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The impact of digital revolution on social fairness: four seminar's topics.

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Abstract

We are in the middle of a digital revolution and the role of the government when dealing with its impact on social fairness should be covered in public economics courses. The topic is also of great interest on the part of the students. This paper proposes four topics for discussion in Public Economics seminars. Each topic addressees, from a different angle, the impact of digitalization and robotization on equity levels: i) Does Internet reduce inequality? ii) How relevant is and what determines digital divide? iii) Does sharing economy alter unfairness level? iv) How do robots affect inequality?

Keywords: Equity, digital revolution, Internet, digital divide, sharing economy, robots.

Códigos JEL: H23, H24

1. INTRODUCTION

The emergence of the Internet and smartphones, the connection between the two phenomena and the progress of digitization have transformed both our personal lives and the way in which economic activities take place. Now we do many things differently at work, and in our leisure time in comparison to how we used to do them. The Internet has become a part of our everyday life, rather than a separate place to be[1] and some tech companies have become a big part of our lives. Looking ahead, phenomena as Big Data, Internet of Things (IoT), artificial intelligence (AI), machine learning (ML) and the advancement of robotization and mobile robotics (MR) will accelerate this transformation. Digitalization does not change economic laws[2], nor does government objectives (economic efficiency, equity, business cycle stabilization and long-term economic development). However, economic relations change and economists who study government intervention in the economy must consider this transformation in their analysis to better understand how society functions. Unequivocally we find ourselves in the middle of an information revolution and incorporating the impact of the digital revolution on public economics syllabus will result in a greater interest on the part of our students. Students who nowadays are digital natives.[3] This article outlines certain topics that could be incorporated in public economics courses in relation to equality and

redistributive aspects. In connection to this specific field, I propose a set of discussion topics that can be used in seminars as well as for individual essays' subjects. In addition, some practical aspects on how to conduct the seminar are included at the end of the paper. In particular, some details on how to organize the seminar, a sample of seminar's instructions and tips on how to perform the presentations, as well as a suggestion on how to evaluate the seminar session are shown.

Although this article focuses on equality and redistributive aspects, it should be emphasized that much of the content of public economics syllabus should be revisited under the light of the impact of the digital revolution.[4] A new generation of students that has already entered the university is termed *digital natives*. This is the main reason why we propose to cover the material on equity using the format of a seminar instead of traditional lectures. This *net generation* is said to have been immersed in technology all their lives. People of this generation are ready to speak about their experiences on the access to ICTs and their skills on tech matters. They feel technology at the core of their lives and a seminar on this subject may contribute to get public economics closer to their learning interests.

2. COMMON TOPICS ON EQUITY AND REDISTRIBUTION IN PUBLIC ECONOMICS COURSES

On the one hand, government interventions in the economy are justified by the existence of economic inefficiencies. The analysis of inefficiencies arising from market failures occupies a relevant part in public economy manuals. But even in the event that an economically efficient outcome could be achieved after all market transactions have taken place, it may happen that the resulting outcome may be undesirable for the society due to its unfairness. This usually occurs when the initial endowments of the society's members are very unequal. Also for that reason, governments intervene in a number markets, in this case aiming to increase horizontal and vertical equity levels. As a result, all public economics courses include the analysis of topics connected to equity level and redistributive goals, including among others those shown in Table 1.

Table 1: Common topics on equity in public economics courses

Optimality and comparability	Social optimality: Second Theorem of Welfare; Social welfare functions; curves of social indifference (Bergson-Samuelson, utilitarian and Rawlsian approaches); Non-tax redistribution: lump-sum taxes; interpersonal comparability, social welfare and Arrow's theorem.
Unfairness and poverty	Definitions of income and minimum needs, equivalence scale; Rowntree, Beveridge and Orshansky analysis; inequality measurement: relative index, relative mean deviation, Pigou-Dalton Principle of Transfers; Lorenz curve and Gini Index; Equally distributed equivalent income and Atkinson measure of inequality; absolute and relative poverty; poverty line; income gap; head-count ratio; aggregate poverty gap; income gap ratio; Foster-Greer-Thorbecke (FGT) index.
Equity and taxation	Tax Incidence; optimal taxation (commodity and income taxation); Rawlsian taxation, progressivity of tax system, negative income tax (NIT); tax evasion and tax avoidance.
Social expenditures and public subsidies	Spending on public education; special education programs; scholarship and student loan programs; public health insurance; healthcare expenditures; social housing programs; subsidized renting; social security systems; unemployment insurance system; unemployment compensation; universal basic income.

Source: Own elaboration.

3. SOME TOPICS ON THE IMPACT OF DIGITAL REVOLUTION ON EQUITY AND REDISTRIBUTION

In this section, I propose four topics that relate to the consequences of digitalization and robotization of the economy on fairness and distributive aspects. For each topic, I point out some of the arguments to consider in the discussion and offer a set of reading lists to deliver to students.

It should be noted that the digital revolution is also significantly affecting two other services typically provided directly or indirectly by governments with an impact on equity: education and healthcare. These two topics are not covered in this article.

3.1. DOES INTERNET REDUCE INEQUALITY?

In the discussion on the equalizing power of Internet,5 we find many arguments regarding the possible improvement of equal opportunities between nations and individuals that the diffusion of the Internet could generate. See Table 2.

Table 2: The case for the equalizing power of the Internet

Arguments	Reading list
In the *cyberspace*, barriers to achieve situations that are more equitable may disappear. Communication through technological means benefits those workers with a peripheral status. The Internet offers mechanisms to reduce the level of gender discrimination (allows women to escape from the *pink ghetto*), and contributes to eliminating social class discrimination as well as racial biases.	Dubrovsky et al. (1991), Kiesler and Sproull (1992), Polly and Polly (1993); Wojahn (1994); Engelman (1995), Michaud (1996), Wolf (1998).
The Internet makes the world smaller and more open. The globalization process 3.0 flattens the world and gives power to individuals: anyone can innovate, demonstrate, and exploit their talent, without the need to emigrate. Although there is no such a thing as a unified global labour market, the informational economy witnesses a greater interdependence of labour markets. The Net may be a mean to reduce the pay gap between workers in the world.	Tapscott and Caston (1993), Negroponte (1995), Castells (1996), Friedman (2005a and 2005 b).
By making access to information easier and less expensive and making it available to everyone, without discrimination, the Internet is a source of inequality reduction.	Anderson et al. (1995) y Hauben and Hauben (1997).
The Internet enhances the level of social integration of individuals. Communication through the Internet with friends and family, as well as the participation in social media improve the level of social support, the self-esteem and the commitment to social norms.	Cohen et al (1984), Cohen and Wills (1985), Sproull and Kiesler (1991), McKenna and Bargh (1998 y 2000), Diener et al. (1999), Wellman et al. (2001).
The Internet, personal computers and other tech-devices change the nature of knowledge workers. These technologies increase workers productivity, emphasizes the importance of talent and increase the individual capacity. All this contributes to a greater professional freedom while reduces discrimination.	Leamer (2007).

Source: own elaboration.

However, not all scholars are so optimistic about the impact of digital technologies on the inequality level among nations and among citizens of each country. For some, the rise of *informationalism* at the end of the millennium has been linked to situations of increasing inequality and higher exclusion.[6] Some pessimistic opinions about the contribution of the Internet to the level of social justice between individuals are shown in Table 3.

Table 3: The case for a negative contribution of the Internet to the level of equity

Arguments	Reading list
Innovations in communication technologies keep workers connected 24/7. It eliminates the edge between working time and free time, something that can lead to situations of labour exploitation.	Nix and BlairLoy (2000).
The *virtual company* allows the gathering and dispersal of labour for specific projects and tasks at any place and time. This circumstance leads to a redefinition of the relationship between capital and labour. The new *networked-worker* is more vulnerable due to a reduction in the working life span in which professionals are recruited to form part of the core of the company, and by requirements of greater mobility.	Castells (1996).
The individualization of work in the digital world leaves each of the *networked-workers* alone to negotiate their fate in the face of constantly changing market forces.	Castells (1998).
Given the importance of the use of new information technologies at work, the inequality in the availability of access to technology (*digital divide*) among the population is an increasingly relevant source of the widening in unfairness levels.	Novak and Hoffman (1998), NTIA (1999), Zhang et al. (2008).
Due to technology advances, many middle and low skill jobs have disappeared, contributing to increasing inequality, falling labour force participation and stagnating median incomes. The overall *return to skill* as measured by the college/high-school earnings gap has monotonically increased over last decades due to technological developments.	Acemoglu and Autor (2011), Autor and Dorn, (2013).
The *second machine age* represents a skill-biased technology. Technology and skills are complements and thus technology requires ever more skills. As the demand for skills rises, the wage gap between skilled and unskilled workers (the college premium) will rise as well.	Goldin and Katz (2009).
Computer-mediated communication is less valuable for building and sustaining close social relationships than other means, such as face-to-face contact. The emergence of technologically assisted communication implies that individuals spend more time alone. It does not contribute to social integration and it may represent a source of marginalization.	Robinson et al (1997), Robinson et al. (1998), Cummings et al. (2002)
Social hierarchies and class relations can be maintained or even augmented in the cyberspace. There is a risk of an increasing *digital divide*: a social gap between the information rich and the information poor – those without access to the computer and the Internet – or between *users* and *losers*.	Negroponte (1995), Tapscott (1996), Golding (1998), Ebo (1998), Bonfadelli (2002), Selwyn (2004), Witte and Mannon (2010).
Recent technological advances have favored some skill groups over others, particularly "superstars" in many fields, and probably also increased the overall share of GDP accruing to capital relative to labor.	Brynjolfsson and McAfee (2011), Westerman et al. (2014).

Source: own elaboration.

3.2. How relevant is and what determines the digital divide?

The access to the Internet has been developing unevenly in the world, between nations[7] and individuals. The digital revolution has transformed the lives of many, but also has left untouched the lives of many others.[8] Part of the world population misses out on the opportunities created by the Internet. This gap between the information haves and have-nots is commonly referred to as the *digital gap* or the *digital divide*.[9] Internet threatens to divide society into two classes: the information elite on the one hand and those not linked to the Net on the other. When it comes to participating in the information age this gap relates to both economies and individuals within each society.[10] This *digital gap* is identified with differences regarding: the availability of physical access to the Internet, the possibility of using the Net from different devices; the spatial access flexibility; or navigation skills[11]. Both, practitioners and researchers distinguish three stages in the diffusion and social impact of new technologies: the access, the effective usage and its tangible impact.[12] Regarding the main determinants of the *digital gap* see Table 4, and see Table 5 for empirical results.

Table 4: Main determinants of the digital gap

Factors	Reading list
A low-income level (national or *per capita*) is the most critical factor of exclusion of access to the Internet.	Benton (1998), Arnum and Conti (1998), Hargittai (1999), Norris (2001), Beilock and Dimitrova (2003), Quibria et al (2003), Fuchs (2008a), Zillien and Hargittai (2009), Montagnier and Wirthmann (2011).
Availability and quality of telecommunications infrastructures and of interregional connections are relevant for digital gap.	Goodman et al. (1994), Press (1997), Mutula (2002), Zhao (2002), Quibria et al (2003).
The cost of access to the Internet is a determining factor in the *digital exclusion*. This cost relates to a number of factors affecting the telecommunications industry, including the quality of public policies, privatization measures and competition levels.	Paltridge (1996), Paltridge and Ypsilanti (1997), Giussani (1997), Fletcher 1998, Dasgupta et al. (2001), Petrazzini and Kibati (1999), Lee et al. (2003), Montagnier and Wirthmann (2011).
Cultural and social factors: the level of political freedom, civil liberties and the social acceptance of new ideas and technologies (*diffusion theory*) affects the *digital gap*.	Ivanova et al (1999), Maitland and Bauer (2001), Zhu and He (2002); Carveth and Kretchmer (2002), Volken (2002).
Educational level of individuals and parents are a source of digital exclusion.	Hoffman and Novak (1998), Cullen (2001), Quibria et al (2003), Cha et al (2005), Chinn and Fairlie (2006), Notten et al. (2009), Weia and Hindmanb (2011).
Regarding the Internet, differences in: the culture of trust in the Internet, the *know-how* of use and needs cover are other sources of digital divide.	Zhu and He (2002), Zhao (2002), Aladwani (2003), Huang et al. (2003), Lee et al. (2003), Robinson et al. (2003), Madon (2000).
Demographic structure of the population is one of the determinants on the *digital gap*.	Kraut et al. (1998), Loges and Jung (2001), NUA (2001), Sciadas (2002), Livingstone and Helsper (2007), Hargittai and Hinnant (2008).
Language of the users has been a cause of digital exclusion, although it is gradually declining in relevance.	Kelly and Petrazzini (1997), Du (1999), Wolk (2004).

(continuation of Table 4)

At least initially, there was digital discrimination per gender.	Ono and Zavodny (2003), Helsper (2010).
The potential digital discrimination per ethnic group has been analysed.	Jackson et al. (2001).
Place of residence (urban vs. rural) has been traditionally a source of *digital divide*.	NTIA (1995).
Differences in political institutions may partially explain the digital gap level.	Milner (2006).

Source: Prepared by the author based on Contreras (2017).

Table 5: Empirical evidence on the digital gap

Empirical evidence	Reading list
Main barriers to people benefiting in from today's information society are: (i) lack of basic computer skills, connected fears and negative attitudes especially among older and less educated people; (ii) new media are expensive; (iii) lack of user friendliness; and (iv) the gaps in the way the Internet is used are mostly education based.	Bonfadelli (2002)
Digital divide resides in differential ability to use new media to critically evaluate information, analyze, and interpret data, attack complex problems, test innovative solutions, manage multifaceted projects, collaborate with others in knowledge production, and communicate effectively with diverse audiences. In essence, to carry out the kinds of expert thinking and complex communication that are at the heart of the new economy.	Levy and Murnane (2004)
Differences in IT usage along demographic and socioeconomic dimensions reflect the extent of differences in other areas of the economy and society. Differential access of skills and usage is likely to increase. The growth of a usage gap is projected..	Van Dijk (2005), Van Dijk and Hacker (2003), Ono and Zavodny (2007)
Empirical evidence has been provided on the progression of the inequality of the installed information capacity (i) among devices, (ii) among countries, (iii) among the global population, and (iv) within countries. One of the conclusion is that the level of informational inequality started to decrease since 2006.	Hilbert (2014 y 2016)
This laggard effect follows a well-documented pattern of previous general-purpose technologies. The divide in the technological information and communication capacity of individuals, groups and societies is here to stay and becomes a major structural feature of our societies.	Freeman and Loucã (2002)
The divide will continue as long as technological progress continues. Economists refer to this process as "red queen effect", which refers to a dynamic in which standing still means falling behind (it refers to the Red Queen in Alice's Wonderland, who explains that one has to constantly run to simply stay in the same place).	Hilbert (2014 y 2016)
The common argument that the digital access divide is quickly closing and that the focus should shift to skills and usage, for others the access to digital communication is a *moving target*. It is unlikely to ever be solved.	Hilbert (2014 y 2016)

Source: Prepared by the author.

3.3. DOES SHARING ECONOMY ALTER UNFAIRNESS LEVEL?

One feature of phenomena such as Web 2.0/3.0 and social media is the relevance of sharing.[13] Sharing of goods and services has always existed, but traditionally it has taken place within the family or among agents who knew each other, and among whom there was a relationship of trust. The emergence of what has come to be called *sharing economy* o *collaborative economy,*[14] represents an important change, since it has allowed the collaboration and sharing among strangers. Something that has been feasible thanks to innovations in information technologies.[15] Individuals and companies increasingly consider sharing as a profitable alternative to ownership[16]. Growth in sharing systems accelerated by social media's ability to facilitate online music and movie sharing, but recently physical product sharing systems are expanding at a rapid rate as well[17]. How does this new *collaborative economy* affect fairness level? Table 6 shows some arguments supporting a positive effect.

Table 6: An optimistic view of the collaborative economy on fairness level

Arguments supporting a positive effect	Reading list
Sharing is a concept that incorporates a wide range of distributive and communicative practices, while also carrying a set of positive connotations to do with our relations with others and a more just allocation of resources.	John (2012).
The environment of low-income growth, and in some countries a significant reduction in income during the worst phase of the last crisis, generated a twofold result: the need to share assets and the incentive to monetize idle assets. The *sharing economy* had a mitigating effect on poverty during the crisis.	Gansky (2010), Sundararajan (2014) y Hamari et al. (2015).
The *collaborative economy* provided important support to the process of new jobs creation, mostly freelance. During the crisis, unemployment rates raised and the growth of the *sharing economy* contributed to reducing the impact that would have been evident without these developments.	Kumar (2015).
Empirical evidence has stated that elites have no impact on creation of skilled content. Social and entertainment content is more likely to be created by non-elites. Only the creation of political content is significantly and positively associated with elite status.	Blank (2013).

Source: Own elaboration.

However, many commentators are of the view that the development of the *collaborative economy* will result in a more unfair society. In Table 7, some arguments supporting this negative effect are shown.

Table 7: An optimistic view of the collaborative economy on fairness level

Arguments supporting a negative effect	Reading list
The *wikinomics* phenomenon is positively correlated to the self-employment expansion. It can lead to situations of greater precariousness for workers, greater labour risk and lower contributions to social security. The most likely result is a certain exploitation of labour by the companies that benefit from less paid work.	Bernhardt (2014), Schor (2014) Rogers (2015).
The growth of the *collaborative economy*, with the expansion of free lancers, can lead not only to a possible lack of protection of workers in terms of working conditions, but also to the risk of greater racial and gender discrimination.	Fuchs (2008b).
In the *new economy*, socioeconomic status is gradually associated with one's ability to create information online. *Prosumption* in the Internet era is not only the merging of production and consumption, but it also describes an interdependent relationship between them. *Digital gap* and *online production gap* are linked phenomena.	Correa (2010), Hargittai and Walejko (2008); Robinson (2009), Warschauer (2003), Ritzer and Jurgenson, (2010), Schradie (2011).
Owning or having access to the economic capital of hardware, software and other technological devices is paramount to going online. Researchers describe this as the quality and autonomy of one's Internet activity. Therefore, the more the *collaborative economy* advances the more relevant becomes the problem of the digital divide.	Hargittai (2008), Hassani (2006).
Online content production, such as posting to a daily blog or maintaining a Web site, is labour intensive and requires more leisure time since this commodity is often "free labor" in the *digital economy*. It is not the distribution of online content that is so costly but the production opportunity cost.	Terranova (2000) Humphreys and Grayson (2008), Ritzer and Jurgenson (2010).

Source: Own elaboration.

3.4. How do robots affect inequality

Computers are beginning to automate and make redundant plenty of jobs previously expected to remain in human control for a long time. The combination of artificial intelligence, big data, machine learning and mobile robotics imply that robots will be able to do almost every job. We face a world of driverless cars, drones for package delivery, computer programs to diagnose illnesses, and intelligent pattern recognition software that replaces lawyers, professors, doctors, journalists and others professionals. Robotics is already playing an important role in employment in the industrial and service sectors. Robots replacing humans has become one of the most discussed topics in research and business circles.[18]

It has been stated by some commentators that automated technology will be much more destructive of jobs than previous technological innovations. Cybernation or automation would result in an economy where potentially unlimited output can be achieved by systems of machines, which will require little cooperation from human beings.[19] Virtually every industry in existence is likely to become less labour-intensive. Machines are not only tools that increase the productivity of workers. Machines themselves are turning into workers. Technology will lead to a permanent, structural unemployment.[20] For some, the advance of robotics will result

into not only higher unemployment, but also an additional step of redistributing income from work to capital. See Table 8.

Table 8: A pessimist view of the impact of robotization on fairness level

Arguments	Reading list
There is a current trend towards labour market polarization, with growing employment in high-income cognitive jobs and low-income manual occupations, accompanied by a hollowing-out of middle-income routine jobs. Wages and educational attainment has exhibited a strong negative relationship with the probability of computerization.	Goos and Manning (2007), Frey and Osborne (2013), Graetz and Michaels (2015).
Digitization and robotization imply a greater inequality between skilled workers (who may escape from the automation trend), and the less skilled who cannot. Digital technologies allow the replacement of less skilled work by robots, which reduces their wages to the cost of the investments needed to enable replacement. On the contrary, the technology helps the productivity of those undertaking highly skilled tasks that require real-time analysis, decision, and reprogramming capability to the degree that only the human brain can master it so far.	Castells (1996), Ford (2015), Floridi (2016).
Although automation and digitalisation are unlikely to destroy large numbers of jobs, low qualified workers are likely to withstand the worst of the adjustment costs as the automatibility of their jobs is higher compared to highly qualified workers. Therefore, the likely challenge for the future lies in coping with rising inequality and ensuring sufficient (re-)training especially for low qualified workers.	Arntz et al (2016).
The wages of workers no longer rise in tandem with soaring productivity. The virtuous feed loop between productivity, rising wages, and increasing consumer spending will collapse.	Graetz and Michaels (2015), Ford (2015).
Manufacturing robots and reshoring (the relocation of activity back from the low-wage countries to the high-wage countries) are likely to have a higher impact in emerging markets (as China) than in developed west countries. Three-dimensional printing is ideal for producing highly customized "one-off" products, but manufacturing robots and industrial printers will work in unison – and increasing without the involvement of workers.	Ford (2015).
Massive unemployment will result in soaring inequality and, ultimately, falling demand for goods and services as consumers increasingly lacked the purchasing power. The economy of abundance will require the implementation of guaranteed minimum income programs A universal basic income (UBI) has been proposed as one possible solution to the loss of jobs caused by automation. A UBI would give everyone a fixed amount of money, regularly, no matter what. Proponents say not only would it help eradicate poverty, but it would be especially useful for people whose jobs are eliminated by automation, giving them the flexibility to learn new skills required in a new job or industry.	Ford (2015).
In a world where machines are able to do nearly everything, no one would be able to derive an income from work. Most income would come from capital. Therefore, the concentration of ownership of the machines would be critical for equity.	Karabarbounis and Neiman (2014), Ford (2015).

Source: Own elaboration.

Robotics and artificial intelligence system will bring a wave of abundance. Even if automatization results in a higher level of unfairness, there will be a decrease of material poverty. Abundance of digital goods and services (including healthcare and education services), lowering of costs and increasing personalization will result in a raise of living standards for all individuals. Table 9 shows some arguments supporting an optimistic view of the impact of robots at work.

Table 9: Robotization will not result in a less fair society

Arguments	Reading list
The supply of graduates is substantially larger than the demand for them in industry. The migration of leading-edge artificial intelligence capability into the cloud and big data revolution will be powerful drivers of white-collar automation. Technology and skills are substitutes and thus intelligent machines are replacing educated people such as lawyers, doctors, professors, and journalists. As the demand for skills declines, the wage gap between skilled and unskilled workers will decline as well.	Beaudry and Green (2013).
In the long term, even highly skilled workers may be very affected as artificial intelligence advances. Acquiring more education and skills will not necessarily offer effective protection against job automation in the future. Computers are becoming very proficient at acquiring skills, especially when a large amount of training data is available. Machines are coming for the high-wage, high-skill jobs as well.	Ford (2015).
Fears that technological innovations destroy jobs are not new, and the Luddites' destruction of machines during the early XIX is a striking example. The threat from technological advances thus seems much less pronounced compared to the occupation-based approach. Even if new technologies are introduced, workers can adjust to changing technological endowments by switching tasks, thus preventing technological unemployment. Third, technological change also generates additional jobs through demand for new technologies and through higher competitiveness.	Arntz et al (2016).
On a larger scale, new machines will also create work that is better, more productive, more satisfying than ever before. The new machines will raise living standards.	Frank et al. (2017)
Throughout history, automation commonly creates more, and better-paying, jobs than it destroys. *Robot apocalypse* effect ignores the dynamic economic responses that involve both changing demand and inter-occupation substitution. Companies do not use automatization simply to produce the same thing more cheaply. Instead, they find ways to offer entirely new products, whose production requires hiring more people. Focusing only on job losses due to robotization misses a central economic mechanism by which automation affects the demand for labor: raising the value of the tasks that workers uniquely supply.	Autor (2015), Bessen (2015 and 2016).
Over the longer term, more radical social engineering policies will be needed, moving eventually to a new social contract that recognizes and rewards people for their contributions to society within and outside the employment context.	Marchant et al. (2014).

Source: Own elaboration.

4. PUBLIC POLICY ISSUES

In this section, I propose some public policy issues to be addressed in connection to the role of the government in a scenario of digital revolution. See Table 10.

Table 10: Questions

Questions	Public tool type
1. Should governments invest in Internet and other digital infrastructure?	Public budget
2. Should governments subsidize the access to Internet to low-income groups?	Public budget
3. Should governments develop lifelong education policies and update very often education curriculum to meet technology changes? [a]	Public budget and extra budgetary.
4. Should governments subsidize learning of digital tools to low-income groups?	Public budget
5. Should governments regulate *collaborative economy*?	Extra budgetary.
6. Should governments tax robots?	Public budget
7. Should governments establish limits on technological development? [b]	Extra budgetary
8. Should governments protect jobs by prohibiting displacement of human jobs with technology? [c]	Extra budgetary
9. Should governments restraint to regulate the economy in order to promote job creation? [d]	Extra budgetary
10. Should governments impose a mandatory retirement age, a *shorter work week* and more vacation time? [e]	Extra budgetary
11. Should governments provide Basic Income Programs or Minimum Guaranteed Income (MGI) in scenarios of *technological unemployment* in order to maintain consumer demand? [f]	Public budget
12. Should governments give companies incentives to hire more workers? [g]	Public budget
13. Should governments offer incentives to upgrading the human brain by using *brain-computer interfaces* thereby allowing us to better keep pace with technological change? [h]	Public budget and extra budgetary.

a. Levy and Murnane (2004), Yusuf (2007), Levy (2010), Spence (2011); b. Joy (2000); c. See Yglesias (2013); d. Brewer (2013); e. Tracy (2013); f. Ford (2009 and 2015); g. Spence and Hlatshwayo (2011), Sachs and Kotlikoff (2012); h. Brynjolfssonand McAfee (2011).

5. WHY TO USE THE SEMINAR METHOD?

There are at least two questions to answer in connection to the proposition of the four seminars that are discussed in this article. First, why to use the seminar method to address the

topic of social fairness. Secondly, why to focus on the impact of the digital revolution when studying social inequality.

Regarding the first question, a seminar is a modern method of teaching and an advanced group technique of increasing use in higher education for a number of reasons. When it comes to discussing social fairness, all participants have an opinion to express, and the seminar method may give good motivation and learning experience to participants. The selection of these four topics enables between four and five groups of students and different discussants to participate in a session of 2 hours. See in table A1 in the appendix some instructions proposed for the seminar. Moreover, this method integrates reading and writing skills with presentation skills, which are of quite considerable benefit when compared with traditional lectures. In addition, the human interaction under this technique develops good manners and skills among the participants, and provides a good scholastic experience. The interactions in this method develop observation and questioning skills. Finally, this method inculcates responsibility and cooperative behaviours. See in Table A2 some recommendations and tips proposed to seminar's participants.

The second question relates to the choice of the topic on how digital revolution may affect social inequality levels in a modern society. In public economics courses when it comes to discussing how egalitarian are contemporary societies, issues being tackled traditionally include, among others, inequality of income and social immobility, and how public policies may help to redress these situations. In the last century, taxes and inequality educational opportunity (IEO) have probably been the main drivers of both phenomena. In a digital economy, IEO remains crucial but new issues emerge. In particular, in the knowledge economy, issues as the inequality of access to new technologies, the power of workers in the virtual company, the role of free lancers in the collaborative economy, or the impact of robots and artificial intelligence on labour market become paramount. This is the main argument in support of the proposal included in this paper.

APPENDIX

Table A1: General seminar instructions

- Number of topics: 4
- Group size for presentations: 4 students/topic (assuming 16 students)
- Time limit for the presentation: maximum 16 minutes
- Time limit for the discussion: around 15 minutes long

i. All students participating in the seminar need to prepare one topic and be prepared to participate actively in the oral discussion of other topic, to be chosen between those that will take place during the seminar.
ii. The seminar will be divided in 2 parts: presentations (carried out by the groups) and general discussion.
iii. Presentations will be followed by questions from professor and fellow students.
iv. Be ready to answer questions and comments after your presentation.
v. Those who are discussant for a topic should do the corresponding reading (as if they had to present that topic) and then be willing and able to talk about it in the session.
vi. Be active also during others' presentations.

Table A2: Recommendations and tips

About the presentation	Seminar tips
i. The presentation shall include the problem that is tackled in the reading list papers.	i. Be clear and structured and focus on your main points.
ii. Presentation style: seminar's speakers can decide the exact style of the presentation. Speakers can use powerpoint slides, white board or even just without any written material.	ii. Address the question asked. Not focussing on the question is the most common mistake students make.
iii. In the presentation, speakers should cover the topic as complete as possible and present it in a meaningful way.	iii. Speak slowly, loudly, and clearly. Try to connect to your audience
iv. The presentation must be clearly structured. A useful template is the following: introduction to the field, precise problem statement; development of the solution to this problem; summary and assessment.	iv. Support your points with theory and, when relevant, with evidence as well. Unsubstantiated claims are never great listening.
v. Do not use too many slides - as a rule of thumb, the presentation of one slide takes in-between two and five minutes.	v. There is no need for students to defend the ideas presented in the papers by all means, in the presentation. Students may be respectfully critical.
	vi. Use large fonts so that people in the back rows can read the slides.
	vii. Every slide should be self-contained with a title that summarizes the point of the slide;
	viii. Slides: too much material on one slide will overwhelm the audience;
	ix. Avoid entire sentences, use action words or graphics instead.

Notes

[1] See Howard et al. (2001).

[2] See Shapiro and Varian (2013).

[3] See Tapscott (1998) and Jones and Fox (2009).

[4] See Contreras (2017) for a non-advanced review of effects of the digital revolution on public economics analysis.

[5] See Webster, C. (1995) and Christensen. (1995).

[6] Véase Castells (1998).

[7] See Kiiski and Pohjola (2002) and Vicente and López (2011).

[8] See Yu (2002).

[9] See Mosaic Group (1998), Castells (2001), NTIA (1999), Rogers (2001), Norris (2001) or Kirkman et al. (2002).

[10] See Chen and Wellman (2004).

[11] See Kling (1998), Lessig (1999) O'Mahoney and Barley (1999), Wilson (2000), Bimber (2000), DiMaggio and Hargittai (2001), Fink and Kenny (2003), Hargittai (2003), DiMaggioet al. (2004), Barzilai-Nahon (2006) or Pearce and Rice (2013).

[12] See OECD (2001), Katz and Rice (2002) and Hilbert (2014)..

[13] See O'Reilly (2005).

[14] This phenomenon is also connected with concepts such as *collaborative consumption, co-production, co-creation,* or *presumption.*

[15] Véase Zelizer (2010).

[16] See Belk (2007) and Botsman and Rogers (2010).

[17] See Lamberton and Rose (2012).

[18] See Lukina et al. (2016).

[19] See Ford (2015).
[20] See Ford (2009 and 2015), Brynjolfsson and McAfee (2001)

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