close substitutes to the human workforce, and AI/robots that are complementary to the human workforce, will be inherently complex, as defining such boundaries is indeed a challenging task for policymakers.[152]

Some challenges might complicate the implementation of the higher corporate tax rates for automatized businesses apart from being non-neutral (*see* section 4.2.2.3.2.). For example, when should a business be classified as an "automated business" or not? Will a business be an automated business if it replaces 5% of the human workforce, 10% of the workforce, 20% of the workforce or more than half of the workforce? How will these percentages be measured? These questions add complexity to the proposal.

Automation-related taxes (*see* section 4.2.2.3.3.), depending on their design, could also be complex to implement. For instance, if the ratios pegged to such taxes are subjective and not well-defined, then tax uncertainty rises.[153] Moreover, as the ratios are linked to the ratio of the workforce to sales or profits, the approach effectively penalizes all businesses (not only automated businesses) that have high income and low headcounts.[154] In addition, if the tax is pegged to employees or revenue ratios, several companies in the retail sector would be impacted negatively as they have high amounts of revenue but low profit margins. Overall, such taxes clearly stunt productivity and innovation. Granting tax incentives for employing humans instead of machines by exempting social security contributions may break the social security system. Such incentives would also not be consistent with the underlying idea of solving the problem of reduced tax revenues.[155]

Finally, targeted VAT measures (*see* section 4.2.2.4.) wherein businesses need to separately estimate the value added by robots could create complexity[156] and negatively impact investments in view of the effect of double or multiple taxation. As Sam Mitha states, "it would be highly complex, costly and unpopular with businesses. It would also conflict with the government's unstated objective of maintaining the continuity and congruency of the VAT regime with that in the EU".[157]

Efficiency aspects (compliance costs)

Moving to efficiency aspects (compliance costs), as discussed above, all proposals that are dependent on (i) defining AI/robots; or (ii) defining AI/robots that substitute human labour

149. Barros, *supra* n. 54, at p. 10.
150. Id., at p. 13.
151. See also Dimitropoulou, *supra* n. 97, at sec. 3.1.2.
152. Mazur, *supra* n. 54, at p. 302.
153. W. Meisel, *The Software Society: Cultural and Economic Impact* pp. 220-221 (Trafford Publishing 2014).
154. Mazur, *supra* n. 54, at p. 303; and Atkinson, *supra* n. 50, at pp. 16-17.
155. Abbott & Bogenschneider, *supra* n. 94, at p. 171.
156. Barros, *supra* n. 54, at p. 13.
157. Mitha, *supra* n. 107.

and those that do not; and (iii) require calculations of value linked to robots will enhance complexity, thereby increasing tax uncertainty and ultimately resulting in tax disputes.[158] The cost of complying with such taxes will undoubtedly be high for taxpayers (especially companies) as well as tax administrations, as "these proposals involve substantial elements of arbitrariness and … unjustified line-drawing".[159] Given the complexity, the adoption of such measures is to be discouraged.[160]

Effectiveness and fairness considerations

First, from an effectiveness standpoint, the authors believe that proposals that are dependent on defining AI/robots would lead to a compliance nightmare and even if this hurdle is overcome, governments will find it extremely difficult to enforce the collection of such taxes. For example, if more than 10 million self-driven autonomous vehicles enter into the market (e.g. US market) then, under the proposals that deal with taxing AI/robots as independent taxable subjects or deeming a notional salary in the hands of the owner, we would have to assess taxes with respect to 10 million new taxpayers. In this regard, it could well be possible that owners would be tempted to not disclose the ownership of AI/robots on their tax return. Also, it could be difficult for the tax administration to carry out an audit to understand whether or not a taxpayer uses AI/robots or whether or not an AI/robot is autonomous. Thus, tax collection and control could be a challenge.

Second, from a fairness standpoint, the above proposals could trigger profit shifting as they hamper innovation (discussed subsequently).[161] It is obvious to the authors that if a state introduces the foregoing proposals (on a unilateral basis), then corporate taxpayers would be tempted to move their activities to another location that does not introduce such measures. For example, if tax incentives in R&D in automation are penalized or scaled back, then the taxpayer will simply move its activities to a jurisdiction that is ready to provide it with input or output incentives. Moreover, if a high-net-worth individual uses several AI/robots and if that individual would be required to pay taxes on deemed employment income attributed to the AI/robots, then that individual could contemplate moving to another jurisdiction wherein they are not subject to such taxes and compliance requirements. But this phenomenon is not new. As long as taxes are levied on mobile taxpayers (individuals or companies), profit shifting will continue to exist.

Flexibility

Last, the proposals could also breach the principle of flexibility.[162] First, the tax loss issues triggered by AI/robots, at this stage, seem a probable but not an actual concern. Thus, there is no need to introduce taxes on such innovations. Second, as discussed above, most of the proposals will require defining AI/robots. A narrow definition could lead to the legislation being inflexible when taking into account future developments, whereas with a broad definition it could well be possible that a vacuum cleaner, which people have at home, could also be classified as a robot. Third, some proposals on taxing AI/robots could lead to tax evasion (due to non-compliance) and possibly profit shifting. Fourth, some of the proposals apply only to selected situations or to selected businesses. It could well be possible that in the near

158. Barros, *supra* n. 54, at pp. 15-16.
159. Mazur, *supra* n. 54, at p. 303.
160. Barros, *supra* n. 54, at p. 18.
161. Mazur, *supra* n. 54, at pp. 300-301.
162. OECD, *supra* n. 78, at p. 10; and Action 1 Final Report, *supra* n. 78, at p. 20.

future, all individuals/all businesses could use AI/robots to a certain extent and benefit from them. Accordingly, designing AI/robot-related taxes only for selected situations would lead to the outcome that the system for taxation is neither flexible nor dynamic.

4.4. Concluding remarks from an innovation perspective

In light of the discussion above, it does not come as a surprise that several states have rejected the idea of a tax on AI/Robots. The UK Parliament rejected the idea of imposing robot taxes.[163] It states: "in his evidence to us, the Minister indicated that the Government too found the idea of a robot tax in current automation environment as 'perverse'. We need more robots and not fewer. A tax on them would further discourage take up. We do not believe that a tax on robots is in the interest of businesses or workers in the UK".[164] A similar conclusion was reached in Switzerland.[165] A statement from the Swiss Federal Council (English translation) declares "the report issued by the Federal Council on 11 January 2017 on the main framework conditions concerning the digital economy, which analyses the situation in the context of the Digital Switzerland Strategy, does not foresee any immediate need to fundamentally revise the social and fiscal systems in force. In addition, current knowledge does not allow us to anticipate a negative effect of the digitization of the economy on employment".[166] In 2017, the European Union in turn rejected the adoption of robot taxation.[167]

Moreover, in light of the BEPS initiative, in particular BEPS Action 5, many governments have introduced input and output-related tax incentives (IP boxes) for promoting R&D.[168] AI (technology) would typically fall under the category of qualifying IP assets.[169] Thus, imposing taxes on such assets would be contrary to the R&D policy of many states. They could then be considered to hamper innovation.[170] On this issue, the UK Parliament, by comparing its own tax system with Japan's system for taxing AI/robots, indeed stated "we

163. UK Parliament, Energy and Industrial Strategy Committee, *Businesses Face Being Left Behind by Transition to New Technologies* (18 Sept. 2019), available at https://www.parliament.uk/business/committees/committees-a-z/commons-select/business-energy-industrial-strategy/news-parliament-2017/automation-and-future-of-work-report-published-17-19/.

164. UK Parliament, Parliamentary Business, *Automation and the Industrial Strategy*, para. 41 (18 Sept. 2019), available at https://publications.parliament.uk/pa/cm201719/cmselect/cmbeis/1093/109307.htm#_idTextAnchor020.

165. In December 2018, the Swiss Federal Council considered taxation of AI/robots as unnecessary. U. Lomas, *Swiss 'Robot Taxes' Deemed Unnecessary*, Wolters Kluwer (21 Dec. 2018), available at https://www.taxnews.com/news/Swiss_Robot_Taxes_Deemed_Unnecessary____96985.html.

166. The original text can be found in French : "*Le rapport du Conseil fédéral du 11 janvier 2017 sur les principales conditions-cadres pour l'économie numérique, qui dresse un état des lieux dans le cadre de la Stratégie Suisse numérique, ne prévoit aucun besoin immédiat de réviser fondamentalement les systèmes social et fiscal en vigueur. De plus, les connaissances actuelles ne permettent pas d'anticiper un effet négatif de la numérisation de l'économie sur l'emploi total*". R. Mathias, *Evaluer l'impact des Robots sur le Système des Assurances Sociales*, The Federal Assembly — The Swiss Parliament (1 Mar. 2017), available at https://www.parlament.ch/en/ratsbetrieb/suche-curia-vista/geschaeft?AffairId=20173037.

167. EU Resolution of 16 February 2017, *supra* n. 120.

168. For further information on the status of IP regimes, *see* OECD, *Harmful Tax Practices – 2018 Progress Report on Preferential Regimes* (OECD 2018), available at https://www.oecd-ilibrary.org/docserver/9789264311480-en.pdf?expires=1590739448&id=id&accname=guest&checksum=B9B32E7B6F77E13549E637DBC877B04E.

169. For further information on the definition of an IP asset, OECD/G20, *Countering Harmful Tax Practices More Effectively, Taking into Account Transparency and Substance – Action 5: 2015 Final Report* paras. 34-37 (OECD 2015), available at https://www.oecd-ilibrary.org/docserver/9789264241190-en.pdf?expires=1590739675&id=id&accname=guest&checksum=1D93F557DDD62C86D3A5B435C5E5FBF1.

170. Mazur, *supra* n. 54, at pp. 299-300.

recommend that the Government brings forward proposals in the next budget for a new tax incentive designed to encourage investment in new technology, such as automation and robotics".[171]

With respect to encouraging investments, Italy's 2020 Budget (Law no. 160 of 27 December 2019)[172] introduced a tax credit ranging from 6% to 40% – which is equivalent to a cash grant – that can be enjoyed by investing in Industry 4.0 assets. For example, investments in machinery and other equipment that are controlled by computer systems and/or operated by smart sensors or drivers and drives linked to the computer system of an industry or factory. Taxpayers can also offset such credit with some other tax debts/liabilities. There are some requirements to classify an asset as a "Industry 4.0" asset. The Law at issue entered into force on 1 January 2020 and replaces the previous provisions known as hyper or super-depreciation.[173]

Similarly, Poland has announced its intention to encourage investments in robots from 1 January 2021 onwards. The idea is to provide a tax relief that would allow both individuals and companies (regardless of sector or size) additionally to deduct 50% of costs relating to this type of investment. This measure will also encompass costs regarding leasing robots, the acquisition of software required to operate such robots and staff training.[174]

One can also note that perhaps the proposals to provide AI/robots with separate tax personality or to install on them specific taxes still leave us with an unanswered question of what would be the justification for such innovations. Namely, as all technology makes human labour unnecessary, relying on such a logic we could call for a tax on all technology that lowers the need for the involvement of people. Would this also encompass taxing all technology based on e.g. the wheel or the leverage mechanism, as these have for millennia made human work superfluous. In other words, apart from flashy details, what is the fundamental difference between the wheel and a robot?

If AI/robots were to fundamentally alter our behaviour in a way as to make the majority of the world's population docile, not by choice but simply due to lack of gainful employment, then it would not suffice just to amend our fiscal policies. In such circumstances, the world would need to find completely new social, economic and only then fiscal paradigms. In order to illustrate the depth of such a change in the simplest terms, the authors can suggest that the very concept of money and remuneration would need to be replaced as the majority of those in need of goods and services would have no means of offering anything tangible in exchange for them. Furthermore, in the absence of a market, our very understanding of capital would need to change. In such circumstances, taxation itself may become an obsolete concept.

On the other hand, if AI/robots are just another step in our development saga, tools that will help us surmount future obstacles (climate change, aging of the population and the global

171. UK Parliament, *supra* n. 164, at para. 44.
172. IT: Italy's 2020 Budget (Law no. 160 of 27 Dec. 2019), available at https://www.gazzettaufficiale.it/eli/gu/2019/12/30/304/so/45/sg/pdf.
173. Deloitte, *2020 Budget Law Enacted, Related Law Decree Converted into Law*, Tax@hand (13 Jan. 2020), available at https://www.taxathand.com/article/12765/Italy/2020/2020-budget-law-enacted-related-law-decree-converted-into-law.
174. A. Bal, *Does a Robot Deserve Tax Relief?*, Tax & Technology Expert (2020), available at https://tax-technology.expert/Technology/article160920.html.

demographic decline, space exploration, etc.), then our attention should not be focused on trying to fiscally target novel material objects (i.e. robots), but we should attempt to understand the social trends with whom they may be related.

5. Our Recommendation: Earmarked Education Taxes

5.1. Overview

At this stage, due to the different opinions on the impact of AI/robots on employment (as outlined in section 3.), that authors share the view expressed by the United Kingdom and Switzerland, as well as some scholars,[175] that taxes on AI/robots should not be introduced. Only as time goes by, will it be possible to tell how this Fourth Industrial Revolution will play itself out, that is, whether employment levels of human beings will reduce (temporarily or more permanently) or increase (temporarily or more permanently).

That said, it is important to keep in mind that taxes are not an appropriate tool to reduce automation levels (and preserve existing jobs).[176] To draw a parallel, the same way that taxing cigarettes does not prevent people from smoking.[177] Levying tax is not always an effective measure to dissuade a given behaviour.

One of the most important policy objectives over the next few years is that policymakers make their best efforts to ensure that the Fourth Industrial Revolution benefits as much people as possible. On the one hand, their aim should be to accommodate and encourage progress that promotes economic value whereas on the other hand, they should aim at redistributing benefits and advantages to the ones negatively impacted (if that happens).

One of the main challenges (among other global challenges) for states would be to find the most appropriate balance between designing taxes around AI/robots and technological development and innovation. The design needs to be made in a manner that the former does not completely or considerably eliminate the latter.[178] Moreover, it should be taken into consideration that technology is progressing exponentially and "what is yet to come" is unknown. It may well be possible that "high-tech" and "high employment" do not need to be exclusive – they can actually coexist.[179]

Keeping the foregoing in mind, the authors believe that policymakers need to be "proactive" rather than being "reactive". Government will need to monitor the evolution of the impact of AI/robots on tax revenues. If reliable economic data starts pointing out that unemployment levels are increasing due to automation (and not other events, for example, COVID-19[180]), then governments should focus on reskilling workers by providing appropriate edu-

175. Mazur, *supra* n. 54, at p. 303; and Atkinson, *supra* n. 50, at pp. 1-19.
176. P. Ericksen, *A Robot Tax is a Very Bad Idea*, Technology and IIOT (20 Sept. 2019), available at https://www.industryweek.com/technology-and-iiot/article/22028269/a-robot-tax-is-a-very-bad-idea.
177. K. Callison & R. Kaestner, *Do Higher Tobacco Taxes Reduce Adult Smoking? New Evidence of the Effect of Recent Cigarette Tax Increases on Adult Smoking*, National Bureau of Economic Research (Aug. 2012), available at https://www.nber.org/papers/w18326#:~:text=There%20is%20a%20general%20consensus,adult%20smoking%20is%20relatively%20sparse.
178. Barros, *supra* n. 54, at p. 14.
179. University of Arkansas, *Machines and People Can Coexist, Work Together More Productively* (15 Aug. 2012), available at https://phys.org/news/2012-08-machines-people-coexist-productively.html.
180. D. Bloom & K. Prettner, *The Macroeconomic Effects of Automation and the Role of COVID-19 in Reinforcing Their Dynamics*, Vox EU (25 June 2020), available at https://voxeu.org/article/covid-19-and-macroeconomic-effects-automation.

cation instead of funding support schemes that entail handing out minimum wages.[181] This is because "for every robot we put in the world, you have to have someone maintaining it or servicing it or taking care of it".[182] One may raise the question "why not create a national skills centre, which would anticipate/shape the needs of the market in terms of skills and help with a programmed reorientation before obsolescence? Or introduce a 'skills insurance', which would help finance career reorientation?".[183]

By doing so, the chances of people being employed increases. Thus, by empowering individuals and putting them back on the job market, governments can expect taxes from such personnel (payroll taxes, income taxes or consumption taxes). Towards this end, policymakers could, as a start, identify the existing "jobs" which could be automated and already reskill the people working in these jobs. It is not the purpose of this contribution to discuss what "new" skills will look like, but sufficient information seems to be available in the public

181. The most popular proposal is the universal basic income (UBI) scheme. The scheme is based on the idea of "an income paid by a political community to all its members on an individual basis, without means test or work requirement". *See* P.V. Parijs, *Basic Income: A Simple and Powerful Idea for the Twenty-First Century*, p. 8 (2004), available at https://www.onlabor.org/wp-content/uploads/2016/06/Chap1.Simple_and_Powerful.pdf. In this regard, governments would regularly pay an income to individuals regardless of their employment status, income earned or wealth held with the aim of providing social protection. Its advocates defend such schemes by arguing that it would encourage further education, the search for better jobs and also entrepreneurship (self-employment). *See* M. Moody-Stuart, *Universal Basic Income is Best Response to Automation*, Financial Times (10 May 2019), available at https://www.ft.com/content/5f931514-e46e-11e9-b112-9624ec9edc59. The adoption of UBI to help society has been supported by many economists. *See* F. Coppola, *Top Economists Endorse Universal Basic Income*, Forbes (31 Aug. 2017), available at https://www.forbes.com/sites/francescoppola/2017/08/31/top-economists-endorse-universal-basic-income/#4502a05915ae; and A. Lago, *Is Universal Basic Income the Answer to Automation?*, Medium (12 Sept. 2020), available at https://medium.com/datadriveninvestor/is-universal-basic-income-the-answer-to-automation-43d1f7e75d5c. In contrast, nobel prize-winning economist Paul Krugman has expressed his concerns regarding UBI, since the cost for governments would be high and the amounts paid to people could be inadequate. *See* J. Malter & K. Sprague, *Why Paul Krugman Is "not a UBI Guy"*, CNBC (23 Apr. 2019), available at https://www.cnbc.com/2019/04/23/paul-krugman-on-universal-basic-income-im-not-a-ubi-guy.html. Moreover, Daniel Susskind, who played an important role during the Blair and Cameron governments, affirms that people could get the wrong idea about the incentive and feel offended about receiving something without any consideration in return. Therefore, he defends the implementation of some conditions with the scheme, such as voluntary work. *See* I. Tucker, *Daniel Susskind: 'Automation of Jobs is One of the Greatest Questions of our Time'*, The Economist (18 Jan. 2020), available at https://www.theguardian.com/technology/2020/jan/18/automation-jobs-universal-basic-income-daniel-susskind-interview. Although this proposal has several supporters, it should be noted that UBI seems not to be a feasible solution for the potential unemployment caused by the implementation of AI/robots. First, despite the fact that it is a minimum income, it could discourage the search for work; or being paid by the government for a long period could make the re-entry of the worker into the market more difficult. If nothing is done in terms of reskilling, there is a high chance of the worker being stuck on basic income permanently. Besides, the UBI payment will not solve the problem of inequality – high-skilled people would keep playing important roles in the economy while the UBI receivers, if not reskilled, will possibly not fit in society.

182. J. Pistrui, *The Future of Human Work Is Imagination, Creativity, and Strategy*, Ascend Harvard Business Review (4 Dec. 2019), available at https://hbrascend.org/topics/the-future-of-human-work-is-imagination-creativity-and-strategy/?utm_source=HBR_LinkedIn&utm_medium=social&utm_campaign=HBR_post.

183. Unil, *Le Temps – Isabelle Chappuis, Director of Futures Lab: "The Accounting Profession Can Be Performed at 67% by a Robot."*, Futures Lab, HEC Lausanne (15 July 2020), available at https://wp.unil.ch/futureslab/2020/07/le-temps-isabelle-chappuis-director-of-futures-lab-the-accounting-profession-can-be-performed-at-67-by-a-robot/?lang=en.

domain,[184,185] especially, suggestions to enhance digital literacy or skills.[186] In this regard, as an example, it should be noted that the École Polytechnique Fédérale de Lausanne (EPFL) has created the EPFL Extension School to teach new digital skills to individuals without university qualifications.[187] The question that arises then is how do states fund these education programmes so that individuals can follow them?

5.2. Education taxes: Lessons from selected countries

According to data collected by the OECD from its members, the largest part of governments' revenues earmarked towards education is allocated for primary and secondary education levels (69% of all education expenditure).[188] This statistic could possibly (not definitely) indicate that public sources, which may be needed to mitigate high levels of unemployment in the future due to automation, are not targeted towards higher and professional education. Thus, additional resources may be required.

An easier solution, in comparison to the previous targeted ones, would be the creation of a dedicated fund to finance education or awareness programmes for planetary issues, which are not restricted to the borders of a given jurisdiction (as discussed in section 3.2.). In an AI/robots context, which would be a part of a wider setting, this proposal makes more sense when considering the main rationale for implementing taxes around AI/robots is to compensate for the replacement of humans by machines.

In fact, some countries already collect taxes for education. The Indian Constitution, for example, provides in article 270(1)[189] that the government is allowed to collect a tax called "cess" for generating revenue for specific purposes. By relying on such a provision, the Indian government, via Finance Act 2004,[190] introduced an education cess at 2% to support the provision of basic education. To meet the needs of secondary and higher education, this cess was increased, in 2007, to 3%. In 2018, the Government replaced it with a health and education cess at 4%. The cess is payable by all taxpayers (individuals or companies or other legal forms, subject to certain conditions). Such cess is levied as a percentage on all direct taxes (such as corporate and individual income tax) as well as indirect taxes such as customs

184. J. Stillman, *21 Future Jobs the Robots Are Actually Creating*, Inc. (6 Dec. 2017), available at https://www.inc.com/jessica-stillman/21-future-jobs-robots-are-actually-creating.html.
185. T. Allas et al., *The Future of Work*, McKinsey & Company (Nov. 2019), available at https://www.mckinsey.com/featured-insights/future-of-work/the-future-of-work-rethinking-skills-to-tackle-the-uks-looming-talent-shortage.
186. *See also* Dimitropoulou, *supra* n. 97, at sec. 5.
187. Unil, *supra* n. 19. *See also* https://www.extensionschool.ch/
188. OECD, *Education at a Glance 2019: OECD Indicators* (OECD 2019), available at https://doi.org/10.1787/f8d7880d-en.
189. Art. 270: "(1). All taxes and duties referred to in the Union List, except the duties and taxes referred to in articles 268, 269 and 269A respectively, surcharge on taxes and duties referred to in article 271 and any cess levied for specific purposes under any law made by Parliament shall be levied and collected by the Government of India and shall be distributed between the Union and the States in the manner provided in clause (2)." IN: Indian Constitution, available at https://www.cbic.gov.in/resources//htdocs-cbec/gst/consti-amend-bill-122-2014-new.pdf.
190. Sec. 91 Finance Act 2004 establishes that "there shall be levied […] as surcharge for the purposes of the Union, a cess to be called the education cess, to fulfil the commitment of the Government to provide and finance universalized quality basic education".

duties. The collected amount does not go to the general public accounts, but is allocated for their specific purpose in the fields of education and health.[191]

The approach of Brazil can be used as another example. A National Fund for Education Development (FNDE) linked to the Ministry of Education already exists. The main goal of this fund is to collect financial resources to support education programmes and provide assistance to low-income students (such as food, books, other school supplies, transportation and so on). The contribution allocated to this fund (known as an education allowance), in accordance with article 212(5) of the Federal Constitution,[192] is charged at the rate of 2.5% on an employer's total payroll. Other programmes that could be relevant to the subject at hand include the National Service of Industrial Apprenticeship Contributions (SENAI), the National Service of Commercial Apprenticeship Contributions (SENAC)[193] and the Contributions for Supporting Small and Medium-sized Enterprises (SEBRAE).[194]

Another example can be found in Nigeria. The government implemented an education tax that is allocable to the Education Tax Fund,[195] at 2%, which is levied on the assessable profits of every company registered in the country (it means that non-residents companies or the ones that were not incorporated in accordance with Nigerian legislation are exempt from the tax at stake).[196] The Fund was created for the purposes of rehabilitation, restoration and consolidation of the education system at federal, state and local levels, giving special attention to higher education. The assessment and collection of the education tax is attributable to the Federal Inland Revenue Service. An interesting study regarding the impact of this education tax in Nigeria was published with the conclusion that it has significant positive impact on human capital development in both the short and long term. The ultimate recommendation was to continue with the tax.[197]

Similarly, in Jamaica, an education tax was established in 1983 to support the Ministry of Education to finance education programmes in accordance with the Education Tax Act. The

191. For a detailed discussion, *see* A.P. Kotha & P. Talekar, *Cess Taxes in India: A Rights Based Analysis of Earmarking*, UNSW Business School, available at https://www.business.unsw.edu.au/About-Site/Schools-Site/Taxation-Business-Law-Site/Documents/6-Kotha-and-Talekar-ATTA2018.pdf.

192. Art. 212: "The Union shall apply annually not less than eighteen percent of its tax revenues, and the States, Federal District and Counties at least twenty-five percent of their tax revenues, including revenues resulting from transfers, for maintenance and development of education. […] §5°. Basic public education shall have as an additional source of financing the educational salary assessment, collected from companies, as provided by law." BR: Federal Constitution, available at http://www.planalto.gov.br/ccivil_03/constituicao/constituicao.htm.

193. SENAC and SENAI social contributions, paid monthly, are payroll taxes and the rates are defined by reference to their payroll and the number of workers. V. Arruda Ferreira, *Brazil - Corporate Taxation* sec. 4., Country Tax Guides IBFD (accessed 18 July 2020).

194. SEBRAE contribution is also a payroll tax that is levied as an additional contribution to SENAI/SENAC at the rate of 0.3% for the purposes of promoting medium and small enterprises. *See* V. Arruda Ferreira, *Brazil - Corporate Taxation* sec. 4., Country Tax Guides IBFD (accessed 18 July 2020).

195. The Education Tax Fund (ETF) was established by Education Tax Act no. 7 of 1993 and amended by Act no. 40 of 22 December 1998.

196. O.A. Oraka, C. Ogbodo & R. Ezejiofor. *Effect of Tertiary Education Tax Fund (Tetfund) in Management of Nigerian Tertiary Institutions*, 2 International Journal of Trend in Scientific Research and Development (IJTSRD) 1 (Dec. 2017), available at https://www.ijtsrd.com/management/accounting-and-finance/5909/effect-of-tertiary-education-tax-fund-tetfund-in--management-of-nigerian-tertiary-institutions/dr-a-o-oraka.

197. T.A. Adegbite, *Empiracal Analysis of the Effect of Education Tax on Human Capital Development in Nigeria*, 6 International Journal of Research in Engineering and Applied Sciences 12 (Dec. 2016), available at https://www.researchgate.net/publication/327273786_EMPIRICAL_ANALYSIS_OF_THE_EFFECT_OF_EDUCATION_TAX_ON_HUMAN_CAPITAL_DEVELOPMENT_IN_NIGERIA.

taxpayers are (i) employees over 18 years (retired people not included); (ii) self-employed people who derive a minimum wage; and (iii) employers (companies incorporated or registered in Jamaica). In this regard, the education tax is levied on the emoluments of employees and the chargeable income of self-employed persons at a rate of 2.25%. Additionally, the employer must contribute with 3.5% on the amount paid.[198]

Leveraging from the above models, we also propose that governments introduce the so-called education tax to finance education and the introduction of skills required by the new economic and technological setting. In situations where constitutional provisions allow the imposition of taxes, fees or cess for education purposes, the creation and implementation of a fund would be straightforward. This would not involve any complexity or considerable changes in the tax systems. All taxpayers (individuals or businesses) would make certain contributions. In an AI/robots context, this programme would mainly allow the "replaced" worker to access professional education (for example by financing short-term courses, training courses, technical colleges and universities) in order to ensure that they are reskilled to meet the needs of the future. It is quite important that this specific purpose is well communicated to the general public without any sign of vagueness so that the taxpayer is aware of why they are paying this additional amount.

5.3. General measures vs earmarked measures

5.3.1. General measures not restricted to the AI/robots issue

One may raise the question as to why we favour an earmarked measure over more general measures. With respect to the latter, some scholars have discussed or advocated general changes in the direct or indirect tax areas to address the threat of automation and ensure income redistribution.

Oberson considers the possibility of increasing the corporate tax rates.[199] While this option is certainly attractive, as it applies to all businesses, this measure should not be considered in isolation and should be considered in the wider context of the tax system.

On the other hand, in an indirect tax context, Arndts and Kapper argue that the tax base should be shifted to consumption as opposed to production to address the issue at stake. This is because consumption taxes are less distortive than income taxes (profit shifting concerns). Thus, a possible solution would be to simply increase the VAT rates.[200] However, unlike direct taxes, VAT systems do not differentiate between consumption by the rich or the middle class or the poor. Consumption taxes could probably then place the burden of the issue at stake on the part of society whose jobs are prone to be automated or to the parts of society that would probably become unemployed (routine workers).

More insightful proposals are advanced by Mazur. She argues that under the existing direct tax system, capital income is taxed more favourably than labour income. As a result, she proposes that capital income should be taxed similarly to employment income. In the US context, one option is to modify the payroll tax on labour income (by making it more attractive for employers) and broadening the payroll tax applicable on capital income of

198. *See* T. Francis, *Jamaica - Individual Taxation* secs. 4. and 4.3., Country Tax Guides IBFD (accessed on 27 May 2020).
199. Oberson, *supra* n. 85, at p. 139.
200. J. Arndts & K. Kappner, *Taxing Artificial Intelligences,* IREF Working Paper No. 201902, pp. 19-22 (2019), available at https://en.irefeurope.org/SITES/en.irefeurope.org/IMG/pdf/arndts_and_kappner_final.pdf.

high-income individuals.[201] Another option is to tax capital income. Under the current tax system of many countries (including the United States) capital gains and dividends are taxed at beneficial rates. Mazur argues that the beneficial treatment of such income streams should be withdrawn and they should be taxed on a par with labour income. At the same time, she argues that tax expenditures that significantly subsidize the creation of capital income for businesses (e.g. accelerated depreciation or bonus expensing) should be curtailed. Other interesting measures are also proposed to tax capital income.[202] The authors' view is that although her proposals are solid and have substantial merits, they are fundamental in nature. She admits that "the changes will not sufficiently counteract the predicted disruption of the current workforce, the negative social and personal welfare implications associated with unemployment, and the growing inequality gap. Accordingly, tax policy alone cannot solve all of the issues raised by the robotics revolution".[203] As a result, she indicates that government tax expenditure should be targeted at reskilling workers and empowering them. She states "In short, by seeking to fill existing and new jobs, rather than prolonging the inefficient use of human labor in unnecessary tasks, this direct spending of resources is superior to using a robot tax to address the harmful effects of automation and is a positive complement to the tax policy changes suggested above".[204]

Indeed, her proposals will raise revenues by making general changes to the tax system, but there is no guarantee that the government will expend the money raised for education purposes. This is where the earmarking programme comes into the picture.

5.3.2. Benefits of an earmarked measure

Earmarking can be done in various ways, for example, full earmarking, partial earmarking, hard earmarking or soft earmarking. While the pros and cons of earmarking has been discussed extensively, it does have the potential to raise revenues for dedicated causes. First, earmarking is a measure to protect projects that are socially important and vital for the citizens.[205] In other words, socially important projects will receive a dedicated source of funds. Second, as such taxes, more often than not, come with an accountability mechanism,[206] they can avoid wasteful government spending and thus can prove to be cost-saving for the public sector.[207] Third, there is no doubt that an individual or a business will pay taxes more satisfactorily[208] if they are sure about the cause that has been financed, particularly if it is a social cause such as the financing of educational or awareness programmes to deal with planetary or global issues. In this respect, earmarking can encourage taxpayers to contribute to public coffers and at the same time reduce the opposition to pay taxes given the fact

201. Mazur, *supra* n. 54, at pp. 305-312.
202. Id., at pp. 313-322.
203. Id., at p. 323.
204. Id., at p. 325.
205. IMF, *Case for Earmarked Taxes: Theory and Example* (Jan. 1988), available at https://www.elibrary.imf.org/view/IMF001/14514-9781451922677/14514-9781451922677/14514-9781451922677_A001.xml?language=en&redirect=true&redirect=true.
206. ECONEX, *Funding the NHI – Earmarked Tax*, Health Reform Note 14 (Aug. 2011), available at https://econex.co.za/wp-content/uploads/2015/04/econex_health-reform-note_14.pdf.
207. R.S. Teja, *The Case for Earmarked Taxes*, 35 Staff Papers (International Monetary Fund) 3, p. 531 (September 1988), available at https://www.jstor.org/stable/3867185?seq=1#metadata_info_tab_contents.
208. ECONEX, *supra* n. 206.

that the revenue is being allocated for noble causes.[209] Fourth, with respect to earmarking taxes for education programmes, some studies indicate that, after their implementation, an improvement in education spending and quality was verified.[210] As an illustration, India's Sarva Shiksha Abhiyan (SSA) programme reported improved performance regarding the allocation of resources, building of infrastructure, hiring and training of educators, and so forth.[211] Finally, a programme with a dedicated revenue source may be harder to eliminate than a non-funded programme). In light of this, the authors now express their opinion on who should pay such taxes.

5.4. Tax to be paid by businesses (companies)

As a starting point, every business (as a separate entity) will be subject to this tax considering that each business or company uses automation or artificial intelligence to some extent. That said, a revenue threshold will need to be developed for reasons of efficiency. This means that small enterprises would be out of the scope of the contribution. Premised on OECD,[212] UN[213] and EU[214] data, the fund contribution would be applied to entities/self-employed businesses that have annual turnover that exceeds, for instance, EUR 50 million. This threshold is a suggestion and it should be adapted in accordance with the social and economic circumstances of each state.

The base of the contribution would be the total profit made (accounting profit[215] or taxable profit[216] – whichever is higher). That is because, in many jurisdictions, accounting profit may differ from taxable profits.[217] Moreover, tax incentives (e.g. input or output incentives) may reduce the taxable profit base of the business as opposed to accounting profits. The

209. D. Archer, *Action Aid Research Report for the International Commission on Financing Global Education: Domestic Tax and Education*, p. 39, available at https://report.educationcommission.org/wp-content/uploads/2016/11/Domestic-Tax-and-Eduction.pdf.
210. D. Archer, Action Aid Research Report for the International Commission on Financing Global Education: Domestic Tax and Education, p. 41, available at https://report.educationcommission.org/wp-content/uploads/2016/11/Domestic-Tax-and-Eduction.pdf.
211. A. Mukherjee, *Targeting Education Financing on the Marginalized: Lessons from Implementation of Sarva Shiksha Abhiyan and Right to Education in India*, Background Paper for UNESCO, p. 2 (2013), available at http://unesdoc.unesco.org/images/0022/002259/225951E.pdf.
212. According to OECD Glossary, "small and medium-sized enterprises (SMEs) are non-subsidiary, independent firms which employ fewer than a given number of employees. This number varies across countries. The most frequent upper limit designating an SME is 250 employees, as in the European Union. However, some countries set the limit at 200 employees, while the United States considers SMEs to include firms with fewer than 500 employees". Small and Medium-Sized Entreprises (SMES), Glossary of Statistics Terms, Glossary OECD, available at https://stats.oecd.org/glossary/detail.asp?ID=3123.
213. As reported by the UN, (i) micro-enterprise: fewer than 10 employees and an annual turnover (the amount of money taken in a particular period) or balance sheet (a statement of a company's assets and liabilities) below EUR 2 million; (ii) small enterprise: fewer than 50 employees and an annual turnover or balance sheet below EUR 10 million; (iii) medium-sized enterprise: fewer than 250 employees and annual turnover below EUR 50 million or balance sheet below EUR 43 million.
214. The European Union has adopted the same criteria as the UN. European Commission, *What is an SME? Internal Market, Industry, Entrepreneurship and SMEs*, available at https://ec.europa.eu/growth/smes/business-friendly-environment/sme-definition_en.
215. IAS 12 defines accounting profit as "profit or loss for a period before deducting tax expense".
216. IAS 12 identifies taxable profit (tax loss) as "the profit (loss) for a period, determined in accordance with the rules established by the taxation authorities, upon which income taxes are payable (recoverable)".
217. For example, in 2006, the Interpretations Committee indicated that a tax profit is not necessarily the same as an accounting profit. Consequently, income taxes calculated in accordance with IAS 12 do not have to originate from an accounting profit. E. Eberhartinger & A. Patloch, *Definition of Income Taxes*, in *Tax Accounting: Unravelling the Mystery of Income Taxes* (7 Apr. 2015), Books IBFD.

rate of the contribution could be based on a certain percentage of the accounting or taxable profits (e.g. 1% to 3%).[218]

The information regarding taxable basis, tax rate and due amount can be integrated in a tax return that is already submitted by businesses or companies (such as a corporate tax return). By doing so, this would avoid more compliance complexities and costs. The payment could be done on an annual basis, according to the profit accrued during a tax year.

5.5. Taxes to be paid by individuals

Individuals will be the ones who benefit most from this fund. Nevertheless, it would not make sense to charge the contribution at stake from the ones who are unemployed and who are currently looking for relocation. Accordingly, workers that maintain their employment status during the Fourth Industrial Revolution – meaning people who actually work – can also contribute to the fund to support education programmes based on the gross annual salary they earn.

From a social perception perspective, it would be worth mentioning that tax debates pertaining to individual taxation usually focus on the rich or the poor. In this context, the middle class is the most affected by tax progressivity around the world, founded on the premise that lower income people are mostly exempt, whilst higher income groups have more sources of income and often hire tax professionals to take advantage of loopholes, tax schemes and exemptions.

Based on research performed by Emmanuel Saez and Gabriel Zucman (economists at Berkeley University), the 400 richest American families paid a lower overall tax rate than middle-class American families in 2018, as per Figure 7.[219]

Considering this data, the authors believe that it would not be a good idea to increase the tax burden of the middle class. Moreover, our argument is based on a recent study by the OECD, which pointed out that one in six current middle-income jobs face a high risk of automation[220] (*see* Figure 8).

Thus, the authors' suggestion would address high-income individuals. The definition of a high-income individual would also depend on each state according to the economic and social reality of each country. As an illustration, the authors refer to the chart below to define the meaning of individuals at the upper threshold of income[221] (*see* Figure 9).

Therefore, an individual revenue threshold would be state specific. A percentage of the income crossing the revenue threshold would be subject to the contribution. For example, if Mr X in State X derives USD 100,000 of taxable income (net of deductions) and if the threshold is fixed at USD 80,000, the excess, that is USD 20,000, would be the taxable base

218. IFR, *Robot Investment Reaches Record 16.5 billion USD* (18 September 2019), IRF Press Release, available at https://ifr.org/downloads/press2018/2019-09-18_Press_Release_IFR_World_Robotics_2019_Industrial_Robots_English.pdf.
219. H. Gleckman, *Are US Billionaires Really Paying A Lower Tax Rate Than Working People? Probably Not*, Forbes (11 Oct. 2019), available at https://www.forbes.com/sites/howardgleckman/2019/10/11/are-us-billionaires-really-paying-a-lower-tax-rate-than-working-people-probably-not/#549e8fc629ac.
220. OECD, *Under Pressure: The Squeezed Middle Class* p. 29 (OECD 2019), available at https://doi.org/10.1787/689afed1-en.
221. Id., at p. 20.

Figure 7 – Effective US tax rates by income

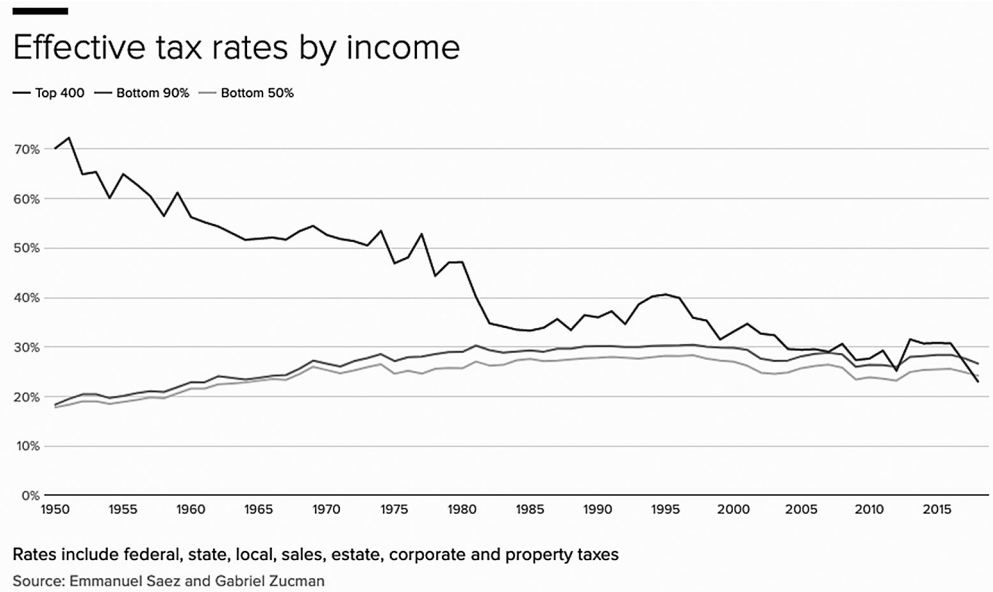
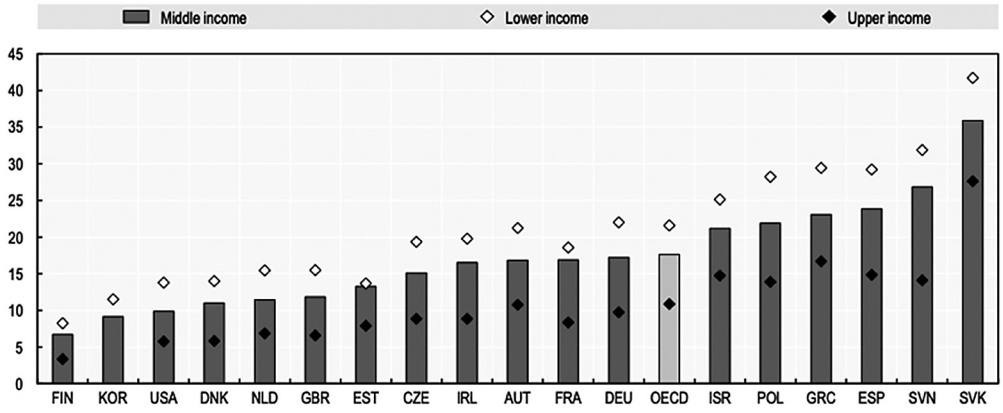


Figure 8 – Share of workers in occupations with high risk of automation, by income class



Note: "Lower income" households defined as households with income below 75% of the national median. "Middle income" households are households with income between 75% and two times the national median. "Upper income" households are households with income above two times the national median. The risk of automation is calculated as the average of the risks of automation by occupation, weighted by the share of each occupation in the income class.
Source: OECD secretariat calculations based on LIS and PIAAC.

of the contribution. A certain percentage of the excess will be paid as an education tax (for example, 1% to 3%). When fixing percentages, policy officials should consider many factors such as the population size, expenses, living costs, marital status, family members and so forth. To facilitate regular payment of this tax, the employer could withhold the levy and pay it to the authorities (for salaried individuals). Alternatively, the individual, could pay it while filing their tax return.

Figure 9 – Lower and upper middle-income thresholds in USD 2010 PPPs, 2016 or latest year available

	Lower threshold	Upper threshold
Luxembourg	26 482	70 620
United States	23 416	62 442
Denmark	19 735	52 626
France	18 173	48 462
United Kingdom	15 856	42 283
Italy	12 206	32 549
Hungary	8 707	23 219
Mexico	3 757	10 019

Note: Middle-income classes and median incomes defined based on equivalized household disposable income, corrected for household size. The middle-income class comprises individuals in households with income between 75% and 200% of the median. Values in USD, adjusted for international differences in 2010 purchasing power parities.
Source: OECD.

5.6. Assessing our proposal

Our proposal is neutral, as it applies to all individuals and businesses that exceed a certain revenue threshold. The design of a threshold is important for efficiency reasons. Depending on the jurisdiction, a simple law or similar legal act would be enough to regulate the application of such taxes. The law would be based on objective factors to foster tax certainty. Also, costs of compliance with this measure for both taxpayers and tax administration would be low. Calculation of the tax would be simple for taxpayers. Further, existing tax returns could be partially modified by the tax administration to ensure taxpayers compliance with the measure. Ensuring compliance would also limit opportunities for tax evasion. The measure is flexible, in the sense that the contributions could be increased or decreased, or the tax could be repealed based on reliable economic data.[222] The proposal also complies with the benefit principle, as taxpayers who make this contribution (individuals or businesses) benefit from general state resources (including Industry 4.0). Also, as the tax is payable by businesses or individuals who have profits or disposable income respectively, it would be compliant with the ability to pay principle. Of course, profit shifting (and tax competition) can still occur if these taxes are not introduced in a unified manner, especially by developed countries. One important point is that many countries, for example Austria, Finland, France, Germany, Ireland and the Netherlands, have created tax incentives in their corporate and individual income tax codes for investment in education and training programmes,[223] and our solution should not be seen as incompatible with these systems given its objective of educating the public on global issues.

On the international tax side, the option proposed above will mostly likely constitute a tax that is covered by a tax treaty, in particular, article 2 of the OECD Model as it is applicable

222. Some economists argue that it is optimal to tax robots only for the first three decades as during this period, the labour force still includes older workers that chose their occupation in the past. However, once these generations retire then optimal robot taxation is zero. *See* J. Guerreiro, S. Rebelo & P. Teles, *Should Robots be Taxed?*, NBER Working Paper Series (Revised Paper, Aug. 2020), available at https://www.nber.org/papers/w23806.pdf.

223. For further details, *see* EU CEDEFOP. *Using Tax Incentives to Promote Education and Training, Cedefop Panorama Series* (Office for Official Publications of the European Communities 2009), available at https://www.cedefop.europa.eu/files/5180_en.pdf.

on income derived by a taxpayer. If this is the case, then the application of such taxes could be restricted by tax treaties in many instances. For example, if a resident in Country R derives substantial business income from its tax treaty partner, that is, Country S (a state that has introduced an education tax), then article 7 of the OECD Model (which deals with business income) will switch off the application of such taxes unless and until the taxpayer maintains a permanent establishment in Country S. In other words, unless and until Country S receives unlimited taxing rights under tax treaties, it will not be able to enforce its education tax. Thus, the tax could fail to operate in a cross-border scenario unless and until states agree to its implementation in all scenarios either through bilateral negotiations or through the Multilateral Instrument (MLI). In light of this issue, a possible policy choice would be to simply collect taxes from residents and not non-residents.

If such taxes are only collected from local tax residents, the proposal presented above suffers from one inherent flaw, namely, it is based on the view of the world in which fiscal prerogatives are completely in the hands of sovereign nation states. Although this view of the world is realistic, it fails when it comes to resolving increasingly global and interconnected problems. Firstly, those states which do possess fiscal potential to successfully implement an Education Tax may actually, due to the demographic decline previously described, be in a need of additional skilled workforce from abroad. Their investment in the local workforce may not be sufficient to meet the needs of their own economy and society in general, simply due to the fact that the domestic pool of potential employees is shrinking so rapidly that not even AI/robots are able to make up for the shortfall. On the other hand, countries that do possess the long-term potential to supply the needed immigration are the ones that cannot rely on their own fiscal base to provide much-needed investment in education. Furthermore, even if they were capable of financing successful education programmes, these would to a large degree only serve to provide developed countries with more skilled immigration, as the local economies would not have the potential to provide the newly educated youth with sufficient employment opportunities. Thus, as it would be safe to assume that many if not most of those who benefited from education programmes in developing countries would attempt to pursue their lives in other parts of the world, where they can expect not only higher wages but also a more politically stable environment, one can reasonably question the justification of programmes that may in the end result in the taxpayers of impoverished countries financing the needs of the taxpayers of the world's most affluent nations.

One lesson that we can draw with some surety from our experience so far is that future migration flows cannot be stemmed by one-sided government measures. Simply building walls and employing more border guards may perhaps slow the tide for a while, but in the long run these are futile measures. If a continent such as Africa, where half of all people are under the age of 15, is left to its current state, what is to stop these multitudes of youths, who are well aware that the world offers environments with much more prospects, from actually trying to reach them? The same conclusion can be made with respect to the other part of the *old* world, which at present has an abundance of young people to whom it can offer for the time being only a bleak future, namely the Middle East and parts of Central Asia. Furthermore, all of these areas of the world are expected to be worst hit by climate change, rendering large tracts of their territory uninhabitable.

Thus, we face the following conundrum at the global level. The places on the globe that can fund investments in education may not have sufficient human capital towards whom these investments could be targeted, while those that do possess the human capital may not have

the financial means and are also, due to the derelict state of their economies and societies, in danger of actually preparing, at their own cost, future immigrants whose talents and skills will be put to work by some other, much more prosperous, economy. On the other hand, we are already aware that unskilled migrants will not give up their dream of finding a better life in a new environment purely because there is no need for them and the services they can provide in their destination of choice. Sound economic reasoning may be persuasive in an academic or a political debate setting, but it is not likely to alter the dream of escaping truly desperate circumstances of a young person full of energy and zeal. In other words, the world's developed countries will not be able to avoid the tides of migration.

6. Our Recommendation: Global (Intercontinental) Fiscal Redistribution in Lieu of a Global Education Tax and the Road towards a Planetary Tax System

Tax scholarship has provided some guidance on how to address the described problem in the form of the Bhagwati brain drain tax. This is a tax paid or transferred to the country of origin of the skilled immigrant by his host state in order to compensate it for the loss incurred due to the emigration of a skilled individual. Under the initial proposal, this brain drain tax was to be borne by the skilled immigrant (i.e., it would be paid in addition to what is owed under general rules of their adopted country of residence).[224] More recent proposals shift the burden from the immigrant to the host country,[225] while Brauner draws attention to the policy merits a brain drain tax should meet in order to be a justified and valid development tool and not just another channel for enriching the corrupt elites in developing countries.[226]

Drawing on existing research, the authors would propose a global mechanism that would enable the transfer of funds from developed countries that rely on immigration to developing countries who are the source of human capital. However, unlike in the current aid setting, this mechanism would take on a fiscal transfer form, wherein, on the basis of a predetermined formula, a certain proportion (indeed, a low percentage) of the host country's tax revenues would be distributed to the countries that are the current and future sources of immigration (rather than finding isolated solutions at the level of individual income tax or corporate income tax or VAT). However, contrary to what the article advocated for on the domestic front, at the international level, the authors would argue against an earmarked approach, namely because, at this point of societal development, our global allegiances are much weaker than those most of us feel towards the polities we are a part of. As the COVID-19 pandemic has painfully reminded us, in times of trouble parochial interests easily take political precedence over broader, planetary ones, regardless of the fact that the problem in need of solving is blind to both national boundaries of political sensitivities. In other words, if an earmarked revenue were to be introduced to fund the development of some other society, then it may be the first to fall as victim of the next crisis requiring economic stringency, regardless of the fact that it may equally be to the benefit of the tax-levying jurisdiction. Furthermore, such an earmarked tax would be an easy point of call for all xenophobic and

224. *See* J.N. Bhagwati, *Taxing the Brain Drain*, 19 Challenge 3, p. 35 (1976).
225. *See* M.J. Lister, *A Tax Credit Approach to Addressing the Brain Drain*, 62 St. Louis University Law Journal 1, p. 74 (2017). For economics research with respect to the issue of the brain drain tax, *see* J. Douglas Wilson, *A Voluntary Brain-Drain Tax*, 92 Journal of Public Economics 12, pp. 2385-2391 (2008).
226. *See* Y. Brauner, *Brain Drain Taxation as Development Policy*, 55 St. Louis University Law Journal 1, pp. 262-263 (2010).

isolationist political forces in any society. On the other hand, we must avoid the trap of defining the transfer as an aid mechanism as these carry an equally dangerous political burden. Aid is understood as an act of generosity, devoid of self-interest concerns. However, the fiscal redistribution mechanism the authors propose serves the interests of both the providing and the receiving countries. In the case of uncontrolled immigration of unskilled labour to countries that have no need for it, the host nations will have to deal with and bear the costs of not only training and educating the new arrivals (at present costs on their markets, which are bound to be far higher than those in the countries of emigration), but also mitigating far more radical social turmoil than what we are witnessing in present reality. In other words, while we should avoid stretching our solidarity capability too far by virtue of introducing earmarked taxes bound to be viewed as at the very least hidden foreign aid, we should build upon developing our broader allegiances by developing an understating of our interconnected destinies. To put such a conclusion into perspective, one should bear in mind that e.g. in July 1960, when it became independent, the Democratic Republic of Congo had a total of 16 domestic university graduates on a population of more than 15 million, simply due to the fact that the colonial power which had ruled it until that time (Belgium) would not allow locals to be educated at a higher level (as it felt that by virtue of education the natives were becoming radical).[227]

Such a fiscal redistribution mechanism could serve as a foundation for the introduction of a global fiscal form, one which is broader, is not restricted by the Bhagwatian foundations, and considers the "social contract" of an individual or business as not limited to the boundaries of its state but rather to that of the entire planet. Such a fiscal form could be used to fund global action against threats that target our very existence as a species (e.g. climate change and global warming).

Based on the chosen option, the use of transferred funds must be subject to a strict mechanism of control. Their use would be limited to education or more broadly towards healthcare, environment, basic public services and infrastructure, with the improvement in the status of and the empowerment of women being a crucial goal, as it is gender equality that can most successfully lower the unsustainable birth rates that are presently found in the world's poorest countries. Furthermore, unlike the Bhagwatian model, the new mechanism must not only take into account the economic aspects of past and current immigration flows but must in essence serve to mitigate as much a possible the future migration flows that will be accelerated by virtue of climate change. If predictions hold true that a few billion (approximately one third of all humanity) of the world's population will need to resettle within this century, the proposed mechanism will serve to finance the preparation of the prospective workforce for the new environment that is expecting them. To reflect on our past experiences, as the gates cannot be closed, nor walls built high enough (e.g. neither the Roman *limes*, nor the Great Wall of China managed to accomplish their tasks), it stands to reason to start working together with those who will be forced to come some time in the future, so as to make their settlement as amicable as possible.

The primary reason why it should be a fiscal, rather than an aid mechanism to implement the authors' proposal is that it is imperative to reflect the reality that the countries that

227. *See* B.B. Fall, *Education in the Republic of Congo*, 30 Journal of Negro Education 3, pp. 271-272 (1961),; and J.A. Kennedy, *Congo's Basic Problems III – Prime Need is Education; Only 19 Native Congolese College Graduates There,* The Daily Times (28 Apr. 1961).

will be the source of the transfers are not providing one-sided aid to those in need, but are actually investing in their own long-term prosperity. In other words, the authors are not proposing a charitable donation strategy, but rather a global initiative to finance global challenges; challenges that are set to impact us all.

While the functioning of the fiscal redistribution mechanism would naturally require a global multilateral platform, it is not the technical details that would be the greatest obstacle to its success. Such a mechanism would in any eventuality require a novel, global, or as global as possible, social contract with the aim to fund the resolution of planetary issues. As it would make little sense to divest demographics from climate change, this social contract would in essence serve to protect the interest of humans as a species. Sadly, the recent opportunity to jointly, as a united front, combat an enemy that sees all of us in the most non-discriminatory fashion, namely the COVID-19 virus, was lost, as we put our faith in that a virus will respect the sanctity of legal fiction, such as national boundaries. Thus, as tax academics, we must remind political decision-makers that it is up to them to provide a platform for the implementation of particular solutions. These must be global in order to be effective, and therefore so must be the platform.

However, prior to a global mechanism, the authors can suggest the setting up of at least two continental or intercontinental mechanisms.

Namely, the European Union is bound to be the destination for the vast majority of African immigration, particularly its uncontrolled (formally illegal) spectre.[228] Simply the vastness of the Atlantic Ocean will serve as a natural deterrent for an American passage, at least for the time being. In order to maintain its level of prosperity, the European Union will need immigrants, while technological progress will require these to have valuable skills. However, the use of AI/robots will lower the need for human capital, whose uncontrolled import also leads to very complex social and political issues. On the other hand, current demographic and economic data, in combination with the failure to successfully stop immigration tides, suggests that it is with some surety that we can expect an ever-increasing wave of new settlers from Africa into the continent of Europe. Furthermore, the new settlement will not be distributed evenly, but will be more prevalent in the most affluent parts of the continent. On the basis of such an assessment, there are at least four clear policy goals to be accomplished:

(a) Develop the skills of prospective immigrants so that they can bring these to their host countries, enabling them to integrate more quickly and use their full potential.

(b) Create local opportunities in the countries of origin for their ever-increasing young populations, thus mitigating the calamitous consequences of the brain drain on development.

(c) Stem the population explosion in places that are unable to sustain them in the long run – a goal best achieved, as the world's developed nations' stories testify, by virtue of education, the empowerment of women, and economic and infrastructure development.

228. Here we must give credence to the inspirational speech given by Prof. Frans Vanistendael at the 2020 annual meeting of the EATLP in which he specifically underlined the importance of Europe/Africa relations for the future of both continents.

(d) Enable a more even dispersal of new immigrants within the European Union (or more broadly continent).

As stated in this section, the percentage to be transferred (from national budgets) would depend on a formula that would have to take into account the following factors:
- the current level of immigration and the economic benefit it brings to the host state, as well as the sources of such immigration;
- the future level of immigration (taking into account climate change) and the cost of undesired, but unavoidable immigration; and
- the benefits of needed immigration flows and the cost of the development of skills the new immigrants should ideally bring with them.

The collecting entity would be the European Union, with its Commission being in charge of overseeing the administrative implementation of the entire mechanism.

The distribution mechanism would also need to be settled, bearing in mind that it has two targets. Namely, on the one hand, the funds should be transferred to those countries that are the source of immigration, but on the other they should also be diverted to those nations on the European continent that have been in the past and are still the source of immigration, but which will in the future have to accept the role of the host countries in order to have a more even distribution of new arrivals. Namely, in order for a proportional number of the new immigrants to be voluntarily shared between European countries, they need to achieve a comparable level of development, i.e. a comparable ability to provide new arrivals with equal opportunities. If such comparability is not achieved, so that the only argument that remains to incite new immigrants to choose less affluent jurisdictions as their new home is force, it would be an argument of limited value, particularly in the long run.

In the case of African countries, the GDP per capita in addition to demographic statistics can be used as the basis for distribution, while in the case of future host countries similar criterion can be taken into consideration, with particular attention being given to the costs incurred by them through the process of the brain drain (a process which in itself limits growth potential).

While the collection of the funds can be entrusted to the European Union, the use of the funds must be in the domain of national governments, and the monitoring of their spending must be a more complex affair. Namely, if we were to entrust the monitoring of the spending solely to the organization made up of the countries that are the source of the funds, we would inadvertently be replicating the not-so-distant colonial past, something that would hardly be acceptable to the recipient nations. Thus, there would need to be a clear set of standards in order to outline the purposes for which the received funds could be spent, the processes under which they can be allocated by national governments and their authorities and a strict peer review mechanism that would involve both the source and the recipient countries. The receiving nations should be able to scrutinize their peers as they have a vested interest in the success of the programme, while the failure of a peer review process would entail not only the termination of the transfer of funds, but an obligation to sanction the sale of such goods and services that were acquired by virtue of their abuse, as well as the persons benefiting from such abuse. The sanctions mechanism should naturally encompass all countries taking part in the programme.

The described mechanism would entail two separate legal foundations. One would have to be an intra-EU treaty, outlining the obligation to contribute funds, determining the formula for the assessment of the size of the contribution and providing for a redistribution mechanism targeting those European states that have been the source of immigration to other European nations and who will in the future be expected to host the new arrivals. Such a treaty should also encompass those countries on the continent of Europe that are not members of the European Union (with perhaps the exception of Russia, which is the target of immigration primarily from Central Asia and the Caucasus region), where failure to partake in this process would be connected with economic penalties for the refusing state. The other would be a multilateral treaty between African countries and the European Union (representing not only its Member States, but all European nations who join the mechanism) outlining the distribution, spending, reporting as well as the peer review standards and procedures.

A similar mechanism, although one that would require the development of administrative capacities, in the absence of a structure corresponding to the European Union, could be introduced in the Americas, where on the one side would be the United States and Canada, and on the other primarily Central American states and a selected number, if not all, of South American ones.

However, such intercontinental solutions should be only temporary as the authors reiterate that the only way to truly address global issues would be through global action. Perhaps, the OECD's Inclusive Framework could be entrusted with carrying out such a task at the global level. On the other hand, the two suggested stepping stones in reaching this goal are possible, and actually, in the case of the EU/Africa mechanism, there already exists an administrative platform capable of carrying out such a task.

7. Conclusion

Based on the transformation has been taking place in the world and the uncertainty about how things will shape in the future, the discussion regarding taxation of AI/robots will still continue for a while. This is because we are not even sure if high rates of unemployment will infiltrate the society due to replacement of human workforce by machines, keeping in mind that studies conducted by several respected institutions reach different conclusions.

The wide range of targeted proposals that have been presented so far could be difficult to implement, besides the fact that most of them violate commonly accepted principles of tax policy, such as neutrality, simplicity/certainty, efficiency, effectiveness and fairness, as well as flexibility.

The authors believe that taxing AI/robots would slow down innovation, which directly impacts the fields of science, health, economy, security, nutrition, the environment, leisure and so forth. Moreover, it would also deter people from enjoying innumerable benefits arising from AI/robots in all those fields. For those reasons, the authors' opinion is that those new technologies should not be taxed.

That said, governments need to be proactive and not reactive. COVID-19 has taught this lesson to many "reactive" governments (in the sense that the number of people affected by the virus was substantially high). If it ever happens that a trend of unemployment due to, for example, automation is being witnessed in a state, government will need to have a damage

control plan in place so as to invest in people's education. In this regard, on a national level, this article discussed the possibility of implementing an earmarked education tax, that is, a contribution that would be allocated to a special fund dedicated to finance and foster education programmes.

Such a contribution would be paid by individuals and businesses, as both of them would benefit from the fund and hence the programmes. In the case of companies, the tax rate would be levied on accounting or taxable profits (whichever is higher). In the case of individuals, it will be payable when the gross annual income exceeds a certain threshold. The thresholds will be established in accordance with the economic reality of each country or region. The contribution will be made on an annual basis, and related information and payments would be integrated with tax returns that are already submitted by the taxpayers, thus avoiding an increase in compliance obligations.

However, as many countries would not be in a position to implement or fully benefit from an education tax, the authors suggest building on the already existing Bhagwatian foundations or a new global "social contract" argument to implement a global fiscal redistribution mechanism, in order to allow developing countries to escape endemic poverty, allow more sensible migration flows and prepare for the grim consequences that climate change is bringing upon us all. Unfortunately, the authors have to warn that global decision makers must realize that threats that target us indiscriminately as a species must also be combated by humanity as a whole, regardless of relatively novel social inventions such as boundaries and nation states.