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A TAX ON ROBOTS?

Some food for thought

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A tax on robots?
Some food for thought[*]

By

GERMANA BOTTONE[1]

> *Professor Stephen Hawking said that artificial intelligence (AI) will "either be the best, or the worst thing, to happen to Humanity".*

Abstract

Tax administrations face new and ever greater challenges. Some data collected show that the use of industrial robots has been increasing since 1990; therefore their entry in our life is not more a fantasy and it will generate relevant changes in legal, economic and social systems. As far as tax policy is concerned, if robots have a high elasticity of substitution with labour a fall in tax revenue is expected, as labour taxes represent a significant portion of tax revenue. In addition, since robotization seems to jeopardise especially routine and low skilled workers, governments need growing public resources to be invested in education and training system. Starting from these premises, the paper deals with the possible design and the effects of the introduction of a robot tax.

Keywords: Artificial intelligence, Government Expenditures and Education, Fiscal policy
JEL classification: O33, H52, E62.

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1. Introduction

The coming age of “robots” raises a lot of questions with regard to social, economic and legal order. Therefore, it may be helpful to begin thinking about how to face the issues arising in the future from robotization and trying to control them rather than being mere bystanders. First of all, the paper deals with the definition of artificial intelligence (AI), which seems to bring about a technological revolution in many ways different from the past ones, given that AI may reproduce human cognitive capabilities. The second step is to establish the actual diffusion of AI mainly in productive activities and try to predict future scenarios. These premises are preparatory to a discussion about the introduction a robot tax, provided that robots progressively substitute labour and policy makers have to face massive unemployment and the lack of public resources. Two issues are at stake: a) labour taxes supplies a large portion of tax revenue almost everywhere, therefore if robots progressively substitute labour, a fall in tax revenue is expected; b) most of the economic literature suggest to invest in education and training to face unemployment brought about by AI, since data show that robotization hampers especially routine/low-skilled workers. As a consequence the need of public resources may increase. Summing up, a robot tax – restoring tax neutrality among productive inputs - may slow down the growth of unemployment and provide the necessary public resources.

In addition, the literature in favour of a robot tax highlight that labour taxes are very high as they include also payroll taxes, while capital taxation is more favourable also because policy makers aim at fostering private investments, infringing the principle of neutrality with a view to promote economic growth. This is a relevant issue in the discussion about a robot tax, especially considering globalization and tax competition among global jurisdictions. Therefore, the conclusion of this paper is that, if we agree upon the convenience to introduce a robot tax, a global effort is required to include this topic in the international agreements already in place to fight global tax competition.

2. “Artificial intelligence”: definition and impact

The core difference between current and past technology is due to the existence of “intelligent autonomous machines” which should gradually substitute the old automatic machines. Artificial intelligence (AI) does not function automatically but imitate human behaviour and intelligence and act autonomously. The AI is what is commonly called “robot”. After industrial revolution, automation has basically consisted in making a hardware or software capable of doing things automatically. According to UK government AI may even overcome human cognitive capacity:

…. Indeed, artificial intelligence is not a replacement, or substitute for human intelligence. It is an entirely different way of reaching conclusions. Artificial intelligence can complement or exceed our own abilities: it can work alongside us, and even teach us….. This offers new opportunities for creativity and innovation. Perhaps the real productivity gain from artificial intelligence will be in showing us new ways to think[2].

Actually, “Robotics” is a new science, as for the first time scientists are endeavouring to create machines functioning intellectually and physically as human beings: a revolutionary experiment, still in progress. Within the category called “artificial intelligence” there are the “industrial robots”: they do not require a human operator and can also be programmed to perform routine and manual tasks such as assembling, packaging, and painting. The category of “industrial robot” is officially defined by the International Organization for Standardization (ISO) as an automatically controlled, “reprogrammable” (whose programmed motions or auxiliary functions may be changed without physical alterations), multipurpose manipulator (capable of being adapted to a different application with physical alterations that is alteration of the mechanical structure or control system except for changes of programming cassettes, ROMs, etc.), programmable in three or more axes (direction used to specify the robot

[2] Growing the artificial intelligence industry in the UK, Independent Report by Professor Dame Wendy Hall and Jérôme Pesenti, 15 October 2017, published in gov.uk from the Department for Digital, Culture, Media & Sport and Department for Business, Energy & Industrial Strategy. Available at:
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/652097/Growing_the_artificial_intelligence_industry_in_the_UK.pdf

motion in a linear or rotary mode), which can be either fixed in place or mobile for use in industrial automation applications. The classification of a robot into “industrial robot” or “service robot” is done according to its intended application:

- ✓ A service robot is a robot that performs useful tasks for humans or equipment, excluding industrial automation application.
- ✓ A personal service robot or a service robot for personal use is a service robot used for a non-commercial task, usually by lay persons. Examples are domestic servant robots, automated wheelchairs, personal mobility assist robots, and pet exercising robots.
- ✓ A professional service robot or a service robot for professional use is a service robot used for a commercial task, usually operated by a properly trained operator. Examples are cleaning robot for public places, delivery robot in offices or hospitals, fire-fighting robot, rehabilitation robot and surgery robot in hospitals. In this context an operator is a person designated to start, monitor and stop the intended operation of a robot or a robot system.

Actually, robots may be used in several activities. Veruggio G., Fiorella Operto (2016) have listed lots of fields in which robots may be employed: *for example, they may be linked to Web, for data sharing and cooperative working and learning; they could also be employed in dangerous operations such as laying explosives; they can work in the environmental protection (robots for pollution cleaning and decommissioning of dangerous facilities). Mobile robots in particular can be highly valuable tools in urban rescue missions after catastrophes such as earthquakes, bomb or gas explosions, or everyday incidents such as fires and road accidents involving hazardous materials. Concerning space robotics, on the basis of current knowledge and technology, the robot can be our pioneer in space travel and missions to explore the far planets of the solar system and beyond. Moreover, computer-controlled diagnostic instruments have been used in the operating theatre for years to help provide vital information through ultrasound, computer-aided tomography (CAT), and other imaging technologies. Finally, health care and quality-of-life robotics is a very promising field, where progress will be directly measured by the well-being of people. Assistive technology will help many people to conduct a more independent life and may be a very good tool for education, culture and art.*

Given the enormous applicability of "artificial intelligence", European Union is fostering enhancements in this field. In particular, Horizon 2020[3] proposes to establish Public-Private Partnerships (PPP) in order to strengthen Europe's competitive position in a particular business sector. The goals of the Robotics PPP are:

1. Develop strategic goals of European robotics and foster their implementation;

2. Improve industrial competitiveness of Europe through innovative robotic technologies;

3. Promote position robotic products and services as key enablers for solving Europe's societal challenges;

4. Strengthen networking activities of the European robotics community;

5. Promote European robotics;

6. Reach out to existing and new users and markets;

7. Contribute to policy development and addressing ethical, legal and societal issues.

The long description of artificial intelligence provided above aims at reflecting on which kind of revolution it may produce in the legal, social and economic system.

Veruggio G., Fiorella Operto (2016) affirm that: *robotics is going to trigger widespread social and economic changes opening new social and ethical problems for which the designers, the end user, the public, and private policy must now be prepared*.

Not surprisingly, new disciplines are emerging as for example "Roboethics", dealing with ethical implications arising from the relationship between humans and robots. Two issues may unravel the ethical implications: robots may be used in war conflicts (and they have already been) and in the medical field (biorobotics) and as a consequence may have a significant impact on our set of ethical rules. On March 2018, an Uber self-driving vehicle killed a woman although self-driving technology is supposed to detect pedestrians, cyclist and others and prevent accident. The car crash, however, points out that specific regulations of the nascent technology are required as the robot cars cannot accurately predict human behavior. In other words, the real problem arises in the interaction between humans and the robot vehicles.

[3] Horizon 2020 is the financial instrument implementing the Innovation Union, a Europe 2020 flagship initiative aimed at securing Europe's global competitiveness. Running from 2014 to 2020 with a proposed indicative budget of €80 billion, the EU's new program for research and innovation is part of the drive to create new growth and jobs in Europe.

The World Economic Forum[4] lists nine points relating to roboethics:

1. The probability of more unemployment (the most discussed topic in the economic literature); this involves also that humans have more free time if machine are employed in productive activities in place of them;

2. Inequality (if more wealth is accumulated thanks to machines, the question is whether or how this wealth is redistributed);

3. Humanity (machines may affect the way humans interact);

4. Artificial stupidity (a mistake is always possible by a machine);

5. Incapacity of AI to distinguish between a mere task and human rights (for example, in predicting future human criminal behaviour, machine could discriminate and act against people selected as probable criminal);

6. Security (we have already highlighted the possibility to program robots for war or terroristic attacks);

7. Evil genies (How do we defend against not pondered consequences?);

8. Singularity of humans (if humans are no longer the most intelligent beings on earth, what is going to happen?);

9. Robots rights (Deeming machines as entities that can perceive, feel and act as humans, ought we to think about their legal status? Should they be treated like animals of comparable intelligence?)

Public institutions are deeply involved in these issues. They have to be ready to manage a new environment where humans and machines act together.

3. The actual diffusion of robots in economic activities and the worldwide level of innovation

We are going to verify to what extent robots are spread in production activities at the present time. However, being a very new science frontier, still in progress, exhaustive datasets on the topic have not been developed yet.

[4] Available at: https://www.weforum.org/agenda/2016/10/top-10-ethical-issues-in-artificial-intelligence/

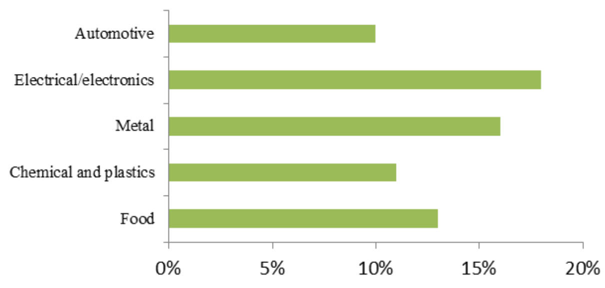
The International Federation of Robotics (IFR) published some data by industries and countries, estimating also the future development in 2018-19. Tab. 1 shows the distribution of the worldwide operational stock of industrial robots by industries, in 2015. It is mainly concentrated in "Automotive" (623,100 units) and "Electrical/electronic" industries (328,600 units); "Chemical and plastic" (150,900 units) and "Metal" (160,900 units) industries follow. Comparing 2015 with 2014, we observe a general upturn; in particular, "Food" industry increased by about 13%, "Chemical and plastics" by 11%, "Metal" by 16%, Electrical/electronic by 18% and "Automotive" by 10%. The higher increase is registered in the Electrical/electronic industry (Fig. 1).

Tab. 1 Estimated worldwide operational stock of industrial robots at year-end by main industries

Industry	Thousand of units
Food	51,2
others	91,6
Chemical and plastics	150,9
Metal	160,9
not specified by industries	225
Electrical/electronics	328,6
Automotive	623,1

Source: IFR World Robotics 2016

Fig. 1 - Estimated worldwide operational stock of industrial robots at year-end by main industries (% increase 2015/2014)



Source: IFR World Robotics 2016

Considering the major western European countries: Germany, Italy, Spain, France and UK, the annual supply of industrial robots on aggregate increased by 12,000 units, from 2010 to 2015, and is expected to double, in the period from 2010 to 2019 (Tab. 2).

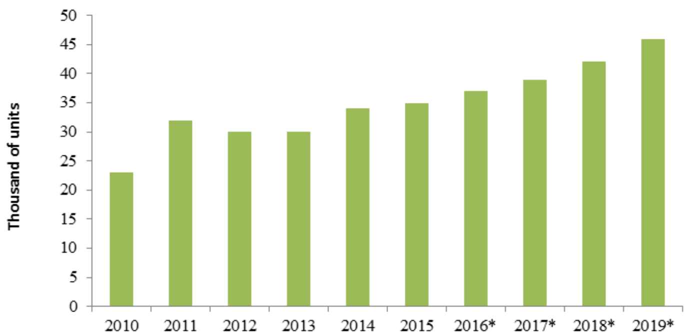
Tab. 2 - Annual supply of industrial robots to main Western European markets (Germany, Italy, Spain, France, UK) 2010 -2019*

Years	Thousand of units
2010	23
2011	32
2012	30
2013	30
2014	34
2015	35
2016*	37
2017*	39
2018*	42
2019*	46

Source: IFR World Robotics 2016

It is interesting to underline that the annual supply of industrial robots in Germany, Italy, Spain, France and UK has enhanced even after the 2008 financial crisis, in spite of recession, debt consolidation and high unemployment (Fig. 2).

Fig. 2 - Annual supply of industrial robots to main Western European (Germany, Italy, Spain, France, UK) markets 2010 -2019*



*Source: IFR World Robotics 2016 - * Forecast*

The density of industrial robots (their number per 10,000 employees) in worldwide manufacturing industry, in 2015, is higher in Korea, Singapore, Japan and

Germany (Fig. 3). Germany is the European country which ranks first in the international comparison. Italy comes after Sweden, Denmark and Belgium.

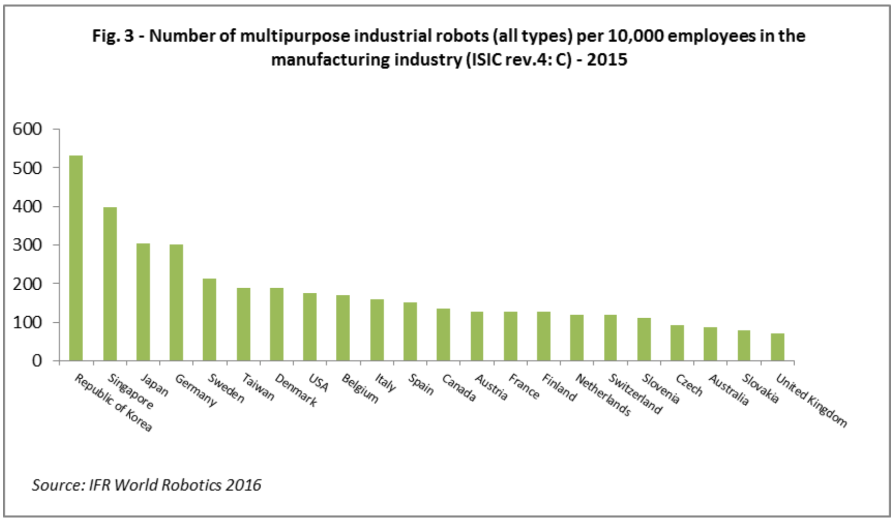


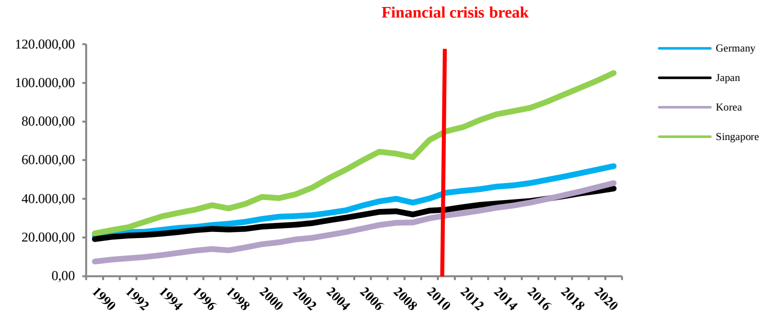
Fig. 3 - Number of multipurpose industrial robots (all types) per 10,000 employees in the manufacturing industry (ISIC rev.4: C) - 2015

The first four countries experienced a relative small impact of the 2008 financial crisis in terms of economic growth; therefore, they probably have had more resources to be invested in innovation during the after-crisis period (Fig. 4). In addition, they show a very low unemployment rate, in 2016, equal to 1.8% in Singapore, 3.7% in the Republic of Korea, 4.1% in Germany, 3.1% in Japan[5].

Actually, Asia is an innovation hotbed in 21st century, abreast of Northern American and some European countries. In the Asian continent, Japan has confirmed its role of driving force of global innovation, since 1970, but starting from the 1980s, other countries have emerged: Hong Kong (China), Singapore, the Republic of Korea, and to some extent Malaysia. In particular, Japan and the Republic of Korea have created, in Asia, innovation networks in technology-intensive manufacturing sectors; even if these networks still act as strategic way to outsource manufacturing activities in low-cost areas rather than to spread innovation (Cornell University, INSEAD, and WIPO, 2017).

[5] World Bank data: https://data.worldbank.org/indicator/SL.UEM.TOTL.ZS

Fig. 4 - Gross domestic product based on purchasing-power-parity (PPP) - per capita GDP - Current international dollar



*Source: IFR World Robotics 2016 – 2018-2021 * Forecast*

4. A "robot tax"? Theoretical insights

The first pillar of the following discussion is that the primary purpose of tax systems is to raise revenue, preventing to affect behaviour. The second pillar is that we cannot imagine a robot tax *sic stantibus rebus* but according to possible future scenarios which might include a significant use of artificial intelligence and therefore might be very different from the present one.

Traditionally, the optimal taxation of productive inputs depends upon the institutional capacity to offset theoretical criteria usually employed to evaluate a tax design: neutrality, efficiency and equity. But, actually, it also depends upon policy goals. As far as capital and labour are concerned, they are always taxed differently: the infringement of the principle of neutrality is justified mostly by the need to foster productive investments. In addition, lots of fiscal incentives – patent, subsidies, and allowances – are provided in favour of capital investments, with a view to increase capital investments, Gross National Product and employment. After globalization, it is also a way to tackle global tax competition.

Against this background, to establish the fairness and efficiency of a robot tax, first of all we need to define its role in the production process, trying to establish whether it is an intermediate, a labour or a capital input. Most of the literature tries to answer the question whether robots and labour are complement or substitute[6]. Some

[6]See also: De Canio Stephen J. (2016), Robots and humans – complements or substitutes? *Journal of Macroeconomics*, Volume 49, September, Pages 280-291.

literature dealing with the determinants of economic growth recognise the particular nature of robots – neither labour nor capital – and distinguish three inputs in their macroeconomic models: traditional capital, robot capital, and labour. In particular, robot capital is assumed to have a higher degree of elasticity of substitution with labour than traditional capital as well as information and communications technology (ICT) and various types of automated equipment (Tsu-ting Tim Lin, Charles L. Weise, 2018).

Actually, robots currently used are mainly "industrial robots" but it is worthy to make hypothesis on the eventual scientific developments of artificial intelligence as well as on the degree of their elasticity of substitution with labour. The higher the elasticity of substitution they are going to have with labour, the higher the level of unemployment which may be expected. Nevertheless, this is not the principal topic of our discussion. Here, the assumptions on the nature of robots are helpful to discuss the eventual effect of a robot tax.

We assume in our discussion that robots are essentially capital goods, according to the definition given by ISO, described in section 1 and deal with the taxation design concerning this scenario.

Actually, the particular nature of artificial intelligence and its impact on economic and social system worries policy makers, taking for granted its high degree of substitution with labour input. Not surprisingly, the European Parliament (2015/2103 INL- Legislative initiative procedure – Civil law rules on robotics[7]) has already treated the topic in a motion for a European Parliament Resolution, stating that:

….. the development of robotics and AI may result in a large part of the work now done by humans being taken over by robots without fully replenishing the lost jobs, so raising concerns about the future of employment, the viability of social welfare and security systems and the continued lag in pension contributions, if the current basis of taxation is maintained, creating the potential for increased inequality in the distribution of wealth and influence, while, for the preservation of social cohesion and prosperity, the likelihood of levying tax on the work performed by a robot or a fee for using and maintaining a robot should be examined in the context of funding the support and retraining of unemployed workers whose jobs have been reduced or eliminated…

[7] Available at: European Parliament on robotics civil law

According to European Parliament, a possible solution is: *levying tax on the work performed by a robot or a fee,* considering the need *of funding the support and retraining of unemployed workers whose jobs have been reduced or eliminated.* Therefore, in relation to a tax on robots or on the use of robots, it seems worth establishing which category of workers is more at risk: high or low skilled, or rather routine or non-routine workers. It is difficult to build ad hoc indicators of a simple theoretical notion such as “routine” workers. According to some studies, routine workers do not necessarily are the low skilled ones (for example, “accounting”), but the degree to which tasks can be routinized shows a negative correlation with employment levels (Becker et al., 2005; Goos et al., 2014). In other words, in most surveys routine workers are reckoned at risk to lose their job, in the robot era; but to analyse the distribution of skills by industry, in order to establish where routine workers are located, is not a straightforward task. Policy makers aiming at intervening to prevent unemployment of routine workers should first try to identify them within each industry. In this respect, Marcolin L. et al. (2016) built a robust indicator to measure the routine intensity of occupations and its relation with the skills of workers. However, their conclusion is not so clarifying:

….empirical evidence in the economic literature suggests that high-skilled workers tend to specialise in non-routine tasks. However, it also suggests that some low skill tasks can be complementary to high skill ones (e.g. cleaning services)……. understanding the link between routine intensity and the industry skill distribution in a country may be less than straight-forward (p. 22).

Nevertheless, assuming that the characteristics of occupations modify slowly over time, data show that the business cycle affects more routine intensive occupations than non-routine ones (Marcolin L. et al., 2016). In addition, Acemoglu and Restrepo (2017) estimated for USA that one more robot per thousand workers reduces the employment to population ratio by about 0.18%-0.34% and wages by 0.25%-0.5%. In addition, they show that the categories experiencing substantial declines are routine manual occupations, blue-collar workers, operators and assembly workers, machinists and transport workers. Observing the impact of robots on employment in different education groups, surprisingly, they found a stronger negative effect for workers in the middle of the educational distribution: in other words, people with very low or very high educational attainment seem to be the less hampered.

As far as the taxation system is concerned, the substitution of workers with robots raises the issue of a possible loss of tax revenue as labour taxes are its major source. If low-skilled or routine workers are displaced by robots and policy makers do not make investments for retraining them, then unemployment raises and tax revenue coming from labour income falls, even if robot prices reduces (OECD, 2018).

For example in Italy, during the period 2010-2017, the share of tax revenue coming from labour income is equal on average to about 73%, while the share of tax revenue coming from business income is equal on average to about 17% (Tab. 5). The concern is that a declining of labour demand and as a consequence of labour income could be hardly set-off by an upward of business income.

Tab. 5 - State tax revenue in Italy personal and corporate income tax 2010-2107

	2010	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
Total	218.014	218.090	229.009	232.631	224.994	240.059	245.294	245.887
PIT	164.608	163.868	165.614	163.691	163.650	176.220	180.004	182.661
CIT*	37.000	35.949	36.582	40.026	32.293	33.402	35.251	35.246
PIT and CIT as a percentage of State total tax revenue								
PIT	75,50	75,14	72,32	70,37	72,74	73,41	73,38	74,29
CIT*	16,97	16,97	16,97	16,97	16,97	16,97	16,97	16,97

*Only income coming from business is included.

Source: Data from the Department of Finance - Mef

Therefore, a tax on robots would be justified as it would raise tax revenue and balance the reduction of robot prices in relation to routine workers' wages (OECD, 2018).

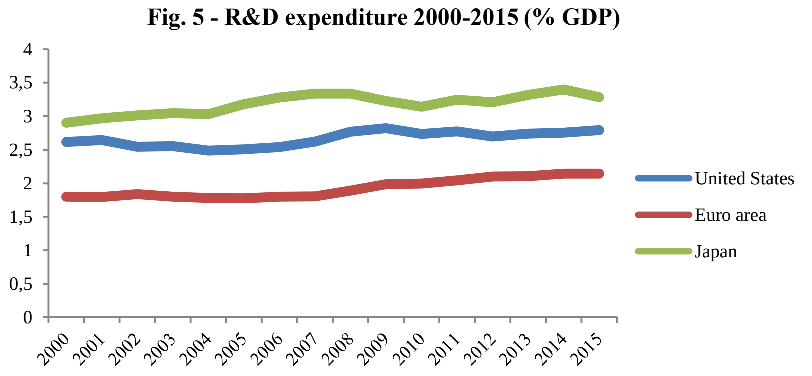
A way to approximate roughly the revenue loss is to multiply the effective personal tax rate by the eventual gross salary loss due to automation. The McKinsey Global Institute (2017), for example, estimated that automation in USA would eliminate $2.7 trillion in annual wages.

Not surprisingly, in an interview[8], in 2017, Bill Gates (Microsoft co-founder) suggested to establish a "robot tax" in order to preserve a fair competition between human labour and machines and reduce the speed of automation. Moreover, in a Report released in January 2018, the World Economic Forum highlighted the need for a permanent training to workers as "*reskilling and retraining the existing workforce are essential levers to fuel future economic growth [and] enhance societal resilience in the face of technological change*".

Although the economic literature is not unanimous about the massive unemployment potentially caused by AI[9], it is hardly questionable that workers need to be permanently reskilled in a growing technological complexity. Therefore, public and social costs of "education and training" will be increasing. Finally, Programs of Social Assistance for those excluded from the labour market, even if cyclically – given the huge technological revolution – become even more urgent. In synthesis, the need of public resources could be increasing. This is a further justification for a robot tax.

Conversely, after the financial and economic crisis, in OECD countries an increase in tax incentives for capital investments is observed, especially in R&D investments (Fig. 5) which exacerbates the imbalance in favour of capital. Moreover, OECD is regulating agreements among countries in order to prevent the tax competition brought about by more favourable tax rules concerning productive capital: "capital" more than labour is on the worldwide policy agenda. The reason is simple: capital is more mobile than labour and each country attempts to attract foreign investments, in a globalised world. But the eventual displacement of labour by robots may result in a more dangerous macroeconomic imbalance due to a massive unemployment and a fall in public resources.

[8] https://qz.com/911968/bill-gates-the-robot-that-takes-your-job-should-pay-taxes/
[9] For more detail see: Bottone G. (2017).



Source: The World bank data.

In this scenario, if governments need to safeguard a given amount of public resources, they have few alternatives, among which mainly: 1. Fighting tax evasion 2. Levying new taxes. Therefore, if we agree on the need to levy a robot tax, the second step is to establish its possible design.

Some policy suggestions was given in the field of fiscal policy, based on the prediction that the higher unemployment brought about by AI will result in a sharp reduction of tax revenue due to the dramatic fall of labour income. In order to re-establish a balanced tax system, in relation to labour and capital, Abbott and Bogenschneider (2017) propose four possible solutions:

- ✓ disallowance of corporate tax deductions for automated workers;
- ✓ levy of an automation tax;
- ✓ grant offsetting tax preferences for human workers;
- ✓ levy of a corporate self-employment tax.

The first solution aims at reducing tax incentives for capital investments, while the second one is finally a way to raise corporate income tax rate. The third solution seeks directly to shift employer's preferences towards labour, for example repealing social security contributions so that both capital and labour are exempted from the payment of payroll taxes. Finally, the fourth one looks for an increase in corporate income tax rate against self-employed which do not employ human labour. This corporate tax would substitute Social Security contributions avoided by the firm automation.

Alternatively, The World Economic Forum (2018) proposes a financial transactions tax or a new tax on high-net-worth households to finance job training and face indirectly the eventual unemployment and fall in tax revenue. This would be applied in place of a robot tax which could slow down innovation.

A further possible solution might be the provision of tax credits in favour of companies which hire and retrain displaced workers, providing that public resources are made available.

A very futuristic proposal is to levy an income tax on the imputed hypothetical wage a robot would have earned if it had been a worker. The "robot income tax" would be justified by the "economic advantage" obtained by the employer from the use of robots over workers. Instead, a lump-sum amount could be paid by the employer, warranted by his ability to pay the tax (Guerreiro et al., 2017). Afterwards, as technology evolves, the robot's ability to pay could be recognized by law. This is also the point of view of OECD Forum 2018, stating that robots may have a legal personality and should be taxed in order to recover the drop of tax revenue owing from the labour force substitution[10].

Finally, a value-added tax on the activities performed by robots could be levied in the same way the VAT is applied to self-employed, paying attention to safeguard the neutrality of VAT system.

As the imputed wage to robots is not easily computable, a VAT on their activities could represent a valid alternative. Nevertheless, while proposals examined so far are essentially founded on the principle of neutrality, a possible robot VAT requires some reasoning. Robots' activities should be categorized as supply of goods or services (Oberson X., 2017). Probably, however, if a robots is employed to produce goods or services, these are already taxed both as intermediate or final goods, therefore the danger of the double taxation could be envisaged. Only if robots are considered as though they were business men with a juridical and fiscal capacity, a VAT on their

[10] http://www.oecd.org/forum/oecdyearbook/how-taxing-robots-could-help-bridge-future-revenue-gaps.htm

activities could be justified. This is quite futuristic, even if the debate around the juridical and fiscal capacity of robots has already started[11].

All the proposed solutions are quite controversial as globalization and the consequent easier movement of capital generate tax competition among jurisdictions. Hence, as a tax on physical capital implies higher costs for national companies and reduces their global competition, any robot tax design should be analysed globally, taking into account the discussion on the international taxation at the OECD and the UN, in particular, in the frame of tax treaties and transfer pricing rules.

4.1 The incipient political debate

The idea of taxing robots is still at a first stage: no countries have actually introduced it. However, the geopolitics of AI shows that in some countries the proposal to establish a robot tax in order to prevent a massive unemployment has been already discussed. For example, in San Francisco[12], politicians running for local government have included AI in their electoral campaign. Jane Kim of the San Francisco Board of Supervisors has created a committee called the "Jobs of the Future Fund”[13]. The core of her point of view is the relevance of the State or local government action to lighten the impact of technological progress and support the displaced workers by education and training programs. Her concrete proposal consists in extending the payroll tax to robots which perform human jobs. Companies would pay into a fund the same payroll tax and social security the replaced worker would have payed. Tax revenue gathered in this way could be used to train workers and make them able for more capital intensive jobs, provide free education, and "*invest in creating meaningful and high wage jobs in industries that are currently hard to automate like child care workers, which is currently a poverty profession*".

Similarly, in UK, in 2016, the British House of Commons, through its Business, Energy and Industrial Strategy Committee, launched an inquiry to find out people’s opinion about the impact of AI on British society in the next future. The inquiry is very detailed and aims at capturing British people’ feelings and perceptions of AI, including

[11] See for example: European Parliament, Report with Recommendations to the Commission on Civil Law Rules on Robotics (A8-0005/2017).
[12] http://ethanallen.org/the-california-robot-tax/
[13] Jobs of the Future Fund.

the convenience of taxing robots. In July 2017, the British House of Lords launched another inquiry focusing, in particular, on ethical, moral, and social implications of AI. British government investigations have a key goal: to gather information from any stakeholder which could be useful to cope with robot impact. As it is possible to read in the British Parliament website[14], a robot tax could be necessary as millions of jobs are at risk of being automated in the U.K.; policy makers are aware of it and prefer to be ready: a robot tax is deemed a good instrument for this challenge.

Actually, the U.K. as a whole could see 35% of jobs be displaced by robots. In Wales, one in three jobs could disappear by the 2030s. In Northern Ireland, 50% of jobs are at risk of being automated, and in Scotland 46% of jobs could be automated (Frey C. B. and M. Osborne, 2015).

In the same way, this topic has been discussed in South Korea which is the world's most heavily automated country, with more than one robot per 19 employees in the high-tech manufacturing sector. Actually, what the government of South Korea is discussing concerns a revision of the corporation tax in order to limit tax incentives for companies investing in automation. Previously, a seven per cent deduction in corporate tax was introduced to incentivize capital investments. A cut of up to two per cent in this deduction is under consideration. The country's current tax laws are due to expire at the end of 2019. Although this is not a robot tax, rather a partial reduction of incentives to automation mainly in the business sector, it has the same effects of a robot tax[15].

Synthesizing, up to now no countries has concretely established a robot tax, but the discussion on the opportunity to levy a robot tax to prevent high rates of unemployment and a fall in tax revenue is vibrant. There are supporters and opponents, according to the acceptance or refusal of the possible massive unemployment brought about by AI.

[14] https://www.parliament.uk/ai-committee

[15] https://www.roboticsbusinessreview.com/regional/during-the-2018-winter-olympics-south-korean-robot-reflect-the-geopolitics-of-technology/

Conclusions

Artificial intelligence is spreading quickly in the most advanced countries and currently it does not seem to hamper economic performance everywhere. The taxation on robots is very controversial as it may intensify tax competition among different jurisdictions. Therefore a global effort is required to include this topic in the international agreements about the common rules of taxation to be established in order to face global tax evasion and elusion.

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