



NEW ECONOMIC MODELS



TOOLS FOR POLITICAL
DECISION MAKERS DEALING
WITH THE CHANGING
EUROPEAN ECONOMIES

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PREFACE

Dear reader,

I am delighted that you have chosen to read this publication. It shows that you are willing to look for solutions to issues faced by our economies, both now and in the near future, just as we are at the European Liberal Forum (ELF).

This publication builds on the fruitful strings of projects on new economic models that ELF has coordinated since the beginning of 2016. Throughout 2017, we have continued to be active in discussing potential solutions for the most pressing challenges of our economies. With the invaluable help of our member organisations, we have been able to organise numerous projects, ranging from roundtable discussions to policy papers and live streamed debates.

This current publication builds particularly on a publication from 2016 that came about from the cooperation between ELF and one of its Swedish member organisations, Fores. [Machines, jobs and equality](#) focuses on the ways that automation is changing our labour market. The content formed a springboard into many debates during the past year, and is just as relevant today in the arguments it puts forward.

Here, we aim both to deepen the knowledge on the effects of automation on the labour market, and to look at other challenges and opportunities for our economy. Our goal is to address new solutions for the good of our future economies in a more holistic way. In close cooperation with our member organisations Fores, Hans van Mierlo Stichting, Institute for Politics and Society, NEOS Lab, Studiecentrum Albert Maertens and Svenska Bildningsförbundet (and the individual authors), I am happy to say that we have achieved our objective.

I would also like to thank Johannes Lith, the ELF Research Coordinator, who edited this publication. Johannes' work at the ELF Secretariat in 2017 was kindly supported by our member organisation Svenska Bildningsförbundet. Without his assistance this publication would not have been possible.

I wish you an enjoyable read and hope this publication will inspire you to continue working to improve our societies by way of liberal solutions.



Susanne Hartig
Executive Director | European Liberal Forum asbl. (ELF)

INTRODUCTION

We are in the midst of a fourth industrial revolution, in which digitalisation and automation are creating unprecedented challenges to our labour markets.

At the same time, the negative effects of pollution and climate change are becoming ever more visible. Decisions have been taken to move in the right direction, but as long as red tape keeps entrepreneurs from creating better working and climate-smart solutions, there is still work to be done. Of course, laws and regulations are needed to create a climate-friendly, transparent and functioning economy. While the future will bring more and more changes to the labour market and the economy as a whole, people need a feeling of stability. Democratically accepted laws provide that stability. But, not just any regulation will do. For it to be effective, regulation must be clearly understandable to all parties and must achieve the desired results.

This publication discusses some of the biggest challenges for the economy that policy makers are already facing, or will soon have to. It builds on trends we can already see developing today, as well as detailed predictions for the future. Through practical examples from business life as well as academic analysis, the aim is to make relevant issues tangible and provide a liberal toolbox for decision makers looking for ways to achieve a more effective economy.

The chapters can be thematically divided into three parts, based on the context in which they address ongoing developments.

The first part focuses on the trends we can see developing in European economies.

Robotisation is unlikely to decline in the near future. Using knowledge on robotics we currently have at hand, Fabian Dekker underlines in chapter one the opportunities that they can provide our society.

How technology affects the labour market has been debated at least since the first industrial revolution, but new technological advances bring up the question again and again. Many researchers claim it will be different this time, but are the challenges actually as unique as the media portrays them? In chapter two, Sabrina Dorn provides us with empirical evidence on whether this is true and if so, in what way. She focuses on the effects that digitalisation can be expected to have on the labour markets of the 28 EU member states.

In the chapter that follows, Jan Klesla looks at trends in what is frequently called the sharing economy, and outlines the importance of clearly defining what we mean by “sharing economy” before regulating it.

The second part of this publication concentrates on how ongoing developments can bring benefits for both societies and businesses.

The key for policy makers is to make it as easy as possible for companies to be greener. Chapter four focuses on ways to improve conditions for car pools. This chapter is followed by a business perspective, with a contribution from an innovative biotechnology company called Ductor on how to improve the prerequisites for companies working towards a more circular economy.

Chapters six and seven form the third part of this publication, which analyses the effects and options when the trends of digitalisation and robotisation – like those outlined in the first part – have become accepted politically, instead of refuted or blocked.

The definition of the sharing and platform economies, and what their limitations should be, is indeed important to keep in mind. This is, among other things, necessary for the sake of combating oligopolies or even monopolies in several fields. It is especially important and difficult, given access to big data is so decisive these days. The difficult equation of the value added by companies like Google and Apple on the one hand, and the near impossibility for smaller actors to compete on the other, is something that Stefan Larsson raises in chapter six.

Even if we set aside our expectations on exactly what the impact on the labour market will be, the certainty is that technology and globalisation are changing it every day. This new reality has given rise to discussions on the introduction of a universal basic income, an initiative that could combat unnecessary bureaucracy and give everyone the chance to work exactly in the way they want and to the extent they want. Chapter seven shows us a calculation and analysis by Jan Van Cauwenberghe on the advantages and disadvantages of solving the future challenges of the labour market and the social-welfare system with a universal basic income.

A conclusion, presenting a toolbox for policy makers based on the preceding chapters, wraps up the publication.



Johannes Lith
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CHAPTER 1



THE ROBOT SOCIETY: ANTICIPATING CHANGE IN THE NETHERLANDS



FABIAN DEKKER

INTRODUCTION

There seem to be two stories when it comes to the effects of robotisation. The one about job losses and the search for new forms of social protection and the one about the opportunities and benefits that come with technological progress. In public debate, the first perspective is usually singled out for attention. This is a shame, because not only are the effects of robotisation hard to predict, but it overlooks attempts to develop a unifying robot vision that enables everyone to reap the benefits of modern technology.

ROBOTS AROUND THE WORLD: WHERE THINGS STAND

Robotisation comes on the heels of digitalisation, in which the internet particularly has brought about new methods of production and organisation (Brynjolfsson & McAfee 2014). Mobile internet and the use of software have made things like online banking and the online registration of health insurance claims commonplace, and have made it easier for companies to do business with each other on a global scale. The relationship between employer and employee is also changing. The advent of new technology has enabled the implementation of place- and time-independent work processes, which, since the 1990s, have created a rapid rise in the number of flexible workers. In this context, some people talk of the “on-demand” or “gig” economy, in which workers are always on call through digital platforms (see also McAfee & Brynjolfsson 2017).

The current discussion is about the latest form of technological development, and is also referred to as the *Second Machine Age* (Brynjolfsson & McAfee 2014) or the *Fourth Industrial Revolution* (Schwab 2017). Robots, smart machines with sensors, are its focus. These are the classical industrial robots in car manufacturing, agricultural and milking robots in food production, surgical robots in hospitals, drones, cloud robotics, and self-driving cars. Unfortunately, the publication of books like *Rise of the Robots* (Ford 2015), *Mindless* (Head 2014), and here in the Netherlands, *De Robots Komen Eraan! (The Robots Are Coming!)* (Van Bergen 2016) has taken the conversation in the direction of an envisioned dark, dystopian future with no jobs. What is more, where far-reaching technological applications are involved, many fear a future in which there is great disparity between different groups of workers. But how realistic is this fear?

Worldwide, the robot is slowly but surely making its way into industry. According to the International Federation of Robotics (IFR), 2.5 million industrial robots will be in use by 2019 (IFR 2017). Most of them are in countries with a strong industrial sector, like South Korea, Japan, and Germany. In other countries, like the Netherlands, Austria, Canada, and Finland, robotisation is not taking off to the same extent (IFR 2014). We do not have a large-scale industrial sector in the Netherlands (and so few industrial robots), and robots are still relatively expensive, especially for small and medium-sized enterprises (SMEs), of which there are many in the Netherlands. Although here and there we do find real-world examples, such as in the Port of Rotterdam and pilots in the healthcare sector, only roughly 2% of employers say they have deployed new robots for production processes in the past two years (Dekker 2016). Especially in a service-heavy country like the Netherlands, companies apparently still have the option of not robotising and of adding value in other ways. Of course, it is entirely possible for the adoption ratio to rise as costs fall, but large-scale industrial robotisation will probably not occur in the Netherlands. And most of the research indicates that if the use of robots increases, on balance it is likelier to

result in more jobs, not fewer (IFR 2017). Naturally, jobs will disappear, but most jobs consist of bundles of tasks that are not always easily automated (Arntz et al. 2017). At the same time, under the influence of technological change, the production costs of work processes often decrease, thus allowing prices to fall, which logically results in increased demand and employment growth. For instance, robotisation caused significant job losses at Amazon in 2016, but partly due to falling labour costs and rising demand from customers, an equal percentage of jobs returned. Also, new jobs will emerge that we have not seen before. For instance, imagine new employment around renewable energy, ICT, or in transport and logistics. Furthermore, new technology enables the return of jobs from low-wage countries (“reshoring”). Philips and VDL Nedcar are Dutch examples of this. In the latter case, robots enabled the car manufacturer to produce more competitively, boosting employment from 1,500 to 4,000 in the period between 2012 and 2016.

WAITING AND SEEING IS NOT AN OPTION: POLARISATION IN THE JOBS MARKET

Still, it is not wise to just wait and see if a wave of robotisation occurs. Because imagine if the future does hold a major robotisation breakthrough. The earlier stage of technological development (digitalisation) has already caused far-reaching changes for certain groups of workers. Many routine tasks in financial services have disappeared, and in countless professions the levels of education required are rising. In that sense, there is no guarantee that in the future everyone will be able to continue to participate in the jobs market in the same way. A divide between winners and losers on the labour market still looms. We are already seeing this in Europe in a polarising jobs pattern, in which employment for more highly educated workers in particular rises as it falls for those in the middle (Goos et al. 2014). We also see this pattern on the Dutch jobs market (Dekker & Van der Veen 2017). Furthermore, the use of new technology causes the nature of work to change. An increasing number of people are active as flexible workers and earn (a part of) their incomes through digital platforms. Research institute TNO (2016) calculated last year that 12% of all Dutch adults (16–70 years old) have earned income from work through digital platforms. This raises questions about, among other things, lagging income trends and underinsurance among flexible workers (including the self-employed), so about people’s social protection. How can policymakers, employers, and employees make sure that in the future, as many people as possible share the benefits of new technology in the workplace?

ANTICIPATING CHANGE

We need an overarching vision when it comes to robots. But what does such a vision look like concretely? In any case, it requires a coalition of cooperating parties: education, government, technology developers, social partners and international organisations.

PROMOTING ENTREPRENEURIAL SKILLS

In order to counter the looming mismatches between the demand and supply sides of the jobs market, first and foremost, education has an obvious role to play. This touches on the classic economic question of the so-called race between education and technology (Goldin & Katz 2008). This relates to the education level (technology is often complementary to highly skilled labour), but it is also about the content of education.

Alongside sufficient technical skills, social skills and entrepreneurial spirit are very hard, if not impossible, to automate, making them robot-proof. In policy circles, this is referred to as 21st century skills (OECD 2009). Entrepreneurial skills are not only important for the self-employed, but also for employees. Within companies, we can already see a growing need for so-called entrepreneurial employees (also: “intrapreneurs”). Intrapreneurial employees undertake new business activities within organisations. Fortunately, these behavioural skills can be taught at a relatively young age in primary and secondary school and in vocational education (Van Praag 2016). Besides preparing for new technology through education, naturally the workplace also has an important part to play in teaching employees to better deal with changes through courses and on-the-job training. In this, needless to say, employers should focus on offering the needed support infrastructure (time and resources). Philips has recently launched a good initiative to stimulate employees to work on their skills. Through the use of learning ambassadors, the people there seem to be much quicker to take action, compared to having a traditional career development meeting. And in the cleaning industry, collective agreements have been made to find ways to have people and machines work together through the use of co-bots. The government could stimulate these developments further. This can be done, for instance, by establishing a personal learning account, which would provide a tax benefit when people save for their own career development. This is another way to achieve a more active learning culture in a roboticised economy. The Dutch organisations ABU, Cedris, NRTO, and OVAL have already presented a concrete proposal earlier this year. And recently, the new Dutch government has presented its plans for individual learning accounts (Dutch government coalition agreement 2017–2021).

THE GOVERNMENT AS A DRIVING FORCE BEHIND INCLUSIVE ROBOT TECHNOLOGY

In addition to emphasising education reform, we can also look at the work-inducing character of new technology and ways in which to stimulate this. This is not just about creating high-skills jobs in the robotics industry, but maybe especially about jobs for people with poor job prospects. In the past few years, groups with lower levels of education, non-Western immigrants, and people with a work-limiting disability have been affected by slower job growth (UWV 2017). Promoting job growth through new technology provides a good solution to this. We are already seeing examples in which app technology creates “gig” services that enable people to supplement income from a part-time job or benefits. Or what about initiatives that aim to use robot technology to help children with autism develop their social skills? The British daily *The Guardian* has already published an article about this (*The Guardian*, 1 February 2015). And servicerobots, like Rose, and other forms of robotisation enable people with a work-limiting disability to participate on the jobs market (Hu et al. 2016).

An inclusive robot agenda does require a precise interplay between industry, educational and knowledge institutions, and the government. In other words: it requires cooperation from all parties involved in the development and use of new technology. In this, the government can serve as a driving force, for instance by providing financing for new forms of public-private partnership. The current action programme *Smart Industry*, in which knowledge is shared and applied in networks of companies and knowledge institutions, is a concrete example of this. This programme was presented at the Hannover Messe and describes the transition of industry to a digital world and the creation of practical environments in which companies and knowledge institutions develop, test and implement new technologies (see www.smartindustry.nl).

THE ROLE OF EMPLOYERS' ORGANISATIONS, UNIONS AND SOCIAL PROTECTION

The consequences of new technology are also, or maybe even especially, determined on the level of work organisation. In order to enhance acceptance of robotisation, it is important to, from the moment the decision to implement it has been made, include as many stakeholders as possible. In this context, we speak of realising so-called *co-creation* between technology developers, employers, and employees. For instance, there are hospitals in the Netherlands that make every major technical investment in direct consultation with groups of end-users (healthcare professionals and client representatives). This expands the support base and contributes to quicker adoption of new technology and higher productivity. At this point, there is a fairly solid consensus in the scientific community that every technological innovation has to be accompanied by equal attention to social innovation, in other words: attention to people (through education or codetermination).

We have talked about the fact that new technology can also change the nature of work. Increasingly, people work in temporary jobs, and some say that technological change enables so-called platform capitalism, as we are seeing in discussions about the taxi service Uber (Rathenau Instituut 2015). When it comes to the “flexibilisation” of work, we need to counter a certain division in the labour market (between steady and flexible jobs) and in social protection. In a proper social-liberal tradition, the key is to find ways to enhance the social protection of flexible workers without constricting their flexibility (and with it, the adaptability of the economy). This can be done, for instance, by stimulating social insurance schemes for flexible workers.

BUT WHAT IF IT TURNS OUT THAT THERE IS NOT ENOUGH WORK AFTER ALL?

Finally, we can also imagine a scenario in which, despite the attention paid to education reform and an active innovation and HR policy by industry and the government, the job-finding odds of certain groups of workers still diminish drastically. As we have seen, there are signals that mid-ranking jobs and parts of the lower end of the labour market face pressure due to technological development (see also Dekker & Van der Veen 2017). In light of this observation, we need to keep paying attention to a proper social safety net. Consideration could be given to the introduction of job guarantees, through which, unlike in the case of an unconditional basic income, the groups that need it the most receive the right to a minimum-wage job at their local municipality (Kleinknecht et al. 2016). These are government-funded jobs for people who can no longer find a place on the jobs market on their own. A displacement test can be used to prevent the crowding out of regular jobs. Key in all this is that we work on a widely shared vision on robots in which new technology offers great opportunities to improve our international competitive edge and eliminates the need for tedious work, while at the same time keeping the possible downsides in clear view. Following the recommendations made by The Netherlands Scientific Council for Government Policy (2015:27), education organisations, governments, technology developers, social partners and international organisations should try emphasising co-creation in robotics development, by focusing on complementary and by appreciating and nurturing human skills in education.

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CHAPTER 2



**DIGITALISATION AND LABOUR:
ARE PESSIMISTS WINNING
GROUND? – AN EMPIRICAL
ASSESSMENT OF THE EFFECT
OF DIGITALISATION ON THE
LABOUR SHARE FOR THE EU-28**



SABRINA DORN

INTRODUCTION

The nature of labour as executing a series of tasks is changing due to technological advancements in artificial intelligence (AI) and high-performance computing. At the heart of this process called digitalisation are novel technologies capable of providing major efficiency gains for a substantive subset of tasks, including the execution of non-routine cognitive tasks. Such tasks are those executed by lawyers, doctors, accountants, financial analysts, and, more generally, any task where employees require advanced mental contributions. In contrast to this destructive aspect, automation of one task usually implies a complementary task in the sense of supervision and maintenance. Moreover, when looking at historical evidence about the past 200 years, breakthrough inventions were made previously in history and, after a period of adaptation, when some traditional sectors vanished, new jobs in new sectors enabled by the technological advance were created.

Nevertheless, the inherent fact of an increased substitutability of AI for labour is likely to negatively affect the economic output from labour income. To shed light on this issue, this chapter takes a functional income perspective, and finds that the labour share of GDP has declined due to digitalisation for European countries. If the economic value of labour diminishes more in the future and capital income is distributed very unequally among households, this is likely to increase income inequality beyond a desirable level, potentially leading to a negative effect on economic growth and on our societies in general.

To assess the *status-quo effect* of digitalisation on the labour share for European countries in the recent past, empirical data for the EU–28 and the period 2014–17 is analysed. The analysis concludes, from several different types of regressions, that the destructive nature of technological change has dominated in the short run. Moreover, simulations assuming different scenarios about the speed of digitalisation in the future are undertaken, to illustrate the length of the time window it takes from now under *ceteris paribus* conditions until large changes in the labour share would occur. This thought experiment reveals, that if digitalisation increases at least linearly in the future, political actors will face major challenges within the next couple of decades.

The rest of this chapter is organised as follows: The next section contains a literature review, followed by the results from an empirical analysis and an assessment on some quantitative effects, and finally the last section summarises and concludes.

LITERATURE REVIEW

The set of opinions on the impact of digitalisation on labour is mixed: The conventional wisdom among pessimists (including Bill Gates, Joseph Stiglitz, and Klaus Schwab) is that AI is likely to destroy jobs on average. As Schwab (2016) notes, speed due to current technologies, as well as breadth and depth due to simultaneity are typical of this time as compared to earlier technological revolutions which might make human labour – given the current distribution of skills – obsolete. As according to a list published in Frey and Osborne (2016) approximately a share of 25 % of 702 examined tasks has a probability of being automated of at least 90 %, and approximately half of all examined tasks has a probability of being automated of at least 65 %. In a recent report, the Boston Consulting Group predicts that by 2025, up to 25 % of jobs will be replaced by either smart software or robots.

Also Leontief (1983) already worried that the pace of modern technological change is so rapid that many workers are unable to adjust and will simply become obsolete, like horses after the rise of the automobile. Great pessimism by great minds was observed previously in history, as already Keynes (1930) warned on widespread technological unemployment and obviously proved to be wrong. In response to Leontief, Acemoglu and Restrepo (2016) stress that, as compared to horses, humans have a comparative advantage with learning new and more complex tasks, and also Autor (2015) follows the moderate view, that many jobs will continue to demand a mixture of tasks from across the skill spectrum, even if some jobs might be eliminated by automation.

There exist several studies that provide evidence in favour of the general trend of a declining wage share since the 1980s, which is at odds with conventional macroeconomic wisdom. Two broad reasons for this phenomenon have been examined so far: Firstly, changes in the technological landscape due to digitalisation and, secondly, the effects from globalisation.

Evidence in favour of a potentially negative effect of digitalisation on the labour share is provided by several sources: Chapter 3 of the IMF's *World Economic Outlook 2017* attributes about one half of the decline in the labour share in advanced economies to the impact of technology. Acemoglu and Restrepo (2017) calculate that the number of robots per workers reduces the employment to population ratio and wages. Karabarbounis and Neiman (2013) also present evidence in support of a declining wage share due to the rise of computer and information technology. Autor et. al. (2017) examine the rise of superstar firms that benefit from the decreasing cost of IT and typically have a relatively low share of labour.

Also for the second strand of literature, several sources confirm a potentially negative effect of different measures of globalisation on the wage share: Young and Tackett (2017) find that greater values of economic globalisation tend to be negatively related to the wage share. This is confirmed in Harrison (2005) and in Guscina (2006) using trade as measures of globalisation. Elsby et. al. (2013) present evidence of a negative impact of import shocks on the wage share. Similar considerations are also examined by Autor et. al. (2013). Doan and Wang (2017) focus on the impacts of trade openness and foreign direct investment on the labour share in developed and developing countries and find a significant impact of trade with exports depressing and imports increasing the labour share, as well as no significant effect of foreign direct investment.

A phenomenon analysed as a likely correlate of automation, is job-polarisation into low- and high-skilled labour, i.e. an increase of employment at the upper and lower ends of the occupational skill distribution where jobs associated with the middle of this distribution vanish. Research by Autor et. al. (2003; 2006), Goos and Manning (2007), and Goos et. al. (2009) provides according evidence that the share of employment in occupations in the middle of the skill distribution has declined rapidly in the US and in Europe. Whereas job-polarisation does not necessarily imply an increase in unemployment, it will decrease the return from labour in the total economy once low-salary and low-skill increases more than high-skill and high-income labour.

That a further rapid decline in the labour share is likely to increase income inequality, is further pronounced by the stylised fact that there are many households that could not easily compensate diminishing labour income from capital rents: A report on wage dispersion in the EU published in 2015 by the Policy Department A for the Committee on Employment and Social Affairs reveals that the source having contributed most to the observed increase in overall income inequality between 2006–11 (i.e. from before until after the economic crisis in 2008) is capital income.

High levels of income-inequality are undesirable for several reasons. They may reduce overall aggregate demand in an economy, and hence limit growth. This hypothesis was discussed and confirmed by several previous studies (see Persson and Tabellini, 1994; Easterly, 2007; Berg and Ostry, 2011; Berg et. al, 2012; Stiglitz, 2012). Moreover, high levels of inequality are likely correlates of social tensions and unstable societies. Also insights from behavioural economics suggest that humans are at least to some degree averse to inequality (cf. Fehr and Schmidt, 1999). In consequence, overall allocations with a too high level of inequality must be suboptimal as a societal outcome.

EMPIRICAL ANALYSIS

In this analysis the effect of digitalisation on the wage share for the EU–28 for the years 2014–17 is examined using regression analysis. The aim is to measure the *ceteris paribus* effect of digitalisation on the wage share of GDP, when holding constant other variables controlling for a country's public expenditure on labour market policies, its share of workforce with academic education, the opportunity costs of capital, a country's openness to trade as a measure of globalisation, along with other unobserved factors as reflecting the conditions of the sampling period. Note that, the following results may be interpreted as a policy-benchmark under a *status-quo* prediction.

This section is organised as follows: Readers less concerned with the details of the statistical analysis and data construction can skip several subsections and go straight to the subsection called Quantitative effects on page 19, where the immediate quantitative conclusions are presented. For readers interested in the details, or selected aspects of the statistical analysis, the data-set along with some descriptive statistics is introduced below, followed by a presentation of the estimation results derived from a set of different regression models. The section called Robustness checks augments the reliability of these results by a set of robustness checks challenging statistical model building, the functional form of the previously specified regression equation, and addresses potential endogeneity issues.

DATA

DEPENDENT VARIABLE

As a measure of the wage share (i.e. that part of GDP attributable to labour) for the EU–28, the adjusted wage share at market prices (including taxes and excluding subsidies) provided by the annual macroeconomic database of the European Commission's Directorate General for Economic and Financial Affairs (AMECO) is used. The adjusted wage share (ALCD0) is therefore calculated as the compensation of employees over total economy GDP multiplied by total employment.

DIGITALISATION

A measure of digitalisation at the level of the EU–28 is the Digital Economy and Society Index (DESI) released by the European Commission. The index is available for all EU–28 for each year in 2014 until 2017. The DESI is a composite index that summarises five indicators on Europe's digital performance: (1) Connectivity (i.e. the deployment of the broadband infrastructure), (2) Human Capital/Digital Skills (this dimension covers the required skills to fully benefit from the digital society), (3) Use of Internet by Citizens (i.e. the variety of activities

performed by citizens online), (4) Integration of Digital Technology by Businesses (i.e. the digitalisation of businesses), and (5) Digital Public Services (e.g. eGovernment). As according to the relevance given to these dimensions by the European Commission, a composite DESI index can be constructed as the weighted sum of all dimensions (1)-(5) using the weights as published by the Commission: (1) 0.25, (2) 0.25, (3) 0.15, (4) 0.2, and (5) 0.15, respectively.

OTHER CONTROL VARIABLES

As further control variables measures of labour market characteristics, a measure of the opportunity costs of capital, and a measure of trade openness and globalisation are included. As measures of labour market characteristics, data on public expenditure for labour-market policies (LMP) as provided by Eurostat, data on the density of trade unions provided by the OECD and the International Labour Organization (ILO), information on the shares of employment in industry and services also taken from ILO, and the share of labour force with tertiary education from the World Development Indicators (WDI) are included. Costs of capital are measured by the real interest rate from the WDI. As a measure of a country's openness to trade and globalisation, the trade share of GDP from the WDI is used. For the instrumental variables approach presented as a robustness check below, the globalisation index as published by the Swiss Economic Institute at ETH Zurich is used as an instrument.

ESTIMATION SAMPLE

Table 1 contains some descriptive statistics for the data-set analysed in the sequel, that comes as a balanced panel of the EU-28 from 2014-17. The data-set consists of 112 observations, the dependent variable represents a share bounded between 0 and 1 with observed values between 0.369 and 0.618. Further, the variable measuring expenditure for labour market policies was log-transformed.¹

[> See Table 1 / Page 24](#)

ESTIMATION RESULTS

Table 2 reports the coefficients estimates as obtained by different regression estimators: Linear regression of the dependent variable measured on its original scale in panel (A), linear regression using an arcsin-square-root transformation of the dependent variable (which is a common practice when the dependent variable is a share) in panel (B), the results from a Box Cox model (see Box and Cox, 1964) with the dependent variable being subject to a power transform in panel (C), the results from Quasi-Poisson regression (see, e.g., Cameron and Trivedi, 2012) in panel (D), and finally panel (E) reports coefficients estimates from a Tobit model with censoring of the dependent variable from above and below (see Tobin, 1958; or Cameron and Trivedi, 2005).

Odd-numbered columns ((I), (III), (V), (VII), and (IX)) use the composite DESI as measure of digitalisation, and even-numbered columns ((II), (IV), (VI), (VIII), and (X)) consider the five disaggregate dimensions as explanatory variables instead. Each of the models controls for unobserved heterogeneity across countries and periods of time by including according fixed effects, and for all further explanatory variables as listed above in Table 1.

¹ In order to cover all available 112 observations on the DESI with observations on the dependent variable and the further controls, missing values for these variables were interpolated using predictions from country-wise time-series models fitted by local polynomial regression.

The results suggest a significantly negative effect of digitalisation on the labour share of GDP, where significance is found for a two-sided 90% confidence interval for the regressions reported in columns (I), (III), and (VII), and for a two-sided 95% confidence interval for columns (V) and (XI). When controlling for the disaggregate dimensions of DESI separately instead, the results presented in columns (II), (IV), (VI), and (VIII) indicate a significantly negative effect of the digitalisation of businesses on the wage share based on a two-sided 95% confidence interval. The 2-limit Tobit in column (X) even suggests a significantly negative effect of digitalisation of businesses for a 99% two-sided confidence interval, and in addition a significantly negative effect of the variety of activities carried out online by citizens for a 90% two-sided confidence interval. All other dimensions of DESI are not found to have an effect on the wage share that is significantly different from zero.

The three further variables, the shares of employment in industry, the share of employment in services, as well as trade openness, as a measure of globalisation, have a significantly negative effect on the wage share. In the vast majority of cases, significance is found at a level of 99% of confidence.²

As a measure of fit, the Pearson correlation between the predicted values of the dependent variable and the truly observed values for the sample is reported in the last row of Table 2. For all models this correlation lies above 98% and one would conclude that all models have very large explanatory power for the observed data.

> See Table 2 / Page 25

For inference it is assumed that the dependent variable given the explanatory variables is independently and identically distributed (iid) over countries and periods of time. As this assumption is peculiar in statistical applications, its justification for the employed data is further justified by a residual analysis (see Appendix A1).

ROBUSTNESS CHECKS

Three different types of robustness checks to challenge variable selection, functional form, and potential endogeneity, confirm the statistical conclusions derived from Table 2.

VARIABLE SELECTION

To challenge the choice of explanatory variables used for the regressions presented in Table 2, variable selection is performed: Using the full set of explanatory variables as reported there as candidate variables, the set of variables to be included on the right hand side of the regression equation is refined using forward selection. The procedure is initiated from a model controlling only for country- and time-fixed effects and then subsequently includes explanatory variables with the highest significant effect on the dependent variable for a fixed level of the type-I error. Candidate variables are included until there is no further candidate variable (not yet included in the model) that has a statistically significant effect on the dependent variable at the desired level. Here, the significance level for inclusion is set to 15%.

² Moreover, note that also statistical testing reveals that country- and time-fixed effects are highly significantly different from zero, and should not be omitted from the model.

Table 3 reports the results when controlling for the retained variables for the linear model with the dependent variable measured on its original scale (panel (A)), the arcsin-square-root transformed dependent variable (panel (B)), and Quasi-Poisson regression (panel (C)). The DESI (columns (I), (III), and (V)) and its fourth dimension (Integration of Digital Technology; columns (II), (IV), and (VI)), respectively, as well as the employment shares in industry and services and trade openness, are always retained. The real interest rate is retained by four out of six regressions, public expenditure on labour market policies is retained for the Quasi-Poisson regressions (panel (C)), and the third dimension of the DESI (Use of Internet) is retained only for column (VI).

[> See Table 3 / Page 26](#)

As compared to the results when controlling for the full set of regressors (Table 2) the model fit hardly changes and a more parsimonious model is preferable over a richer one if the larger set of variables hardly improves the fit.

FUNCTIONAL FORM

To ensure that any previously estimated significantly negative effect of digitalisation on the wage share is not driven by the specified linear parametric specification, a set of Generalized Additive Models (GAMs) is estimated (for details see Hastie and Tibshirani, 1990). GAMs have the advantage that they allow for a relaxed relationship between the response and specific explanatory variables. Including employment shares in industry and services, trade openness, and the real interest rate, the influence from each of these further control variables may enter as a smooth function of the original variable and is now not restricted to a linear coefficient as is the case for the analyses presented previously in Tables 2 and 3. Here the smooth terms are estimated by smoothing splines.

Two sets of experiments are conducted here. For the results presented in Table 4.1, only the measure of digitalisation enters as a parametric coefficient. The coefficient estimates show little sensitivity as compared to the coefficient estimates reported above in Table 3. The relatively largest sensitivity is found for the Quasi-Poisson model (panel (C)). In Table 4.2, next to a linear coefficient for the effect of digitalisation, also a linear effect for trade openness is imposed. Now the estimated coefficients are even closer to those of Table 3, but overall sensitivity is small.

[> See Table 4.1 / Page 27](#)

[> See Table 4.2 / Page 27](#)

POTENTIAL ENDOGENEITY OF TRADE

Since both, the wage share and openness to trade are measured as a share of GDP, unobservable variables related to GDP could imply a simultaneity bias. To address this, the regressions reported in panels (A), (B), and (D) of Table 2 and the according regressions relying on a more parsimonious set of explanatory variables (cf. Table 3) are re-estimated using instrumental variables estimation and a control function approach, respectively. As instruments for the variable Trade Openness, indices of overall and economic globalisation as based on data provided by Dreher (2006) are employed.

Tables 5.1 and 5.2 report the according estimation results. Nine out of twelve different regressions suggest a significantly negative effect of digitalisation on the wage share. There is no longer a significant effect of openness to trade, but the sign of its coefficient is still estimated to be negative. As is well known, controlling for endogeneity by using exogenous variation in the potentially endogenous variable can lead to lower bias,

but however at the same time usually increases the variance of the estimates. However, as reported in the last rows of Tables 5.1 and 5.2 Durbin-Wu augmented regression tests (cf. e.g. Davidson and McKinnon, 1993) for potential endogeneity rather suggest that openness to trade may be treated as exogenous.

> See Table 5.1 / Page 28

> See Table 5.2 / Page 29

QUANTITATIVE EFFECTS

Based on the statistical analysis presented previously, one would conclude that pessimists' fears cannot be judged as completely unrealistic, since their consequences can be confirmed by recent EU data: As the empirical analysis reveals, all performed regressions suggest a significantly negative effect of digitalisation, or digitalisation of businesses specifically, on the wage share for the EU-28 in 2014–17.

Quantitatively (considering the linear models with the dependent variable measured on its original scale as presented above) the marginal effect from an increase in DESI by one percentage point implies a *ceteris paribus* decrease in the wage share ranging from –1.36 to –1.57 percentage points. Looking at the effect from digitalisation of businesses, decreases of –0.47 to –0.54 percentage points in the labour share as digitalisation increases by one percentage point are found from the data.

Assuming that any other conditions as present in the sampling period 2014–17 remain unchanged, a thought experiment on how long it would take until the wage share would have fallen to half of or 25 % of its level in 2017 for each country among the EU-28 is conducted. Observe that, for all 28 countries, the DESI has increased over the sampling period.

Three different scenarios about the speed of the further diffusion of digitalisation over time are assumed: Scenario (A) takes a conservative view, and assumes that after 2017 digitalisation increases linearly every four years by the same constant increase as observed between 2014–17. Scenario (B) takes the view that digitalisation increases exponentially fast after 2017 with the same rate of increase every four years as observed for the timespan 2014–17. Scenario (C) assumes that digitalisation increases in the future, but does so at a decreasing rate such that digitalisation increases at a rate slower than for linear increase as in scenario (A). For scenario (C) it is therefore assumed that digitalisation grows only with the square-root of time-intervals passing. The scenarios (A)-(C) are then used to determine the hypothetical numbers of years it would take from 2017 onwards until digitalisation would have spread out so much that it would in fact decrease the wage share by the hypothetical amount.

Table 6 summarises the results from this simulation exercise. Therefore the coefficient estimate –1.549 as reported in column (l) of Table 4.2 was used. The detailed calculations for the numbers reported in Table 6 are explained in a note added at the bottom of the table.

As reported in panel (IV) of Table 6 for a linear increase in the level of digitalisation (scenario (A)), a reduction of the wage share to half of its level in 2017 for the five fastest transitioning countries would occur in 22 years for Ireland, in 26 years for Cyprus, in 27 years for Estonia and Hungary, and in 29 years for the Czech Republic. For the five slowest transitioning countries the wage share would have reduced to half of its level in 2017 in 52 years for Sweden, in 49 years for France, in 48 years for Finland, and in 47 years for Belgium and the United Kingdom. For scenario (B), the according transitions would have occurred after 13 years for Ireland and Cyprus, after 15 years for Estonia and Hungary, and after 16 years for the Czech Republic. For scenario (C), representing

a decreasing speed of digitalisation in the future, the according transitions would have occurred only after 110 years for Ireland, after 112 years for Cyprus, after 154 years for Hungary, after 183 years for Estonia, and after 232 years for the Czech Republic.

> See Table 6 / Page 30

To obtain a statement about the EU–28, the country-wise maturities as reported in Table 6 are aggregated by calculating their weighted sum, where the weights are calculated as a country's share of total economic output where output is measured by the level of GDP in 2017. The results suggest, that at the EU–28-aggregate level the wage share would have fallen to half of its level in 2017 after 42 years for scenario (A), after 23 years for scenario (B), and after more than 500 years for scenario (C). According timespans for the wage share falling to 25% of its level in 2017 are 62 years for scenario (A) and 30 years for scenario (B).

It clearly follows from this exercise that as how urgent the matter of a falling wage share due to digitalisation has to be considered, strongly depends on the speed of the process of digitalisation over the next couple of years. If the rate of increase in digitalisation is assumed to decrease in the future, the simulated reductions in the wage share occur on average only after 500 years. For a linear process according reductions occur after 42 and 62 years, where however nineteen out of the EU–28 have individual durations until this will have occurred that lie below the aggregate values. If in contrast, digitalisation is assumed to increase more in the future, the matter will firstly become immanent in 2030.

SUMMARY AND CONCLUSIONS

Though, technological advancement and global economic integration have increased global prosperity in history, their effect on the wage share remains challenging. The previous analysis reveals a significantly negative effect of digitalisation on the wage share for the EU–28 in the period 2014–17: Roughly, if the amount of digitalisation would increase by one percentage point, then the wage share (*ceteris paribus*) decreases by approximately –1.5 percentage points.

To obtain a rough picture of how this phenomenon could develop in the future, different hypothetical processes about the future speed of digitalisation are assumed in an exercise. Depending on the scenario assumed, it is found that it would take 42 years from now for a linear increase of digitalisation over time, and 23 years from now if digitalisation increases more in the future, until the EU-aggregate wage share would have fallen to half of its level in 2017. Though, it is likely that humans have a comparative advantage over horses at learning new tasks, as it might take horses more than 500 years to learn how to program an algorithm, it is still open how long it will take to educate a sufficiently large proportion of the labour force to obtain the required AI-skills.

The main goals for future policy will therefore include engaging those executing tasks at high risk of automation to adapt more quickly to the changing work environment and to distribute the benefits from digitalisation and globalisation more broadly across the population.

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APPENDIX

APPENDIX A1 – RESIDUAL ANALYSIS

Figure A1 examines a set of residual plots for the linear models reported in panels (A) and (B) of Table 2 mentioned in the main text. Plotting the regression residuals against the predicted values does not indicate any omitted structure or patterns of heteroskedasticity or clustering and, hence justifies the iid assumption. Plotting the standardised residuals against quantiles of a standard-normal distribution suggests that normality is well approximated within the central 95 % of probability mass of the distribution of the estimated residuals.

> See Figure A1 / Page 31

TABLE 1: DESCRIPTIVE STATISTICS FOR ESTIMATION SAMPLE

VARIABLE NAME	SOURCE	MEAN	STD. DEV.	MINIMUM	MAXIMUM
Adjusted Wage Share	AMECO	0.524	0.053	0.369	0.618
DESI	EC	0.103	0.022	0.058	0.149
Connectivity	EC	0.143	0.030	0.075	0.204
Human Capital	EC	0.126	0.032	0.065	0.191
Use of Internet	EC	0.070	0.015	0.029	0.108
Integration of Digital Technology	EC	0.067	0.022	0.029	0.125
Digital Public Services	EC	0.076	0.025	0.027	0.126
log(LMP Expenditure)	ILO and OECD	7.466	2.133	3.702	11.158
Employment in Industry	ILO	0.239	0.063	0.102	0.380
Employment in Services	ILO	0.705	0.089	0.427	0.885
Trade Openness	WDI	1.321	0.756	0.558	4.195
Real Interest Rate	WDI	0.094	0.200	-0.085	1.163
Union Density	WDI	0.262	0.200	0.001	0.695
Advanced Labour Share	WDI	0.786	0.039	0.715	0.873

Note: Balanced cross-country-time-series data for the EU-28 for 2014–17 (112 observations in total).

TABLE 2: REGRESSION RESULTS FOR FULL MODEL

	(A)		(B)		(C)		(D)		(E)	
	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)	(IX)	(X)
Dependent variable: Adjusted Wage Share	Linear regression with dep. variable measured on original scale		Linear regression with arcsin-square-root- transformed dep. variable		Linear regression with Box-Cox transformed dep. variable		Quasi-Poisson regression		2-limit-Tobit regression	
DESI	-1.360 *		-1.377 *		-0.289 **		-2.664 *		-1.368 **	
Connectivity		-0.266		-0.271		-0.048		-0.529		-0.274
Human Capital		-0.050		-0.048		-0.018		-0.063		-0.048
Use of Internet		-0.624		-0.626		-0.193 **		-1.122		-0.656 *
Integr. of Dig. Tech.		-0.542 **		-0.547 **		-0.106 **		-1.087 **		-0.533 ***
Digital Public Services		-0.054		-0.057		-0.014		-0.180		-0.061
log(LMP Expenditure)	0.006	0.010	0.006	0.010	0.002	0.003 *	0.012	0.020	0.007	0.011 *
Employment in Industry	-4.037 ***	-3.698 ***	-4.073 ***	-3.735 ***	-0.744 ***	-0.609 ***	-8.698 ***	-8.146 ***	-4.164 ***	-3.803 ***
Employment in Services	-2.279 ***	-1.921 **	-2.288 ***	-1.931 **	-0.482 ***	-0.364 ***	-4.706 ***	-4.133 **	-2.237 ***	-1.876 ***
Trade Openness	-0.075 **	-0.080 ***	-0.075 ***	-0.080 ***	-0.015 ***	-0.015 ***	-0.156 ***	-0.166 ***	-0.077 ***	-0.081 ***
Real Interest Rate	0.059	0.035	0.060 **	0.036	0.009	0.003	0.133	0.090	0.061 *	0.038
Union Density	-0.082	-0.043	-0.081	-0.042	-0.033 *	-0.022	-0.138	-0.068	-0.073	-0.035
Advanced Labour Share	-0.030	-0.129	-0.029	-0.128	-0.001	-0.022	-0.065	-0.249	-0.046	-0.145
Correlation(fitted,true)	0.986	0.987	0.986	0.986	0.986	0.987	0.984	0.985	986	0.986

Note: ***, **, and * indicates significance at 1%, 5%, and 10%, respectively. Inference is based on iid assumption. All regressions include a constant, time-, and country-specific indicator variables. For the Box-Cox regressions in panel (C) the parameters for the Box-Cox transform of the dependent variable are estimated to be 3.399 (V) and 3.537 for column (VI).

TABLE 3: REGRESSION RESULTS AFTER VARIABLE SELECTION BY TESTING-BASED FORWARD SELECTION

	(A)		(B)		(C)	
	(I)	(II)	(III)	(IV)	(V)	(VI)
Dependent variable: Adjusted Wage Share	Linear regression with dep. variable measured on original scale		Linear regression with arcsin-square- root-transformed dep. variable		Quasi-Poisson regression	
DESI	-1.549 **		-1.567 **		-2.839 **	
Connectivity						
Human Capital						
Use of Internet						-1.283 *
Integration of Digital Technolgy		-0.499 **		-0.503 **		-1.152 ***
Digital Public Services						
log(LMP Expenditure)					0.011	0.025 ***
Employment in Industry	-4.034 ***	-4.083 ***	-4.075 ***	-4.124 ***	-8.413 ***	-7.744 ***
Employment in Services	-2.229 ***	-2.317 ***	-2.245 ***	-2.333 ***	-4.235 ***	-3.735 ***
Trade Openness	-0.073 ***	-0.070 ***	-0.073 ***	-0.070 ***	-0.159 ***	-0.158 ***
Real Interest Rate	0.068 *		0.068 *	-0.503 **	0.145 **	
Union Density						
Advanced Labour Share						-0.368 *
Correlation(fitted,true)	0.986	0.985	0.986	0.985	0.984	0.985

Note: ***, **, and * indicates significance at 1%, 5%, and 10%, respectively. Inference is based on iid assumption. All regressions include a constant, time-, and country-specific indicator variables. For the Box-Cox regressions in panel (C) the parameters for the Box-Cox transform of the dependent variable are estimated to be 3.399 (V) and 3.537 for column (VI).

TABLE 4.1: SEMIPARAMETRIC REGRESSIONS WITH PARAMETRIC EFFECT FOR DIGITALISATION

	(A)		(B)		(C)	
	(I)	(II)	(III)	(IV)	(V)	(VI)
Dependent variable: Adjusted Wage Share	Dependent variable measured on original scale		Arcsin-square-root-transformed dependent variable		Quasi-Poisson regression	
DESI	-1.569 **		-1.587 **		-3.115 **	
Integration of Digital Technolgy		-0.467 **		-0.471 **		-0.985 **
Correlation(fitted,true)	0.986	0.985	0.986	0.985	0.985	0.985

Note: ***, **, and * indicates significance at 1%, 5%, and 10%, respectively. Inference is based on iid assumption. All regressions include a constant, time-, and country-specific indicator variables. Models fitted by a generalised additive model (GAM) using backfitting.

TABLE 4.2: SEMIPARAMETRIC REGRESSIONS WITH PARAMETRIC EFFECTS FOR DIGITALISATION AND TRADE OPENNESS

	(A)		(B)		(C)	
	(I)	(II)	(III)	(IV)	(V)	(VI)
Dependent variable: Adjusted Wage Share	Dependent variable measured on original scale		Arcsin-square-root-transformed dependent variable		Quasi-Poisson regression	
DESI	-1.549 **		-1.567 **		-3.084 **	
Integration of Digital Technolgy		-0.509 **		-0.515 **		-1.038 **
Trade Openness	-0.073 ***	-0.070 ***	-0.073 ***	-0.071 ***	-0.151 ***	-0.145 ***
Correlation(fitted,true)	0.986	0.985	0.986	0.985	0.985	0.985

Note: ***, **, and * indicates significance at 1%, 5%, and 10%, respectively. Inference is based on iid assumption. All regressions include a constant, time-, and country-specific indicator variables. Models fitted by a generalised additive model (GAM) using backfitting.

TABLE 5.1: CONTROLLING FOR POTENTIAL ENDOGENEITY OF TRADE OPENNESS (CF. TABLE 2)

	(A)		(B)		(C)	
	(I)	(II)	(III)	(IV)	(V)	(VI)
Dependent variable: Adjusted Wage Share	Instrumental variables regression with dep. variable measured on original scale		Instrumental variables regression with arcsin-square-root-transformed dep. variable		Quasi-Poisson regression with control function approach	
DESI	-1.570 **		-1.590 **		-3.474	
Connectivity		-0.289		-0.295		-0.669
Human Capital		-0.048		-0.046		-0.051
Use of Internet		-0.596		-0.598		-0.937
Integration of Digital Technolgy		-0.620 **		-0.627 **		-1.376 *
Digital Public Services		-0.015		-0.017		-0.014
log(LMP Expenditure)	0.008	0.013	0.009	0.013	0.018	0.026 *
Employment in Industry	-4.050 ***	-3.659 ***	-4.086 ***	-3.695 ***	-9.106 ***	-8.363 ***
Employment in Services	-2.100 ***	-1.759 **	-2.106 ***	-1.765 **	-4.273 ***	-3.658 ***
Trade Openness	-0.133	-0.117	-0.135	-0.119	-0.319	-0.278
Real Interest Rate	0.080 *	0.043	0.081 *	0.044	0.195	0.116
Union Density	-0.070	-0.027	-0.070	-0.027	-0.064	0.019
Advanced Labour Share	-0.016	-0.135	-0.015	-0.135	-0.048	-0.301
Correlation(fitted,true)	0.985	0.986	0.985	0.986	0.982	0.983
p-value Durbin-Wu endogeneity test	0.606	0.706	0.603	0.702	0.512	0.571

Note: ***, **, and * indicates significance at 1%, 5%, and 10%, respectively. Inference is based on iid assumption. All regressions include a constant, time-, and country-specific indicator variables. Measures of overall and economic globalisation are used as instruments.

TABLE 5.2: CONTROLLING FOR POTENTIAL ENDOGENEITY OF TRADE OPENNESS (PARSIMONIOUS SPECIFICATION; CF. TABLE 3)

	(A)		(B)		(C)	
	(I)	(II)	(III)	(IV)	(V)	(VI)
Dependent variable: Adjusted Wage Share	Instrumental variables regression with dep. variable measured on original scale		Instrumental variables regression with arcsin-square-root-transformed dep. variable		Quasi-Poisson regression with control function approach	
DESI	-1.519 **		-1.538 **		-3.391	
Integration of Digital Technology		-0.500 *		-0.507 *		-1.186
log(LMP Expenditure)	0.007	0.010	0.007	0.010	0.015	0.022
Employment in Industry	-3.862 ***	-3.752 ***	-3.899 ***	-3.788 ***	-8.940 ***	-8.715 ***
Employment in Services	-1.929 ***	-1.817 ***	-1.936 ***	-1.822 ***	-4.176 ***	-3.951 ***
Trade Openness	-0.100	-0.107	-0.102	-0.110	-0.271	-0.286
Real Interest Rate	0.074	0.049	0.075	0.049	0.186	0.125
Correlation(fitted,true)	0.986	0.985	0.986	0.985	0.983	0.982
p-value Durbin-Wu endogeneity test	0.657	0.622	0.656	0.618	0.576	0.542

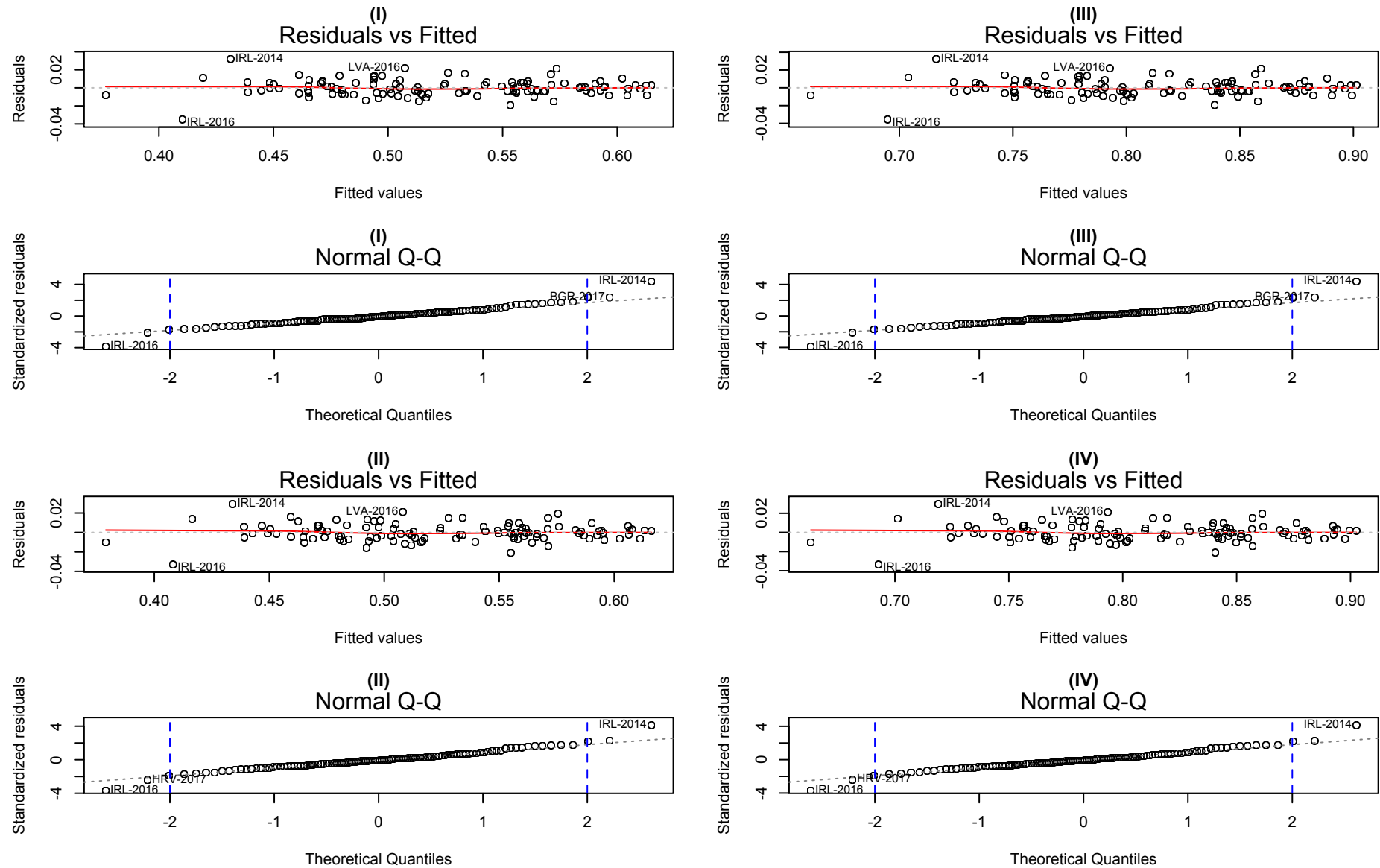
Note: ***, **, and * indicates significance at 1%, 5%, and 10%, respectively. Inference is based on iid assumption. All regressions include a constant, time-, and country-specific indicator variables. Measures of overall and economic globalisation are used as instruments.

TABLE 6: TIME UNTIL WAGE SHARE WOULD HAVE FALLEN BELOW A CERTAIN THRESHOLD FOR DIFFERENT PROCESSES FOR THE SPEED OF DIGITALISATION

	(I)	(II)	(III)	(IV)			(V)		
	Adjusted Wage Share 2017	DESI		Time until wage share would have fallen to half of the level in 2017 in years			Time until wage share would have fallen to 25% of the level in 2017 in years		
		2014	2017	Scenario (A)	Scenario (B)	Scenario (C)	Scenario (A)	Scenario (B)	Scenario (C)
				Linear growth	Exponential growth	Slow growth (log of time)	Linear growth	Exponential growth	Slow growth (log of time)
AUT	0.557	0.098	0.121	31	17	306	47	22	>500
BEL	0.609	0.113	0.130	47	27	>500	71	35	>500
BGR	0.595	0.060	0.079	41	18	394	62	23	>500
HRV	0.534	0.072	0.090	38	19	494	58	24	>500
CYP	0.491	0.070	0.095	26	13	112	39	17	283
CZE	0.473	0.087	0.108	29	16	232	44	21	>500
DNK	0.564	0.131	0.149	42	26	>500	63	34	>500
EST	0.525	0.095	0.120	27	15	183	41	20	>500
FIN	0.586	0.127	0.143	48	29	>500	72	37	>500
FRA	0.596	0.093	0.109	49	26	>500	73	33	>500
DEU	0.575	0.104	0.121	43	24	>500	64	31	>500
GRC	0.507	0.064	0.081	38	19	416	57	23	>500
HUN	0.462	0.077	0.099	27	15	154	41	19	438
IRL	0.430	0.099	0.124	22	13	110	33	17	310
ITA	0.549	0.068	0.090	33	16	210	49	20	>500
LVA	0.508	0.085	0.100	43	23	>500	65	30	>500
LTU	0.478	0.098	0.116	34	20	>500	51	26	>500
LUX	0.511	0.115	0.132	38	23	>500	56	30	>500
MLT	0.476	0.096	0.116	30	18	333	46	23	>500
NLD	0.600	0.125	0.142	44	26	>500	66	34	>500
POL	0.476	0.075	0.090	39	21	>500	59	27	>500
PRT	0.497	0.091	0.112	32	18	342	48	23	>500
ROU	0.434	0.058	0.073	37	18	398	55	23	>500
SVK	0.452	0.081	0.098	35	20	546	53	25	>500
SVN	0.605	0.087	0.108	37	19	447	55	24	>500
ESP	0.549	0.089	0.112	31	16	238	46	21	>500
SWE	0.510	0.130	0.143	52	33	>500	79	44	>500
GBR	0.595	0.114	0.130	47	27	>500	71	35	>500

Note: Reported numbers are based on a coefficient estimate for DESI of $b = -1.549$ as according to the model reported in column (I) of Table 4.2. The detailed calculations for the above numbers are as follows: Firstly, note that a change in the dependent variable y by dy implies a change of DESI of $dx = dy/b$. Denoting by y_{2017} the value of the wage share in 2017 (column (I)), changes $dy = -0.5y_{2017}$ (panel (IV)) and $dy = -0.75y_{2017}$ (panel (V)) are assumed. When the wage share changes to $y^* = y_{2017} + dy$, and this change occurs exclusively due to digitalisation, then the level of digitalisation in 2017 (column (III); denoted x_{2017} in the following) would have to change to $x^* = x_{2017} + dx$. Using information about the observed values of DESI in 2014 and in 2017 (columns (II) and (III)) the following patterns to reflect scenarios (A)-(C) to find the critical number of time-intervals of four years length t^* and x^* follows as: (A) $t^* = (x^* - x_{2014}) / (x_{2017} - x_{2014})$ with $x^* = x_{2017} + t^*(x_{2017} - x_{2014})$, (B) $t^* = [\log(x^*) - \log(x_{2017})] / [\log(x_{2017}) - \log(x_{2014})]$ with $x^* = x_{2017}(x_{2017}/x_{2014})^{t^*}$, and (C) $t^* = \exp\{[\log(x^*) - \log(x_{2017})] / [\log(x_{2017}) - \log(x_{2014})]\}$ with $x^* = x_{2017}(x_{2017}/x_{2014})^{\log(t^*)}$. To translate the according numbers into the number of calendar years ahead from 2017 as reported above, the number t^* must be multiplied by 4 (and was rounded to an integer).

FIGURE A1: RESIDUAL ANALYSIS FOR THE LINEAR MODELS REPORTED IN PANELS (A) AND (B) OF TABLE 2



CHAPTER 3



THE SHARING ECONOMY AND LABOUR: THE CASE OF THE CZECH REPUBLIC



JAN KLESLA

INTRODUCTION

Labour has played a pivotal role in economics and politics for 150 years since the publication of *Das Kapital* in 1867. Today, we can see tectonic shifts in the concept of work and the labour market caused by new economic models such as the so-called sharing economy. This concept may become one of the most important for the reshaping of workforce and social contract in the near future. However, the current state of the sharing economy is not clear. We do not know exactly the size of the real sharing economy, as the real meaning of the term is often blurred and it is also being used to describe various online platforms that are not, strictly speaking, based on any sharing at all.

The term sharing economy has therefore become the most visible example of the disruption of traditional business models by the digital world, and it is a fashionable word. The aim of this paper is to differentiate basic types of the sharing economy and examine its potential and real benefits for workers as well as customers and the national economy as a whole.

Nowadays, many are trying to transpose concepts such as Uber or Airbnb into other industries, or simply copying them. This so-called “uberisation” of economic models has affected not only passenger transport and accommodation, but also other services such as education and healthcare. However, this disruption casts doubts upon established employee relationships, tax and other contributions, and even the very concept of ownership. In the Czech Republic, however, questions arise with regards to whether it is a more efficient use of economic resources, increases in the potential of the national economy, and whether it heightens the value and wealth of society overall. In this respect, it is also necessary to look at the efforts to regulate these innovative business models. The fact that the sharing economy is one of the main priorities of the Digital Coordinator of the Government of the Czech Republic also provides evidence of the relevance and timeliness of the problem (Slížek, 2017).

We tried to bring a minimal basic price comparison to the discussion with the so-called Uber Index, which was inspired by the famous Big Mac Index featured by *The Economist*. Instead of comparing currencies by measuring the number of hamburgers that can be bought, it uses a transportation service – a ten kilometre Uber ride in its basic version (Pop or X) that is provided by contracted individuals in their personal vehicles. Thus, the Uber Index reflects, above all, the different wage levels in individual countries, and indicates that the Czech Republic’s position is roughly equivalent to international and European standards. Its position is also based on the maturity of the market and therefore the competition level. Moreover, the Office of the Czech Government issued its own analysis based on the data provided by the platforms, that shows the differences between the Uber driver-partner and the usual licensed taxi driver.

Both are certainly only simple comparisons. However, certain conclusions can be drawn from the fact that our assessment does not show major differences in the comparison of economies based on indicators of purchasing power parity (PPP). This suggests that the sharing economy has not yet demonstrated its potential to increase the outcome of the Czech economy in general and among its individuals.

Looking at the sharing economy through the labour market, and its contribution to wage growth and national wealth, is one of the most important decisions for its eventual regulation or deregulation. We therefore conclude with the most common regulatory challenges currently.

AN ECONOMIC MODEL OF THE SHARING ECONOMY

The most important principle of the sharing economy and its regulation in the Czech Republic is the economic nature of the individual business models. Under the notion of sharing economy, or gig economy, exist a whole range of new economic models (European Commission, 2017). These often evolve in such a dynamic way that their exact description in professional literature has not yet been fully understood, and certainly not fully implemented. The very concept of a sharing economy is generally considered to be the umbrella term for a number of other phenomena such as co-consumption, collaborative economics, or collaborative consumption, peer-to-peer (P2P) economics, access economy or on-demand economy (Section for European Affairs of the Office of the Government of the Czech Republic, 2017).

Common to all models of the real sharing economy (or sharing economy in the stricter sense) is the use of otherwise dormant sources (e.g. cars, flats, or domestic tools) and, above all, the minimisation of transaction costs through the coordination of economic operators and the inclusion of these unused resources into the economic cycle through online applications, referred to as digital platforms. The key element is the realisation of transactions that would not have occurred without the involvement of these factors. Digital platform-based businesses thus deliver a unique interaction of supply and demand with minimising transaction costs. If the business model fails to meet these basic criteria it can be described as the sharing economy in the broader sense, i.e. similar business model based on digital platform (Evans & Schmalensee, 2016).

A comprehensive definition of the so-called sharing economy cannot be provided without further description of its basic types that currently occurs on the Czech market. The Czech sharing economy can be divided into these basic types (Evans & Schmalensee, 2016):

DIGITAL PLATFORM BUSINESSES

The real use of online platforms is to link supply and demand at lower cost. For instance, Uber cooperates with partners on so-called fleet programs, where local companies (often shell companies) *de facto* employ drivers, rent their cars at a pre-fixed flat rate and then reward the employees with minimum wages (Lidovky, 2017). With respect to leasing through the Airbnb platform, low interest rates for mortgages lead to targeted purchases of real estate exclusively for the purpose of renting the entire dwelling on the platform, even with the setback of using of other services (for example specialised cleaning agencies).

In such cases, it is not possible to talk about sharing in any sense, because there is no use of economic resources that would otherwise not be used. It can be defined as the sharing economy in the broader sense only, i.e. the marketing label, not the real model of sharing. On the contrary, it is likely that such cases can contribute to negative economic phenomena, such as artificially reducing labour supply and raising property prices. There may also be problems in complying with current legislation, from protecting employee rights through to complying with fire and other regulations, to the proper payment of taxes and other levies.

INDIVIDUAL SHARING/GIG ECONOMY

The most controversial and methodologically most difficult part in terms of the economic and legal description is the situation where an individual uses his time and assets for intermittent or even regular gains. However, it is not a systematic work activity under a pre-agreed flat fee and it is very difficult to include it under the notion of the sharing economy. On the one hand, there is actually a sharing of time and resources that would otherwise not be used. In this case, it is a form of a sharing economy in the broader sense. On the other hand, all services provided by, for example, craftsmen-tradesmen are also qualified alongside the main employment relationship, and are often negotiated today using modern communication technologies, such as digital online markets.

In this case, it is also possible to doubt the increased efficiency in the use of scarce resources, as there have been greater and more regular damages for the *de facto* secondary business activity and therefore the need for standard depreciation calculations. Compensating the increased need for new cars, for example, was suggested by Travis Kalanick, the founder of Uber, at the World Economic Forum in Davos in 2016 (Hutt, 2016).

GENUINE SHARING

Genuine sharing is reflected, for example, in regular or *ad hoc* co-drivers, or, in the case of real estate, the rental of residences that owners cannot, or do not, want to use at the moment. This category may also include the borrowing of various movable items (tools, household necessities, but also automobiles) that may have previously been able to be rented, but because of the minimisation of transaction costs through digital technologies, they are used to a greater degree and were previously unrealisable transactions. Various forms of modern communication tools can be used, in some cases even the Facebook groups focused on sharing may meet these criteria. This category is a real sharing economy in a narrow sense that fully meets the generally accepted goals of increasing the efficiency and potential of the economy. In the Czech Republic, Uber does not provide this category of sharing economy yet.¹ In addition, its share of total economic activity is currently negligible.

In this category, however, potentially the greatest benefits in terms of more efficient use of scarce resources are in the future. For example, a home drilling tool is only used for about 12 to 15 minutes throughout its service life. Such sharing in the narrow sense of the word is then also referred to as a collaborative economy (Botsman, 2010). The essence of such an economic model is not only the common use of things, but also the added value that the sharing itself brings. The shared thing increases the economic benefit of the owner, community, and society. This is why, in some cases, we are even talking about a new socio-economic system of material and human resources and their use (Botsman, 2010).

ECONOMIC MODEL	Genuine sharing	Gig economy	Digital platform business
CHARACTERISTIC	Sharing of scarce resources that are not used by the owner	Part-time job, sharing of time and assets for intermittent	Use of online platforms is to link supply and demand at lower costs
EXAMPLE	UberPool	UberPop	UberPop/Black

¹ In the case of passenger carriage known as carpooling, Uber then as UberPool.

The key role in all of the above-mentioned cases is played by intermediaries who connect completely unknown people through means of modern communication, usually in the form of internet applications. Their involvement, and the range they achieve, fundamentally distinguishes the sharing economy from regular neighbourhood assistance. However, the question of profitability of their business model, which is on the margins of reimbursement, is a big question. Their level is limited, because it depends on the efficiency and usability of the whole system.

From the above-mentioned, it follows that the sharing economy is not revolutionary in some respects, as is often publicly proclaimed for the marketing interests of individual companies. This is basically a gradual change that has already begun with the interconnection of customers, the so-called peer-to-peer (P2P) systems. Gradually, a collaborative consumption component has been added and continues to develop into other areas and forms.

A number of services have not been included in this segment because they are in fact a normal business, with traditional business models only using modern communication and digital technologies, especially mobile applications. These services, such as taxi applications, car rentals, and various hotels, hostels, and their search engines, of course, can and are also in direct competition with sharing economy models. However, it cannot be included in the broader sense of the word, as they have generally evolved from traditional models by adding an internet application dimension. For example, there are different bike or car rentals.

Some providers of financial services can also be compared to this group of businesses. Investors in the P2P credit platforms are very often the world's largest banks. This can be seen even in the Czech Republic, for instance with the P2P credit platform called Zonky, which is owned by the financial company Home Credit.

THE CURRENT STATE OF THE SHARING ECONOMY IN THE CZECH REPUBLIC

Nowadays, the sharing economy in the Czech Republic can be described as less developed compared to most advanced economies in the world. As of 2017, these services are being provided in the capital (Prague) and are slowly expanding to other major cities (Brno, Ostrava). Uber, for instance, has operated on the Czech market since 2014. The market is mainly dominated by transnational platforms for the provision of passenger transport (Uber) or rental of flats (Airbnb) (PwC, 2015). As a rule, either the whole range of services is not available or limited to a particular territory (cities, especially Prague). Local services are either minority or do not meet the criteria for inclusion under the sharing economy.

It should also be emphasised that there is currently no conclusive and up-to-date statistical data, and previous studies have generally been limited to the use of author's estimates without a reference to relevant sources or a complete methodology. The Analysis of Sharing Economy and Digital platforms by the Office of the Czech Government is the first real study of the current state of the field based on data. However, this study itself concluded that "[the] main output is the knowledge of the sharply growing share of services of the sharing economy, particularly in Prague, especially in the sector of accommodation and transport services."

The services themselves have recently presented selected data. According to the survey Uber commissioned with TNS Kantar, 14% of Prague residents used alternative taxi services (spring 2017). The survey also said earlier

that Uber had a quarter of a million registered passengers in the Czech Republic over the space of two years (2014–2016) (Kantar Survey, 2017). Similarly, Airbnb also publishes selective data, which states that Prague is the ninth most popular city for using their service, when taking into account the number of reservations, which have doubled year on year. The number of foreign guests was then increased by 59% to 710,000 in 2016 and the average length of stay reached three days. According to a survey conducted by CzechTourism, between January and September 2016, the number of tourists accommodated in private or shared accommodation applications in the Czech Republic reached 2.2 million. The number of beds offered by Airbnb reached 71 600 in Prague in May 2017, whilst the number of beds offered by traditional hotels and hostels was just slightly higher (76 972, end of 2016). (Office of the Government of the Czech Republic, 2017).

The governmental analysis states that genuine or individual sharing of accommodation services in Prague (limited to one-platform-mediated services) reaches less than 20% of the offered accommodation units as “true” hosts. The remaining 80 percent can be considered as activities that are significantly closer to business activity.

BENEFITS OF THE SHARING ECONOMY – THE UBER INDEX

The benefits of the sharing economy, when considering all three mentioned types, are unclear for the Czech economy. The so-called Uber Index, which was put together, in an ELF policy paper, by the think-tank Institute for Politics and Society in cooperation with Lidové noviny, shows us that the costs and wages are below average when comparing Uber rides to traditional taxi services. The study was inspired by the famous Big Mac Index featured by *The Economist*, which consistently argues that the cost of comparable goods worldwide reflects the costs of individual economies (Institute for Politics and Society, 2017). Instead of a hamburger, however, Uber Index bases itself on a comparable service – a ten kilometre Uber ride in the basic version (UberPop or UberX). We compared the theoretical rides (as described) in capital cities where Uber operates this service.

The most expensive in the world is Japan’s megalopolis Tokyo, followed by Helsinki, Finland. Prices are also a considerable distance away from London and other western European metropolises. On the opposite end are India, Kazakhstan and the popular tourist destination, Thailand. In comparison, prices for alternative taxi services like Uber are half of the global average in the Czech Republic and Prague.

COUNTRY	CITY	UBER	BASIC RATE (USD)	PRICE PER MINUTE (USD)	PRICE PER KM (USD)	INDEX
Japan	Tokyo	UberX	\$0.90	\$0.59	\$2.70	\$33.80
Finland	Helsinki	UberBlack	\$5.31	\$0.43	\$2.02	\$29.81
Italy	Rome	UberBlack	\$5.31	\$0.37	\$1.28	\$21.81
United Kingdom	London	UberX	\$3.07	\$0.18	\$1.53	\$20.17
Sweden	Stockholm	UberX	\$4.47	\$0.63	\$0.83	\$19.07
Norway	Oslo	Uber Pop	\$3.52	\$0.35	\$1.17	\$18.72
Belgium	Brussels	UberX	\$1.06	\$0.27	\$1.33	\$17.06
France	Paris	UberX	\$1.28	\$0.32	\$1.12	\$15.68
Netherlands	Amsterdam	UberX	\$1.06	\$0.27	\$1.17	\$15.46
USA	Washington D.C.	UberX	\$1.15	\$0.17	\$1.02	\$13.05
Austria	Vienna	UberX	\$3.19	\$0.27	\$0.69	\$12.79
Russia	Moscow	UberX	\$3.35	\$0.34	\$0.25	\$9.25
Portugal	Lisbon	UberX	\$1.06	\$0.11	\$0.69	\$9.06
CR	Prague	UberX	\$0.98	\$0.12	\$0.39	\$6.08
Slovakia	Bratislava	UberX	\$1.28	\$0.07	\$0.41	\$6.08
Estonia	Tallinn	Uber Pop	\$1.38	\$0.11	\$0.32	\$5.68
Poland	Warsaw	Uber Pop	\$0.97	\$0.06	\$0.32	\$4.77
World average			\$1.54	\$0.18	\$0.63	\$9.56
EU average			\$2.29	\$0.27	\$0.82	\$13.22

This comparison reflects, above all, the different wage levels in individual countries, and the position of the Czech Republic in this respect roughly corresponds to international and European standards. Its position is also based on the maturity of the market and therefore the competition level. Unlike conventional indicators such as the level of purchasing power or GDP, the Uber Index shows how the economic level of the country is reflected in modern sectors of the so-called shared economy. However, the maturity of the market and therefore of competition also have an impact.

Of course, this is a baseline comparison, with prices being affected to a large extent by competition in the markets and just by the labour force. However, some conclusions can also be drawn from the fact that the comparison does not show any significant differences from the comparison of economies based on the PPP. From this, it can also be concluded that the sharing economy has not yet shown its potential in increasing the wealth of the company and the incomes of individual economic entities at an individual level.

The understanding of the benefits of a sharing economy in the broader sense is premature at the moment. It can be said that the above-mentioned lack of development of real sharing is mainly a mixed option, or worse, platforms are used only as a tool for the evolution of older business models. Only with the mixed option can we really expect pressure, for example, on future changes such as the concept of ownership. If we are, on the other hand, only seeing an evolution of older business models, it may lead to a possible further development

towards centralisation, which – as in history – can prove to be more efficient. In this respect, it would simply be a repetition of historical experience.

THE ECONOMIC AND REGULATORY CHALLENGES OF THE SHARING ECONOMY

There is no specific regulation of sharing economy in the Czech law. However, in terms of regulatory challenges, three basic, and one complementary, categories can be identified (Bergström & Wennberg, 2016):

TAXES, FEES AND OTHER CHARGES

A major problem with the relationship between new business models, related services and their suppliers to the public authorities is the mandatory levy, especially the responsibility for the proper payment of taxes. For example, Uber or Airbnb insist that they are only a technological tool, and every driver or landlord must meet this obligation. Customer rights are then provided by rating systems for the provided services. However, regulators often do not have the necessary data, so Uber has reached agreement with them, for example, in Estonia.

Airbnb currently faces pressure to pay city fees in Prague. Only 3,500 dwellings out of the total number of 15,000 are offered in the Prague 1 district. The Town Hall records only 427 flats from which a fee is paid. In this part of the capital, about 30,000 people are registered.

CONSUMER PROTECTION

The question of consumer protection is the main reason for public regulation. The services of the so-called sharing economy are characterised by autonomous systems of service providers and customers that provide instant feedback. On the other hand, however, the key issue is the responsibility of these companies in providing services. For example, Uber is the target of disputes in the US on the part of the victims of traffic accidents (Friedrich-Ebert Stiftung, 2017). The question of its nature as a transport service is also currently under consideration by the Court of Justice of the EU (InfoCuria, 2017).

ANTITRUST

The fundamental question is focused on the application of the rules on competition protection. As a so-called network sector, digital platforms naturally have a strong tendency to create dominant [or] monopoly players on the market. The key question here is how to ensure free competition and competition from small, often local and fast-growing companies. At present, questions still remain as to whether the current setting of competition rules is in line with this dynamically developing industry.

The major difference between the different platforms and services in the sharing economy is above all the issue of pricing. While, for example, Uber is on the level of the platform, other platforms in the true sense leave this

crucial economic moment to the service providers and recipients, and are in fact only intermediaries in this respect. Alternatively, they provide guidance for determining the bid price, depending on location, time, etc. This moment has potentially very significant effects from the point of view of competition and its protection and its importance for possible regulation was highlighted in the Advocate General's Opinion also in the ongoing proceedings before the EU Court of Justice (InfoCuria, 2017).

STATUS OF COOPERATING PARTIES

A major problem not only in the US is the status of service providers themselves, mostly Uber drivers. They are, according to the company itself, only independent contractors, but many work in the factual position of employees. Similar issues are opening up in Europe with stronger labour law regulations. These issues are also appearing on the Czech market (Office of Czech Government, 2017).


CONCLUSION

From a legal point of view, it must be acknowledged that excessive regulation impedes the development of a sharing economy. On the other hand, however, it is necessary to point out the devastating effect of the emerging legal uncertainty. Regulating this area is as inappropriate as regulating too much. The sharing economy in the Czech economy has yet to prove its potential, but it will not succeed if a major legislative barrier to entry is set up.

The key is to bring the basic economic understanding of the different types of sharing economy into the current debate about the regulation of the different models. At present, there is a lack of measurement methodology and data, let alone an authoritative description of this rapidly evolving industry in the Czech Republic. Such a step is absolutely necessary to be able to determine which type of sharing economy best enhances the society and economy, and before blindly interfering with regulatory instruments.

In line with the view above, it is possible to draw some partial conclusions. Above all, it is necessary to describe the real economic impacts of the different types of the sharing economy more closely and to distinguish between them, i.e. between the genuine sharing (sharing economy in the stricter sense), gig economy and digital platform business (sharing economy in the broader sense). The fundamental benefits lie in the minimisation of transaction costs, as the degree to which services are used are higher in the sharing economy as a result of this advantage.

When setting up possible regulations, it must be kept in mind that the sharing economy has not yet developed its potential. Legislative changes have the potential to facilitate growth, provided that they promote the development of real sharing that has a real potential to increase economic efficiency and wellbeing. The issue of competition and its protection is a key issue in a sharing economy, with a crucial aspect being platform-based pricing. Additional challenges such as increasing the protection of consumers, ensuring the proper payment of taxes and clarifying the legal status of the service providers must also be kept in mind when making new legislations. Nonetheless, rather than interpreting these obstacles as the negative by-products of the sharing economy, it would be more beneficial to view them as opportunities to extract greater wealth and add value to the economy and its society.



Three main points for the future can be recognised:

- We need to make a clear distinction between the types of sharing economy.
- More data is needed. Currently data on which type of sharing economy is the best and why is too weak to identify the kind of legislation that would give the best results for our economy and society.
- Once we make new legislation we need to keep in mind, not only which type of sharing economy to support, but also how the challenges mentioned in this chapter, are taken into consideration.

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CHAPTER 4



THE CAR-SHARING BOOM: HOW TO MAKE IT HAPPEN



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INTRODUCTION

The purpose of this chapter is to increase understanding of the growth potential of car-sharing services and how they can help achieve the climate and accessibility policy goals, focusing on the Swedish target for the transport sector for 2030¹, and how this potential can be realised. Particular emphasis is placed on what the public sector can do, partly in terms of national, regional and local decisions, and as a major player with many employees and many vehicles.

The text has been developed in collaboration with large parts of the industry and several leading traffic researchers within the framework of the 2030 secretariat's efforts in the field of education.

BACKGROUND: TRENDS IN CAR SHARING

Many see 2015 as the breakthrough for car-sharing services in Sweden. Sunfleet, the leading commercial player, increased the number of members by 37% to over 40,000, vehicles by 20% to over 1,000 and kilometres driven by 23% to just under 15 million. Sunfleet claims the main reason for the increase is "... the expansion in attractive areas where there is a high demand for car-sharing services." In addition, "... another trend in 2015 is that car-sharing services have become an important factor in housing ads." (Trivector, 2014)

In the spring of 2017 there were at least 70,000 car-sharing members in Sweden, with almost 2,000 shared vehicles, which we believe travel somewhere between 200 and 300 million kilometres per year (Trafikanalys, 2016a).

Trivector data implies that each shared car replaces five privately owned vehicles, meaning car sharing can now be expected to reduce the number of vehicles on Swedish roads by approximately 10,000. In the areas where car sharing is most common, this may have contributed to reduced need for parking spaces and better accessibility in traffic, especially as car-sharing users generally travel fewer kilometres (McKinsey & Company, 2016).

What a typical car-sharing service is, is rapidly changing. From being primarily local, often non-profit services with a handful of cars, there are now several national and international players. Previously, many car-sharing pools had a single car type, typically a medium-sized station wagon. Now, there are pools with everything from small cars to convertibles and vans, as well as clean electric cars. The earlier obvious picture of a shared car in a certain location is now challenged by "floating" pools where the user can leave the car in a different location from where it was picked up. In addition, some vehicles are company cars during the daytime on weekdays and are included in car-sharing pools in the evenings and weekends.

¹ 70% reduction in CO₂ emissions from the entire fleet

The growing interest in car-sharing services is in line with several other social trends:

Urbanisation. The closer proximity in which we live, the less attractive it is to own a car and the more interesting the options become.

Densification of cities. Contrary to the previous trend of urban sprawl, McKinsey estimates that Sweden's major cities will increase their density by 30% between 2015 and 2030.

Sharing economy. Interest in ownership seems to decrease (DriveNow, 2016) not least regarding cars, which make up a large capital cost for a product that is unused most of the time.

Life balance. Many people find that they have trouble organising their day-to-day activities, and are thus more likely to look for solutions that free up time. Car sharing can then be perceived as more attractive than having a car because it does away with "needs" such as refuelling, service and tyre changes.

Climate change. The increasing issue of climate change and tightening of climate targets at local, national, EU and global levels has increased interest in reducing climate impact. This is particularly true in the Swedish transport sector, which has the toughest known goal in the world: 70% reduction in climate impact by 2030.

Lower status. The car seems to lose meaning as a status symbol while other means of communication rise in status: from mobile to bike. (Stockholm Chamber of Commerce, 2016),

Technical development. Modern IT solutions make it much smoother than before to use shared cars, which can now be booked and unlocked via smartphones or smart cards, without the need for key cabinets or the like.

Diversification. Soon all the major car manufacturers have introduced car-sharing schemes in different shapes because they can reach customer groups that they would otherwise not have reached, and therefore more and more people will find an offer that suits them.

But the development is neither linear nor clearcut; despite the opportunity to join a car-sharing service, more and more people choose to get their own car. In 2016, a new record was set for new car sales in Sweden (Statistiska Centralbyrån, 2017). In addition, changes in driving distance (Trafikanalys, 2016b) and the increase in use of public transport and cycling are slow or negligible (Trafikanalys, 2015; WSP, 2016). The vehicle industry has also noted that many customers consider owning a car difficult and have developed competing offers that provide several of the benefits of sharing a car, such as private leasing where service and tyre changes are included (Motorbranschens Riksförbund, 2016).

Car-sharing services also have a number of other challenges to deal with, such as:

- Uneven demand for evenings and weekends and low utilisation at other times.
- Seasonal changes in demand, with high demand during, for example, school holidays.
- Limited and/or expensive parking.
- Uneven distribution geographically, with many cars required in one place and left in another, requiring a lot of vehicle displacements, which increases fees.
- Uneven competition between traffic types, for example; lower VAT for taxis than for car sharing (Sochor, Strömberg & Karlsson, 2014).

CAR SHARING: ONE TERM, MANY VARIANTS

Car sharing is a phenomenon that is here to stay, and therefore we need to know what we really mean by the term. The Swedish Transport Agency's definition is "short-term rent with self-service" (Trafikverket, 2010).

Car sharing in the US is similar to what is being referred to as "car clubs" in the UK. In both these cases, there is a legal definition, which, for example, means that car-sharing operators in the US can have access to reserved parking spaces.

Within the car-sharing concept, there are a few variations:

Commercial sharing services with fixed pools: These require membership and that the rented vehicle is returned to the same location as where it was picked up. The rent includes fuel and usually other charges, such as congestion charges. These services can be closed, i.e. not open to the public, but only to a company/authority/organisation; half open i.e. closed for a certain time to a company/authority/organisation, (usually in daytime during weekdays) and then open to the public; or open to anyone anytime of the day all year long.

Commercial services with floating pools: These require membership, but the car can be picked up and left at any place in a defined zone, such as a city. The car-sharing company has arrangements with cities/carriers that facilitate drop-off. The rent includes fuel, parking and usually other charges such as congestion charges. These services are open.

Non-commercial services with fixed pool areas: Examples include municipalities with their own fleets of shared cars. An example of this is Majornas car company in Gothenburg, Sweden. There are also other players that have taken this further and offer cooperative not-for-profit car-sharing services across major geographical areas, both with vehicles that members own privately or where the cooperative buys the vehicles (Stockholms Bilpool). These operate in a similar way to the commercial services with fixed locations (SOU, 2017).

New ways to share vehicles are constantly springing up, so our description should be seen as a snapshot. One of the latest ways to share vehicles is companies providing digital platforms for car sharing/rental of privately owned vehicles (Snappcar). Other companies provide both a digital platform for private car sharing/rental and interconnection while providing vehicles through leasing concepts (GoMore).

USE OF THE POOL

A shared car can replace several privately-owned cars; how many depends on the layout of the service. An average of several studies suggests that a shared car can replace five private cars (Martin and Shaheen, 2011). This is primarily due to households either refraining from buying their own car or replacing a second car with a car-sharing membership, as well as employers who reduce the need for company cars using car-sharing services. Up to a third of those who have joined a car-sharing service have either sold a private car, or postponed or refrained from acquiring their own car (Baptista, Melo and Rolim, 2014). With fewer cars owned, capital is released that can be used for other things, as well as spaces where cars are parked today that can

be used for homes, shops or parks (Trivector, 2014). If a shared car could replace seven private cars, 85 square metres of parking space would be released (Akerman & Nyblom, 2014). This effect will be enhanced when cars become autonomous, as they can utilise parking space more efficiently. Autonomous vehicles will probably appear earlier in shared car pools than in other situations, both because the replacement rate is higher in the shared car pools and because autonomous cars can respond more quickly to changes in demand in different geographical areas.

The faster replacement of cars in car sharing is largely due to the fact that an average shared car is driven three-to-five times more than an average privately-owned car, and therefore needs to be replaced more often. The effect is amplified by the fact that many car-sharing companies are working to have relatively new cars in their pools. The higher exchange rate is potentially beneficial to the environment, health and the climate, as new technologies and new and more-efficient fuels can be introduced on a wider scale, faster. In addition, many car-sharing services – but not all – have a high environmental profile and will actively choose cars that run on renewable fuels and electricity than the market at large. Loose's report on European car sharing indicates that shared cars have 15–25 % lower carbon monoxide emissions than cars on average (Loose, 2010).

The fact that car-sharing services contribute to increased demand for environmental cars, not least clean electric cars, is beneficial to the transition in general. This is because the cost of environmentally friendly cars decreases as demand for them increases, and because workshops and car dealerships become more used to the technologies by using the sharing services. The option to choose a type of car when using a sharing service can also have indirect and severely amplified effects on other parts of the fleet; those who become familiar with cars such as electric cars will have lower barriers to choosing an electric car when in the market for a car of their own (McKinsey & Company, 2016).

STATE-LEVEL RECOMMENDATIONS

To fully realise the potential for increased car sharing requires changes in state legislation to be implemented on a national level. Here, we present suggestions for a number of such changes, considered to be particularly relevant, in approximate order of importance:

LEGALLY DEFINE THE CONCEPT OF A 'SHARED CAR'

As long as a legal definition of a shared car is absent, the possibilities for favouring car-sharing schemes over private ownership are severely limited. For example, it is not possible to provide shared cars with special parking places. We therefore share the opinion of the Swedish "Investigation on the Circular Economy", that "there are statutory criteria for what is meant by publicly available shared cars." (SOU, 2017)

Our proposal for legal definition is: "a vehicle classified as a motorcycle, passenger car or light truck, which is widely available and can be rented for a period of an hour or less, with self-service both on pick-up and return."

The definition allows the inclusion of vehicles other than passenger cars, but limits the options to motorcycles (which includes light four-wheel electric vehicles) at one end and light trucks at the other. Loan bikes have completely different traffic rules and therefore different needs for legislative changes and incentives. The same applies to heavier trucks. Limitations exclude taxis and other forms of transport where a driver is included in the

price, rental cars, which are normally hired for longer periods than shared cars, as well as other ways of sharing a car, for example between friends or within a housing association.

Our definition does not concern ownership and does not require the vehicle be shared at all times; for example, a company may use the cars on weekdays and car-sharing users have access to the cars at all other times, or taxis and rental cars can be used in shared pools. The definition does not impose any environmental requirements on the vehicles; while, we applaud the fact that car-sharing services are forerunners in the shift to fossil-independent transport, we do not think that it should be a requirement included in the definition.

CHANGE PARKING LAWS

Today, Swedish municipalities are not allowed to give benefits to certain types of vehicles with reserved parking spaces or free or cheaper parking. More than 30 of Sweden's approximately 100 municipalities which have parking fees, including all three of Sweden's three largest municipalities, have offered such benefits. But after being ruled illegal, the last municipality (Karlstad) ended the programme on April 1, 2017. The reason for not allowing such benefits is that it is considered adverse to the principle of equal treatment.

We propose that municipalities should be given the right to reserve parking spots for shared cars in general, but also that they are given the possibility to reserve street parking places for specific car-sharing services; i.e. fixed and liquid systems. Both should be stimulated and great freedom given to the municipalities to choose which development they want to stimulate. Similar rules are already in place in Belgium and in the Netherlands, indicating that the change is in line with EU legislation.

These changes naturally assume that there is a legal definition of shared cars, as well as any other category of vehicles that can benefit from special treatment.

STICK TO THE FOUR-STEP PRINCIPLE

The four-step principle is an approach adopted by the Swedish parliament (Trafikverket, 2017), on which all traffic planning in Sweden should be based. Planning and capacity reinforcements are undertaken in four steps, where step one should always be applied first, and step two should only be used if the first step is not enough, and so on. The steps are:

Rethink. The first step considers measures that may affect the needs of transport and travel, as well as the choice of modes of transport.

Optimise. The second involves implementing measures that lead to more efficient use of existing infrastructure.

Rebuild. If necessary, the third step involves limited rebuilding.

Build new. The fourth step is implemented if the need cannot be met by implementing the three previous steps. This means new investments and/or major rebuilding measures.

If this principle would be implemented systematically in all infrastructure and transport-related projects, on all levels, the conditions for car-sharing services would be greatly improved, since providing alternatives to ownership of a car is a typical step-1 measure.

In order for this to happen, there is no need to change existing rules. Instead existing rules can be applied in new ways. In recent years, however, we have seen a shift away from the four-step principle in Sweden, where government funds available for municipal step 1 or 2 actions have received reduced funding.

TAX CAR SHARING LIKE PUBLIC TRANSPORT

The VAT rate for public transport in Sweden is 6%. This includes not only buses, subways and tram services, but also taxis, rental of limousines and helicopters and ski lifts. However, for car-sharing services, VAT is 25%. Reducing the VAT for car sharing to the same level as for public transport would be beneficial for sharing services, and we believe that it would more accurately reflect the role of the shared car in future transport systems.

MAKE IT EASIER TO CHOOSE CAR SHARING OVER COMPANY CARS

Today, there are just over a quarter million company cars in Sweden. The number has approximately doubled over the last 15 years. An important part of the explanation for that increase is that the cost of having a company car has remained the same since 1997, when the present company vehicle program was introduced. Over the same period, consumer price index has risen by over 20% and the cost of owning a car of your own has risen by about 70% (Dagbladet, 2015).

In addition, a person travelling by car in his or her work is entitled to tax-free mileage compensation from the employer, currently 1:85 kronor per kilometer or 0:95 kronor per kilometer for a company car (0:65 kronor per kilometer if it runs on diesel). The same amounts apply if you decide to make tax deductions for service-related car travel, instead of receiving the compensation from an employer (Skatterverket, 2013). Low costs for company and service vehicles and driving your own car in the course of your work makes the switch to sharing a car unattractive, and should be adjusted at least to parity.

EXTEND AUTHORITIES' CHOICE OF MOBILITY SOLUTIONS

Since 2009, all government agencies in Sweden are required to choose "environmental cars", according to the national definition found in the ordinance purchase, leasing and long-term rental of passenger cars (Förordning, 2009:1). The law also applies to taxi journeys, rental cars and emergency vehicles (Förordning, 2009:1). This has accelerated the change to low emission vehicles and should be supplemented by government authorities reviewing the extent to which they can replace the need to own or lease cars with other mobility solutions. Car-sharing services are part of this, as well as authorities making the vehicles they own or lease available for others to use when they are not needed, through public, semi-open sharing services in combination with other mobility services.

DECENTRALISE CONGESTION CHARGE DECISIONS

A legal definition of shared cars would make it possible to exempt shared cars, completely or partially, from congestion charges. At present, decisions on congestion charges are national, but when municipalities and

regions can, in accordance with governmental guidelines, decide to introduce congestion charges and environmental zones for passenger cars, congestion charges can be used as a tool for promoting car sharing and ride sharing on a local and regional level.

ENHANCE TRANSPORT-POLICY GOALS

Transport-policy goals are important as they set priorities, goals and directions for future work. Here, MaaS, Mobility as a Service, should be used as a guide; public transport, bicycles, walking, taxis and car-sharing services can all be part of an integrated and sustainable transport system. This would provide an important base for an accelerated conversion, which may also be relevant for a change of EU transport-policy objectives: the EU's current target only deals with more efficient use of existing infrastructure and vehicles (European Commission, 2011). It would also increase interest in, and value of, the collective experiences of major European-owned car-sharing services, such as Car2Go in Ulm, DriveNow in Munich and AutoLib in Paris.

A focus on car sharing would also be fully in line with the UN's Global Sustainable Development Goal, often called Agenda 2030, of which Sub-Action 11.2 states the importance of "By 2030 at the latest, providing access to safe, affordable, accessible and sustainable transport systems for all..." (Regeringskansliet)

LOCAL-LEVEL RECOMMENDATIONS

We have identified a number of changes that should take place at the national level to accelerate car sharing take-up, but much of the work for sustainable mobility takes place in the municipalities and can be done within the framework of existing laws and regulations in Sweden. Several recommendations for municipalities follow.

LET MUNICIPALITIES PLAN FOR CAR SHARING

In Sweden, municipalities have the right and duty to plan the use of land within the municipality, according to the Planning and Building Act (Plan, 2010). An important part of the overall planning is to determine how land will be utilised, and which if used correctly, could increase the potential to build an attractive car-sharing service.

As with public transport, it is important for car-sharing services that the density of people in the area is high enough, the mix of homes and workplaces is good and that the distance one has to cover before accessing the shared car is not too large at any given time. Thus, it is crucial to include planning for car-pool locations as well as for public transport stops early in the overview planning.

In the detailed plans, land use is determined, with the possibility to reserve land for shared cars, primarily those with fixed locations.

The lack of a legal definition has led to the fact that most municipalities have not reserved land for shared cars, making it harder for car-sharing services to establish themselves in smaller municipalities.

USE PARKING SPACES AS A TOOL

Car-sharing services with floating parking benefit from lower parking fees, and if access to charging stations is good, the possibility for the car-sharing pools to switch to electrical operation increases (Dagens Nyheter, 2016).

An increasing number of municipalities actively use a restrictive parking quota as a tool to accelerate the transition to sustainable mobility. With a low parking quota, sometimes as low as 0.2 parking spaces per home, car sharing and public transport are stimulated. It is also possible to require even fewer spaces when planning urban areas if building managers are asked to ensure that there is access to a car-sharing service within or in close proximity to the property. Since parking spaces cost a lot to build, with 280,000–400,000 Swedish kronor per parking space in Stockholm (Innovativ Parkering, 2016), the building manager will actively work for the creation of car-sharing services.

USE COACHING AND COUNSELLING

The tendency to change behaviour is highest before behaviours settle. Therefore, in mobility contexts, it is valuable to reach people with structured behavioural influence through dialogue and coaching as they move into new residential areas. This has been proven effective in, for example, the western harbour of Malmö (Malmö Stad, 2014).

A Municipal Energy and Climate Advisory Service can also be beneficial. The Swedish Energy Agency describes this as a service that "... helps you with ideas to become more energy efficient and it helps you to get an overview of the different options you have to choose from" (Energimyndigheten, 2016). However, the focus has mainly been on the home and its energy consumption, and it has been suggested that the mission to work with transport should be completely abandoned. Instead, we think that the advisory service is an extremely useful tool to help people change their behaviours. This particular part of the advisory service should be expanded and emphasise that the car is the single largest expense for many households and that there is rapidly increasing potential for replacing car ownership with other solutions, such as car sharing.

USE GAMIFICATION TECHNIQUES

Gamification, incorporating game mechanisms in things that are not traditionally games, may not be regarded as a municipal affair at first glance. However, many municipalities have shown that it can be an effective tool for improving health, slowing traffic and getting people to recycle better and more (Chou, 2017). Well-known examples are step-counting contests for municipalities' employees or bicycle counters that show how many have cycled past a certain point in one day. To involve the whole municipality in travelling more sustainably through the use of gaming mechanisms can also have a great effect, especially for phenomena such as car sharing, which in many cases is still untried by municipal residents.

REGIONAL-LEVEL RECOMMENDATIONS

For regions and county councils in Sweden, the role of public transport and the public transport operator, in addition to regional planning issue, is an important factor in whether or not car-sharing services are given benefits.

ENHANCE REGIONAL OVERVIEW PLANNING

In many cases, regional overall planning governs the planning of many municipalities in Sweden. A very important task for regional planning is to analyse what is needed to achieve the climate and sustainability goals set at national level, for example with a backcast or GAP analysis.

The role of car sharing in the regional survey has been discussed relatively little, despite the fact that public transport is central to regional planning. County councils and regions should be able to identify where car-sharing services need to be introduced, reinforced or expanded, in dialogue with relevant municipalities, as well as addressing the role of car sharing in a coherent mobility system.

INCLUDE PUBLIC TRANSPORT AND MAAS SERVICES

The new MaaS (mobility as a service) transport solutions that are emerging are erasing the boundaries between services such as car sharing, taxi and public transport. For example, Samtrafiken, an organization consisting of 54 Swedish transport companies, has stated that, "If this trend continues, one might think that the definition of public transport in the future will simply become "traveling with shared resources", no matter who offers the means of travel. If that happens, then it will be reasonable for the public to have an interest in ensuring that all these players together form a system that provides accessibility to everyone at an affordable price. In such a future, it is reasonable to question whether the public should only subsidise the "traditional" public transport, or if the subsidies should be extended to other forms of shared mobility." (Trafikanalys, 2016a)

The public transport operator Västtrafik is one of the driving actors and has participated in the UbiGo (UbiGo, 2013) field study. It has long-established cooperation with car-sharing companies and welcomes dialogue on the subject (Västtrafik).

ISSUE REGIONAL POLICIES AND REGULATIONS

Regional guidelines and statements can be of great importance, since traditional public transport is usually organised regionally. For automotive companies, strategic situations and cooperation with public transport are very beneficial, which has been pointed out in several studies (Trafikverket, 2010).

SUPPORT REGIONAL PROCUREMENT

As in municipal procurement, it is important that regional authorities assess their procurement of travel and vehicles carefully. If the focus changes to purchasing mobility instead of vehicles, there are huge gains to be

found both in terms of reduced costs and car-sharing services being established in smaller urban areas. As previously stated for the state and local level, the existing vehicle park can be used in a procurement for the purpose of utilising the own fleet of vehicles in car-sharing schemes (Stockholms Stad, 2017).

SUMMARY

Car sharing is still an emerging phenomenon, and it needs to be nurtured if it is to realise its potential as a tool in fighting climate change. Using these Swedish examples, we hope to provide some pointers for other European countries hoping to see car sharing prosper.

The examples we have laid out can be summarised in points, five at state and regional level, and five at local level.

AT NATIONAL LEVEL:

Define the shared car legally. As long as there is no legal definition, it is very difficult to create benefits for shared cars.

Reduce VAT. VAT on car sharing in Sweden should be reduced from 25% to 6%, so that car-sharing services are no longer subject to a VAT that is four times higher than taxi, limousine services and helicopter rental.

Change deduction rules. Allow entrepreneurs to deduct the full cost of car-sharing services, as with other transport services they buy.

Change parking regulations. So that municipalities can stimulate car sharing with reserved parking spaces and free or cheaper parking.

Stick to the four-step principle. A concept that has been successfully implemented in Sweden, so that all major infrastructure projects consider initiatives for more efficient mobility as an alternative to road development.

LOCALLY AND REGIONALLY:

Request coordination. Public transport authorities should ensure that shared vehicles are connected to public transport hubs, to facilitate smart mobility.

Bring car sharing into planning work. So that more efficient vehicle use is available from the start when infrastructure planning is done.

Share vehicles, procure mobility services. Let your own fleet be available to the public on evenings and weekends. Purchase mobility to solve transport needs, both with owned cars and car-sharing service operators.

Introduce scarce and flexible parking spaces in residential planning. So that the developer is encouraged to offer the residents car-sharing solutions instead of garage spaces for individual vehicles.

Inform more. Municipal energy advisors, housing and energy companies all play a part in helping citizens to include car sharing as a possible way of meeting their transport needs.

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CHAPTER 5



REVENUE STREAMS FROM RECYCLING WASTE



ILKKA VIRKAJÄRVI

INTRODUCTION

The circular economy is coming and essential for the future of mankind. Ductor Corp. is a small Finnish company that is changing the way renewable energy, fertilisers and food can be produced. We make it possible to use materials that presently can only be used in biogas production in limited amounts. Our patented microbial process (US 9090914) means high nitrogen-containing waste material can be used in biogas production and the nutrients used as fertilisers much more effectively than they can today: a real example of the circular economy. Below is explained what Ductor will change and why, and finally some supportive actions are described.

THE CHALLENGE

The challenges for mankind that must be resolved as a matter of urgency include (not necessarily in order of importance): climate change, waste accumulation and the spiralling need for food and energy. The planet's population is growing, and this requires increased production of energy, food and fertilisers. All this increase greenhouse gas emissions to the atmosphere.

Biogas can and should be a part of the solution. Biogas production can diminish greenhouse gas emissions, reduce the amount of waste, as well as recycle nutrients efficiently for food production while producing renewable energy.

THE AMOUNT OF WASTE IS GROWING AND COST IS INCREASING

Presently, approximately 38 billion metric tons (or a cube 3km*3km*3km) of organic waste worldwide is produced per year. This estimation takes into consideration human, livestock and agricultural activities (Bhat *et al.*, 2015). In an earlier report, Hoornweg and Bhada-Tata (2012) estimated that the global solid waste generation rate will increase by 70% by 2025. The numbers are huge and the associated cost, too. The cost to manage solid waste will rise from \$205 billion per year (equals to 560 million a day) in 2010 to \$375 billion per year by 2025 (Hoornweg and Bhada-Tata, 2012). We should also note that not all organic waste is solid, but a large part of it is liquid, for example liquid manure, so the total amount of waste is much larger.

The estimated volume of animal manure is around 13 billion tonnes per year (FAO, 2006). Because animals do not use all the nutrients from the feed, a large amount of nutrients is contained in animal manure and thus ends up in the environment. The percentage of nitrogen that is taken up by animals varies between 20% and 45% and the percentage for phosphorus is between 20% to 33%. The rest ends up in the environment. On a global scale, the nitrogen seeping from manured agricultural lands into fresh water amounts to more than 12 million tonnes. Phosphorus leaching (movement of phosphorus from the solid material into ground water) is in the order of 1.5 million tonnes (FAO, 2006). Both releases to the environment cause unwanted changes, like excess algae growth that covers seas.

WASTE IS TREATED IN INEFFICIENT WAYS

Waste in general is often been considered unusable, resulting in landfilling or burning. Both create environmental problems: pollution of ground water and the atmosphere. In the European Union, 98 % of the 242 million tonnes of generated waste is treated. Of the treated wastes, 29.9 % is landfilled, 25.5 % is incinerated, 26.9 % is recycled and 15.4 % is composted (Eurostat, 2017a). Nutrients like nitrogen and phosphorus, leak with water from landfills to ground water and cause (an excessive proportion of nutrients in the environment known as) eutrophication. Moreover, pollution of the environment by heavy metals is a problem with landfills. Burning releases particles into the atmosphere, which are considered to cause lung diseases and premature deaths. Nitrogen oxides and dioxins are also released into the atmosphere, even with high purification efficiency of flue gases. The ashes from incineration often have a high concentration of heavy metals, which limits their use as fertilisers. This wastes a lot of resources: recyclable materials, nutrients and renewable energy. Burning, especially, emits most of the nitrogen that was in burned material into atmosphere.

As the organic waste part of municipal solid waste (MSW) and animal manure are good substrates for biogas production, we could mitigate environmental problems and decrease emissions to the atmosphere by managing more of these materials by anaerobic digestion (i.e. biogas production). Not only would the emissions from landfills or burning facilities be decreased, but the need for fossil fuel would decrease, and emissions from manure handling and fertiliser production would also decrease. The anaerobic digestion produces biogas (a mixture of methane and carbon dioxide) for energy and a digestate (solids that remain after the digestion) that contains valuable nutrients, which replace mineral fertilisers. The wastes that could be used in biogas include the organic part of municipal solid waste, animal manures and wastes from meat and cereal processing. Therefore, biogas production would be a good way to treat organic waste.

Treating waste as we do today, we lose nutrients, miss an opportunity to recycle nutrients efficiently and create both greenhouse gas emissions and pollution in the atmosphere. All this has an impact on our environment. Therefore, all ways and means to reuse materials are needed, especially the material what is known today as "waste".

THE SOLUTION

Biogas production, also called anaerobic digestion, could represent the solution for organic waste. In biogas production, organic material is converted to biogas and solid leftovers (digestate) by the action of microorganisms. This is a totally natural process and reduces the volume of organic waste by a factor of over 2, therefore leading to more concentrated nutrient content (e.g., nitrogen, potassium and phosphorus). This digestion will reduce odour emissions, too.

However, some organic waste contains large quantities of nitrogen, which renders it difficult or even impossible to use in biogas production. Levels of nitrogen that are too high lead to ammonia inhibition in biogas production. These high nitrogen-containing substrates include poultry manure, fishery waste, meat-production waste, feathers etc. Usually, the high nitrogen content is associated with high methane potential.

THE DUCTOR TECHNOLOGY

Ductor Corp. has developed a patented and totally biological method to remove nitrogen from organic material (US 9090914). By using this method, microbes convert the nitrogen from nitrogen-rich materials, such as poultry manure, into a separable form. This water-soluble form (ammonia) is then separated before the material enters biogas production. Therefore, there is no ammonia inhibition in the biogas process. The separated ammonia is recovered as a fertiliser – ammonium sulphate.

In the process, the organic waste is converted into renewable energy, a nitrogen fertiliser, and a solid organic portion. This solid part serves as a soil enhancer or even a fertiliser, depending on what kind of waste is used as substrate.

The Ductor process adds a fermentation step to a normal anaerobic digestion. As this extra fermentation takes less than one-sixth of the time needed for digestion, the investment is small. Additional equipment for removing the nitrogen and converting it to a fertiliser (ammonium sulphate) is needed, too. However, all these costs are easily covered by additional incomes.

A typical application of the Ductor method is using 100% chicken litter as the feed, which is impossible in normal anaerobic digestion processing, due to ammonia inhibition. A material balance for a 1 MW (megawatt) electricity biogas plant would be:

IN	OUT
30,000 tons/year chicken litter	7,100 MWh electricity
1,016 tons sulphuric acid	7,700 MWh heat
	3,383 tons ammonium sulphate solution
	6,291 tons dry digestate (315 tn N, 510 tn P ₂ O ₅ , 390 tn K ₂ O)

Of course, it is also possible to produce not just electricity, but biomethane. The latter is the purified part of biogas that can then be fed into natural gas or used as transportation fuel.

In some cases, it is very convenient and economic to dry the digestate with the heat of the flue gases from the gas engine, which turns the biogas into renewable electricity. In the process that Ductor Corp. developed, we use a very efficient super-heated steam dryer to dry the digestate. If the feed into the process is chicken litter, the dried digestate contains somewhere around 5 w/w-% nitrogen, 8 w/w-% phosphorus and 6 w/w-% potassium (see above). Even if the feed is an organic fraction of municipal solid waste, the dried digestate will contain all the phosphorus and potassium that was in the feed.

BENEFITS AND REVENUE LOGIC

With the technology of Ductor Corp., the nitrogen content of the substrate can be adjusted to the level that ammonia inhibition in biogas production is avoided. This increases the options for substrates as well as ensuring the optimal and stable operation of the biogas plant. On the other hand, for example in the case of poultry litter, the digestate is rich in nutrients. With Ductor's technology, nitrogen and phosphorus are separated from each other, at least partially, which enables more precise application of the nutrients into the fields.

For the biogas producer, the application of nitrogen removal opens new substrate options. The price of chicken litter in Germany is roughly one-sixth of the most frequently used substrate: corn silage. In the above example this indicates a €595,000 saving a year¹. Phosphorus and potassium also remain in the digestate and can be dried. When dried, these nutrients are in a solid form that can be stored and transported².

Using what today we call waste as a substrate increases the economic advantages of biogas. If the substrate to the biogas process is chicken manure, there will be additional environmental benefits. The present way to spread the chicken manure on the fields creates ammonia emissions into the atmosphere, corresponding to 60 million tons of CO₂ equivalent. On the agricultural side, more fields would be available for food production as one ton of chicken manure can replace one ton of corn in biogas production. If all chicken manure in the EU (2.1 billion tonnes per year) were to be used in biogas production instead of corn, the EU would have 56 million hectares more cultivated land for food production, calculating the average maize yield in the EU, 37.4 green maize ton/ha (Eurostat 2017b).

Furthermore, there will be environmental benefits by reducing the fossil energy used, for example, in ammonia production. Each ton of the ammonium sulphate recycled through recovery processing can save 38 MJ of energy (0.8 litres diesel oil equivalent) per ton ammonium from production by Haber-Bosch process. In fact, ammonia production by Haber-Bosch process consumes up to 5 % of the world's annual natural gas production and about 2 % of the world's annual energy production as a whole (Chem. Eng. News, 2008).

The nitrogen-removal technology described can be added to existing biogas plants, as well built into totally new installations. Ductor sells both options as turnkey projects all over the world.

1 A 1 MW electrical power biogas plant needs 17,000 tonnes per year corn silage or chicken litter as feed. If the corn costs €40/tonne and chicken litter €5 per tonne the savings are €17,000* (40-5) per year = €595,000 per year.

2 Using Northern European prices (Farmit, 2017) for diammonium phosphate, muriate of potassium and ammonia as \$332, \$224 and \$250 per tonne, respectively, and the nutrient concentration of 24, 58 and 64 kg per tonne dried digestate, we will arrive at a price of \$37 per tonne for the digestate. This does not take into account magnesium, selenium, or other micronutrients which all will be in the digestate. When we estimate the price for the solid digestate basing the calculation of mineral fertiliser prices and calculate the elemental value of nitrogen, phosphorus and potassium we get the result above.

SUPPORTIVE STRATEGIES ARE NEEDED

Very few of the abundant bio-waste resources are currently transformed into valuable products, even if the key principle of the circular economy is the re-use of raw materials.

In Germany, 230 million tonnes of organic fertiliser, cattle slurry being the dominant product, is spread on the fields. Of that, almost 1.2 million tonnes is poultry litter, the substrate for the Ductor biogas process (Destatis, 2016). This amount alone contains 1,210 million m³ of methane potential, 25,200 tons of nitrogen, 20,000 tons of phosphorus (P₂O₅), and 17,000 tons of potassium (K₂O). This forms only a small part of the total fertiliser use (total mineral fertiliser amount of N, P and K was 2.4 million tons in 2013, Destatis, 2013) in Germany, but they could be the starting point for the recycled nutrient quota.

The European Commission is preparing legislation that, in its proposed form, seems to promote the use of biogas digestate as a fertiliser (European Commission 2016/0084 COD). The aim of the proposal is to unify national legislations and standards and thus create an easier and more-accessible market for organic fertilisers. To this end, the digestate is proposed to be given a product status, thus promoting it from a waste product of biogas production to a sellable fertiliser. This legislation will make adaptation of Ductor technology much easier and faster as it removes obstacles of digestate handling.

The legislation could go a bit further by, for example, requiring a certain percentage (or quota) of recycled nutrients to be used in fertiliser production or use. The model for this legislation could be taken from that for renewable fuels (Renewable Energy Directive EC/28/2009). The percentage rule should be imposed on the producers of mineral fertilisers. The requirements for what is a recycled nutrient must be carefully evaluated, taking into account all aspects, including the environmental benefits and disadvantages. This legislation would mitigate the risk of rising prices of sulfuric acid that is needed in the production of nitrogen fertiliser in the Ductor process.


This kind of legislation would speed up adaptation of the nutrient recycling processes by securing the market.

Ductor considers enabling nutrient recycling from field to field as core to the circular economy, and therefore we are supportive especially of this kind of legislation. And Directive 2009/28/EC on the promotion of the use of energy from renewable sources seems to be effective: the share of renewable fuels in the EU has risen from 8.4% in 2004 to 16.4% in 2015 (Renewable Energy Progress Report, 2017).

There are already several EU regulations that also apply to the use of digestate or other forms of fertilisers, like the Fertilizer Regulation, Nitrate Directive, Water Framework directive, etc. Operationally, there are regulations concerning manure management, transport, animal waste treatment and renewable energy regulations, etc.

Support for innovative, new solutions in this field would be very welcome by small companies, such as Ductor Corp., that are spearheading innovations, but do not necessarily have all the manpower or resources needed to cut red tape. A small company may be spending too much time keeping up with all the fast-changing regulations, and this may be the straw that breaks the camel's back.

One practical example of the red tape in digestate management in Germany follows. The law requires that most of the digestate must be spread on nearby fields. One court has decided that nearby is the distance travelled by a tractor in one half an hour. A second has decided that the distance travelled by a tractor in one half an hour is 20km on the road, not as a bird flies. And eventually, a civil servant analysing the building permit



for our plant decided that 23.2km is not a nearby distance. If this is what legislators had in mind when writing “nearby”, then all is well. However, the imminent outcome of the decision is that Ductor, instead of being able to focus on creating energy from waste, must invest more work and resources in finding a new field where the digestate can be applied for the next 12 years. The 12 years come from an authority decision that states that the field must have an agreement for 12 years before it can be accepted as an end station for digestate.

The increasing amount of organic waste is a massive challenge for the planet and the amount will be increasing until 2075, even with actions taken to reduce the amount. In their article in the science journal *Nature*, Hoorweg et al. (2013) pointed out that reducing the waste would bring enormous social, environmental and economic benefits.

The main technical barrier to the use of the organic component of municipal solid waste in biogas production is the sorting process. Metals, stones, and particularly plastics break and block equipment in biogas plants, thus making economic operation difficult. Any action to improve sorting at the point the waste is generated would greatly benefit, not only biogas operations, but all aspects of the circular economy. Unfortunately sorting requires not just the possibility to do so, but changing attitudes, too. For example, in Kenya, plastic bags are now banned and even a jail sentence can result (*Iltaalehti*, 2017), but whether the equivalent in Europe could solve the plastic problem in municipal solid waste remains doubtful.

Legislation, education, monitoring and rewards are all needed to create solutions to handle the huge amounts of organic waste humans generate. At best, the principles of a circular economy are also fulfilled, and successful business cases are the best drivers of these actions.

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CHAPTER 6

ALL-SEEING GIANTS AND BLINDFOLDED DWARFS: ON INFORMATION-ASYMMETRIES ON DATA-DRIVEN MARKETS

STEFAN LARSSON

INTRODUCTION: THE POLICY CHALLENGES OF A DATA-DRIVEN DIGITAL ECONOMY

Much has happened with the “digital economy” in the more than 20 years that have passed since the term was established by Don Tapscott’s book with the same title. In 1996, the modern data-driven platform giants Google, Facebook, Alibaba, as well as contemporary pioneers of the sharing economy as Uber and Airbnb, were yet to be founded. Apple – today the world’s largest technology company by total assets – was a struggling and seemingly confused producer of a variety of consumer technologies. While much of the early thinking on the digital economy revolved around the democratisation of knowledge, the distribution of the internet and the meaning of the shift from analogue to digital, the digital economy has evolved into a highly data-driven ecosystem deeply involved in most aspects of our everyday lives. Elsewhere, I have addressed challenges to policy and regulation of internet-dependent innovation as one of the key policy-related modern challenges, particularly dependent on how to understand the new phenomena (Larsson, 2017a) and in relation to the fundamental challenge of sustaining consumer trust in new data-driven innovations (Larsson, 2017c), where personal data becomes the very means of payment (Larsson & Ledendal, 2017).

The top five companies with the largest absolute increase in market capitalisation in 2009–2017 were all very much consumer-focused data-driven tech companies: Apple, Alphabet (Google), Amazon, Microsoft, and Facebook (PwC, 2017). By March 2017, these five data-driven companies had taken five of the top six spots in terms of market capitalisation globally, overtaking the oil companies and to some extent the financial institutions that were at the top only a decade ago. This is an indication of a recent and very much ongoing development of a digital economy based on the collection, analysis and trade of personal data. The behavioural patterns of individuals, the sociogrammatic links between them, their geolocation, purchasing patterns, as well as their long-used demographic information, all form the inherent value of the digital economy. Consumer profiling, therefore, increasingly serves as a foundation for innovation in this data-driven world, including not only the “big five”, but a rapidly increasing undergrowth of platform-based companies and data brokers at the core of a growing “sharing economy” (Christl, 2017; Leurs & Zimmer, 2017).

The objective of this chapter is to contribute to the understanding of the growth of this global data-driven market ecology, mainly in order to pinpoint important regulatory challenges, where individual choice and agency, as well as competition, seem undermined. Truly, this development holds many promises for new innovation, some more disruptive than others, but also poses challenges that in this chapter is discussed in terms of lack of transparency on the data’s destination and how it is used. As more types of industries develop their own sophisticated uses of personal data, the collaboration between multiple parties by necessity develops. This does however contribute to the lack of insight for individuals and authorities, but also risks skewing the markets to the favour of those in control of distribution platforms and search engines. The challenge then regards how to deal with data-driven dominance and gatekeeping, i.e., the notion of antitrust in relation to digital-markets.

The chapter thereby focuses on: (1.) the “ecosystem” of global data-driven markets and the lack of incentives for data collectors to be more transparent; in order to analyse (2.) the extent to which the information asymmetry brings monopolistic tendencies and a power asymmetry between data-collecting and data-utilising platforms, on the one hand, and individuals and small and medium-sized enterprises (SMEs), on the other, and to (3.) suggest counter-measures to problems arising from this asymmetry. For the sake of expressing the related points, I mainly use the EU commission as the regulatory entity at play.

BACKGROUND: PLATFORM GIANTS AND POWER ASYMMETRIES

About a year before the strategy on the collaborative economy, which is returned to below, the EU commission issued a communication on a digital single-market strategy for Europe (COM(2015) 192 final). The digital single market of course means a substantially broader approach than the case of the collaborative economy, to include also aspects such as telecom rules, VAT burdens across borders and geoblocking obstacles. However, and importantly, *the online platforms* – widely exemplified as search engines, social media, e-commerce platforms, app stores, and price-comparison websites – are also addressed in the strategy. They are described positively, in that they “enable consumers to find online information and businesses to exploit the advantages of e-commerce”, and have come to play a fundamental role in the digital economy. They are, furthermore, heavily dependent on data, they “generate, accumulate and control an enormous amount of data about their customers and use algorithms to turn this into usable information”. The growth of such data is exponential, the commission claims – “90% of all data circulating on the internet were created less than 2 years ago” (COM(2015) 192 final, section 3.3.1).

The Commission argues that the new platforms have rapidly and profoundly challenged traditional business models and that, “the rise of the sharing economy also offers opportunities for increased efficiency, growth and jobs, through improved consumer choice, but also potentially raises new regulatory questions” (COM(2015) 192 final, section 3.3.1). Which, again, is expressed in terms of what this platform-based control of access to online markets means and concerns over the growing market power of some platforms.

“These include a lack of transparency as to how they use the information they acquire, their strong bargaining power compared to that of their clients, which may be reflected in their terms and conditions (particularly for SMEs), promotion of their own services to the disadvantage of competitors, and non-transparent pricing policies, or restrictions on pricing and sale conditions (COM(2015) 192 final, section 3.1.1).”

The main points addressed by the EU commission regard both the balancing of powers between the data-driven platform giants and other companies, relating to the gatekeepers of market access these platforms have become, as well as the relationship between commercial data-collecting entities and individual consumers. The latter is also echoed by the European Data Protection Supervisor (EDPS), which emphasises the importance of rising up to the challenges of consumer privacy that have emerged from the combination of “Big Data” and data analysis. EDPS (2015) points out the importance of (1.) Transparency, (2.) the user’s codetermination, (3.) data protection, and (4.) accountability. There are arguably a number of potential problems arising from lack of insight into how consumer data is used and where it travels. The notion that more transparency is the way forward is also supported by law professor Frank Pasquale in “The Black Box Society”:

“If we’re not going to be able to stop the flow of data, therefore, we need to become more knowledgeable about the entities behind it and learn to control their use of it. We need to hold business and government to the same standard of openness that they impose upon us – and complement their scrutiny with new forms of accountability (2015, p. 57).”

Arguably, the data-driven market development in recent years has led to what Christl in a recent report has described as that “pre-existing practices of commercial consumer data collection have rapidly evolved into

pervasive networks of digital tracking and profiling. Today, a vast and complex landscape of corporate players continuously monitors the lives of billions" (2017, p. 65). Interestingly, the online advertising industry can be seen as a "pioneering force" (Christl, 2017, p. 67) in developing sophisticated technologies that combine and link digital profiles across different companies such as data brokers and data aggregators. It has created a sort of data-driven infrastructure for consumer profiling that are spreading to other types of industries as well (cf. Larsson 2017b), discussed in "Infoglut" by media scholar Mark Andrejevic as "the spreading of prediction markets" (2013, p. 68–70). What broadly started as means to make profit for free services through ads has now developed into the sophistication of personalised services in more sectors, developing insights through collection and trade of big data, as well as utilization of improved analytics and machine learning.

Below, I mainly discuss the issue of power struggles between commercial entities in terms of monopolistic tendencies and market dominance, and I mainly address the consumer issue in terms of information asymmetry, lack of transparency and the complexities of the "data ecosystem".

REGULATORY QUESTIONS OF DIGITAL DISRUPTION

THE SHARING ECONOMY

A sort of conceptual struggle of great legal and political importance can be witnessed with regards to the sharing or collaborative economy, for which the EU Commission presented an agenda in June 2016 (COM(2016) 356). Uber, for example, reportedly had 50 lawsuits filed against it during 2015 in the U.S. federal court alone.¹ Many of the cases regard the extent to which Uber drivers should be seen as independent contractors or employees. Apart from the employment regulatory issues, the tax issue is a concern for many states around the world. Uber, and other representatives of the sharing economy, simply challenges some of the notions under which these markets traditionally have been regulated. The key is how to conceptualise these new ventures – what they are understood to be.²

The Commission sees great potential in the collaborative economy in that it "creates new opportunities for consumers and entrepreneurs" and can "make an important contribution to jobs and growth in the European Union" (COM(2016) 356, p. 2).³ At the same time, the Commission states that the collaborative economy raises issues with regard to the application of existing legal frameworks, such as "blurring established lines between consumer and provider, employee and self-employed, or the professional and non-professional provision of services" (p. 2). The sharing economy is debated, both as a practice and as a concept, as recently underlined by digital business scholars Erickson & Sørensen:

1 Brown, Kristen V. (16 June 2016) "Here's what's going on with all of those Uber lawsuits", Fusion. <http://fusion.net/story/315350/uber-class-action-lawsuit-settlement/>

2 For more on how the metaphorical understanding of digital phenomena is relevant for the regulation of these phenomena, see Larsson (2017a) "Conceptions in the Code: How Metaphors Explain Legal Challenges in Digital Times."

3 For an account on the nature and significance of recent technological change and its impact on European companies and labour markets, see Bergström & Wennberg (2016) "Machines, Jobs and Equality".

“Yet, as ongoing and numerous legal actions and injunctions against companies like Uber and Airbnb across the world demonstrate, opinion differs on the extent to which the sharing economy should be regulated, resisted or embraced (Erickson & Sørensen, 2016, p. 2)”

This is also acknowledged by Erickson & Sørensen in terms of that “[t]he way that society and policymakers define the sharing economy will influence how we choose to regulate its activities” (p. 2). The platform based economy is arguably a key challenge for the assessment and regulation of dominant market positions in terms of competition and antitrust. Particularly when a platform becomes so dominant that it essentially becomes an infrastructure for newcomers, a sort of superstructure that operates as a gatekeeper for new ventures.

ANTITRUST AND INFOGLUT

When it comes to the relationship between the relatively few data giants and smaller newcomers, the trend has for a while been agglomeration through acquisition into more or less monopolistic or oligopolistic markets (cf. Dolata, 2017). This is also underlined by media researcher Andersson Schwarz:

“The present tech economy seems beset by market concentration, which is being harnessed by a handful of actors with the financial muscle to either outperform budding market entrants through pricing suppression, automation, and efficiency-maximization – or to simply buy them. (Andersson Schwarz, 2017, p. 7)”

Much of the coming policy challenges in the data-driven markets will unavoidably have to deal with how to translate antitrust issues into the practices of the giants in the digital economy, a fact increasingly voiced by critics.⁴ According to Andersson Schwarz, actors like Google explicitly admits that the massive data collection infrastructure it holds is key to its market dominance (2017, p. 16), and Andersson Schwarz exemplifies that arguing that by Google holding behavioural mobile internet user data, it can excel in seemingly unrelated sectors, like urban and traffic planning.

“This means that undisclosed steps can be taken toward rapid intrusion into unexpected sectors, only knowable ‘ex post facto’. While it would be preposterous that regulators should have knowledge of business strategies in advance, the radically altered conditions for this kind of market entry begs new questions as to how antitrust/competition legislation should be formulated and implemented in the digital era (Andersson Schwarz, 2017, p. 16).”

This means that the traditional notion of sector-dependent antitrust likely needs to be adapted and rethought, to enable an assessment of contemporary cross-sector outcomes of massive data aggregation by singular corporate entities. An example from legal practice would be the recent case where the European Commission fined Google €2.42 billion for breaching EU antitrust rules, under claims that Google had abused its market dominance as a search engine by giving an illegal advantage to another Google product, its comparison shopping service. According to Commissioner Margrethe Vestager, Google abused its market dominance as a search engine by promoting its own comparison shopping service in its search results, and demoting those of

⁴ The Economist, Leaders section, 6 May 2017. “The world’s most valuable resource is no longer oil, but data. The data economy demands a new approach to antitrust rules”. <https://www.economist.com/news/leaders/21721656-data-economy-demands-new-approach-antitrust-rules-worlds-most-valuable-resource>

competitors.⁵ The case is very much debated and will be so for a long time (cf. Day, 2017). Commentators, like Adam Davidson in *The New Yorker*, state the discrepancies between the US and EU when it comes to antitrust regulation, and notes that the “perhaps most striking about the European Union’s decision is that many of the complaints were from big, U.S.-based firms: not only TripAdvisor and Yelp but also Microsoft, Oracle, and others. They had pursued Google through the U.S. Federal Trade Commission, to no avail”.⁶

The non-transparent aspects of automation in combination with market dominance is also of importance in the relationship between mega-platforms, on the one hand, and smaller companies or new ventures as well as consumers, on the other. For example, both Google’s search engine and the Facebook feed algorithmically moderate the blending of paid and organic editorial content. The design of these algorithms, under constant development and tuning, are both hidden for external scrutiny as well as affecting which sites being promoted over others, making this design crucial for smaller ventures of all sorts, having a consumer orientation. Given the key online gatekeeping position of these dominant platforms – Google holding over 90% of the search market globally⁷ and Facebook roughly 2 billion active users⁸ – any other consumer-oriented company will unavoidably be dependent on the workings of these algorithms.

This gatekeeping aspect is also seen in corporate policy-making in the ways in which Apple implements its App Store usage policy (a “macro-level platform superstructure”, in the words of Andersson Schwarz, 2017). For example, in June 2016, a change in how Apple implements its App Store usage policy suddenly threatened to kill off an entire e-identification system used by millions of Swedes for transferring money to friends, paying bills or being in contact over a personal matter with governmental authorities. After what Andersson Schwarz describes as “a brief furore in the Swedish tech community”, Apple’s head office ultimately granted an exception to the identification app regarding this fundamental rule (2017, p. 18).

THE ‘MIXED MOTIVES’ OF ONLINE SEARCH

Internet search – to return to Google – are also of interest from a consumer-needs perspective, constantly negotiating between striving to offer results of greatest personal relevance and a business model that includes paid content. An interesting paper from 1998 on the “anatomy of a large-scale hypertextual web search engine” states that “advertising funded search engines will be inherently biased towards the advertisers and away from the needs of the consumers” (1998, p. 18). While this bias needs to be assessed from both an antitrust as well as a consumer perspective, the perhaps most interesting aspect with this paper is that it is written by Sergey Brin and Larry Page, the founders of Google, in 1998, the same year the google search engine was launched (without a working business model). Today, Google has created perhaps the most pervasive and significant data-collection infrastructure ever known to man, serving its ad sales. In this early paper, Brin and Page, emphasise the problems of “mixed motives” resulting in search engine bias: “Since it is

5 European Commission – Press release 27 June 2017. Antitrust: Commission fines Google €2.42 billion for abusing dominance as search engine by giving illegal advantage to own comparison shopping service. Brussels. http://europa.eu/rapid/press-release_IP-17-1784_en.htm

6 The New Yorker, 28 June 2017 “Teddy Roosevelt wouldn’t understand the EU’s antitrust fine against Google”, by Adam Davidson. <http://www.newyorker.com/business/adam-davidson/teddy-roosevelt-wouldnt-understand-the-eus-antitrust-fine-against-google>

7 As of July 2017, according to <http://gs.statcounter.com/search-engine-market-share>.

8 Announced by Facebook in June 2017. And, as James Titcomb of the Telegraph points out, at least two in every three people who could use Facebook every month do so, given that around 3.7 billion people around the world have access to internet connections, and around 700 millions of those are in China, where Facebook is banned (The Telegraph, 27 June 2017).

very difficult even for experts to evaluate search engines, search engine bias is particularly insidious” (Brin & Page, 1998, p. 18).

While Google is clearly dominant in the search market, future challenges will regard other translations of antitrust into settings where market dominance is even harder to define. And, from a strict jurisdictional perspective, the question of how to regulate corporations active on a global arena based on rules set in singular countries or the EU will continue to be a challenge.

INFORMATION ASYMMETRIES ON CONSUMER DATA MARKETS

The basic tenets of much consumer policy deals with enabling consumers to be able to make informed decisions. However, several surveys carried out in recent years indicate that users are becoming increasingly concerned about their lack of control of the use and dissemination of their personal data (Lilley et al., 2012; Pew, 2014). Some are particularly worried about having no control over their internet-generated personal data and the possibility of it being used in ways other than they originally intended when sharing it (Kshetri, 2014; Narayanaswamy & McGrath, 2014). This could, in theory, lead to new services that offer the data handling and level of privacy that is demanded from these worried groups (cf. Larsson, 2017c). However, research also shows that many users often continue to use services that can be very intrusive, while at the same time stating that they are concerned about data being collected from their use of online products and services (Bechmann, 2014; Light & McGrath, 2010). This mismatch, sometimes called a “privacy paradox” (cf. Larsson, 2017c; Larsson, 2017d), is likely depending on a lack of transparency of how data is collected, handled and used by the service providers.

In 2015, the Norwegian Data Protection Authority, Datatilsynet, undertook a study on commercial data collection in Norway (Datatilsynet, 2015; cf. Larsson & Ledendal, 2017 for a Swedish account). This study, too, confirms the incentive of aggressive data collection on non-transparent data markets:

“When consumers have no knowledge or understanding about what is going on, they cannot demand services that provide better privacy. This results in the sector having no incentives to provide services that are more privacy-friendly. The winner in the market is the company who has the most data, and future developments will therefore be characterised by increasingly intensive harvesting of personal data (Datatilsynet, 2015, p. 47).”

WHEN INTERNET GIVES YOU LEMONS

The problem with information asymmetries in markets is a basic theoretical concern within economics, too, e.g. early noted by Nobel laureate George Akerlof in “The Market for Lemons” (1970) in terms of quality and uncertainties. Akerlof’s market theorising sought to provide structure to determine “the economic costs of dishonesty” (1970, p. 488). In short, Akerlof’s article shows how markets in which consumers cannot distinguish between good quality and poor quality (he uses the car market, with “lemon” as slang for a bad car) leads to a median pricing. This in turn leads to incentives for sellers of good-quality products not to participate in the

market and to sellers of poor-quality products to do so. This information asymmetry, according to Akerlof, is likely to cause the market to move towards collapse, thus forming an argument for regulation.

The article has contributed to both economic theory and contract theory, but has also been criticised based on the fact that the lack of consumer insight leads to new markets aimed at remedying the information asymmetries (cf. William L. Anderson). The counter-argument is not without merits in relation to price comparisons and product reviews, which – indeed – have democratised markets and strengthened consumers in many cases. However, the market for contractual comparisons and data collection practices do not appear to have had the same growth or operate according to such principles, making the implications of the General Data Protection Regulation (GDPR) – that becomes enforceable from 25 May, 2018 – of particular interest. The GDPR is intended to develop existing legal framework by strengthening and unifying data protection for all individuals within the EU, and to give control back to citizens and residents over their personal data. For example, this includes that automated individual decision-making, including profiling, is made contestable (Article 22), and that the concept of *Privacy by Design* is formalised into the regulation (Article 25). Furthermore, valid consent must be explicit for data collected and the purposes it is used for, and stressing the right to withdraw consent at any time (Article 7; defined in Article 4).

NON-INFORMED CONSENT?

Importantly, from a consumer perspective, a strongly information-asymmetric market can be seen as a dysfunctional consumer market in which consumers cannot make informed choices. When consumers have little knowledge, or do not understand how and when their data is collected, how it is handled, by what party and where it travels, they cannot require services that provide better privacy or for other reasons data practices that would be perceived as more legitimate. This information asymmetry is an indication of a market development with weak incentives to provide services that are more privacy-friendly, which in turn leads to the fact that the winner in the market is the company with the most data, not necessarily the most legitimate collection.

Returning to Akerlof's notion of information asymmetry in the data-driven markets, in relation to contemporary data-driven markets: arguably, consumers cannot distinguish between good quality and poor quality in terms of how fair the data collection is, where the information travels and its use. The development will therefore be characterised by increasingly intensive collection, analysis and trade in personal data, unless consumer transparency is increased. This, of course, too includes a development of a multitude of data-driven consumer services that will be very much sought and utilised by consumers, but it also means that much of the balancing of powers in markets and their regulation will have to be debated on a level above consumers' (non-)informed choices. The notion of informed consumers controlling the data-driven markets is not working in practice. One of the constituting aspects of this lack of control, in addition to the lack of incentives for transparency, regards an increasing complexity of the data markets, which I term the "data ecosystem", also creates a structural obstruction for transparency.

THE COMPLEXITIES OF THE DATA ECOSYSTEM

A challenge from the perspective of co-determination and transparency of data practices is that many different types of data from a variety of sources, both of digital as well as analogue, is used for consumer-profiling purposes (Larsson, 2017b). King & Forder (2016) points out, for example, that privacy protection is often based on an underlying assumption that data is collected directly from the (individual) data subject and that data practices should be limited to the primary purpose of the collection. In fact, many of the actors who handle consumer data do not have any direct relation to the specific consumers, such as the so-called data brokers. Many of the actors dealing with consumer personal data prepare access through secondary sources and use the data for purposes not known at the time of original collection (King & Forder, 2016), mentioned by Pasquale as that we are in an “era of runaway data” (2015, p. 19). This contributes to the lack of transparency, which makes it more difficult for consumers to oppose the use, e.g. by opting out, and for authorities or other parties to carry out supervision.

DATA BROKERAGE

The data ecosystem is thereby a challenge for traditional regulation of personal data and for consumer protection. The data brokers play an interesting role in the midst of this development, motivating a specific focus here. The data broker is a type of market operator who focuses on collecting consumer information from many sources and whose underlying business model is to offer customer profiles to business partners. The U.S. Federal Trade Commission (FTC) concludes that data brokers are important operators in the “Big-Data economy” and include giants such as Acxiom, which reported over \$1 billion in net revenue in 2015 (FTC, 2014). Data brokers are relevant from a consumer perspective, not only as an entity in themselves, but also with regards to how consumer profiling is used, i.e., who their customers are. For example, Acxiom has among its customers the majority of American credit card providers, healthcare insurance companies and domestic airline corporations (note the spreading of prediction markets, mentioned above), according to a report from the US Senate Commerce Committee (2013).

Christl (2017), in a report on how companies collect, combine, analyse, trade and use personal data, shows how data brokers like Acxiom and also the database and software corporation Oracle have developed into sophisticated dealers of consumer data on a global scale. Reportedly, Acxiom manages 15,000 customer databases and 2.5 billion customer relationships for 7,000 clients, including 47 of the Fortune 100 companies. Acxiom also partners with platforms such as Facebook, Google and Twitter in several ways. For example, the company helps improve the tracking and categorisation of their users, based on data collected from beyond these platforms (Christl, 2017, pp. 58–59).

Similarly, Oracle – as one of the world’s largest business software and database vendors – has become one of the largest consumer-data brokers as well. It has acquired several data companies, including Datalogix (tracks purchase transactions from grocery chains), AddThis (tracks 900 million users across 15 million websites, as well as 1 billion mobile users), Crosswise (collects activity data across billions of devices and identifies which PCs, phones, tablets, and TVs are being used by an individual consumer), and BlueKai (collects PC & smartphone users’ data), in order to develop their data brokerage (Christl, 2017, p. 59). In addition, Oracle aggregates and analyses “700 million social messages daily” from social media networks, message boards,

blogs, consumer review sites, and video platforms, according to their own account.⁹ Oracle also partners with Facebook, in order to provide data to help the platform to better sort and categorise its users, with data collected from beyond Facebook, and to track its users' purchases in stores. Oracle also provides data about its clients' customers to Facebook in order to find and target these customers on Facebook (Christl, 2017, p. 61).

This indicates that a large amount of individual consumer information is a component of a data-mediated market into which they have little insight, and that part of the problem concerning data brokers is the lack of transparency and accountability, for example emphasised by the Federal Trade Commission in the US as "a fundamental lack of transparency about data broker industry practices" (FTC, 2014, p. vii). Similarly, a Dutch study found that data brokers often lack legal grounds for managing the vast amounts of data they handle and generally do not respect purpose limitations (Kreiken, 2016). This leads to fewer opportunities for individuals to find out how their information is handled by third parties, since it becomes increasingly complicated for users to control their data once it has been forwarded.


CONCLUSIONS

The regulatory challenges briefly discussed in this chapter in relation to data-driven markets relate to three central regulatory bodies: antitrust/competition law, consumer protection and data protection. The main argument deals with the importance of handling and finding balances with regard to the information asymmetries between individuals and data collecting, analysing and brokering platform parties.

Firstly, regarding competition, as developed above, the issue of competition on data-driven markets is a central one for innovation in the years to come, where a few corporations have become very dominant over the course of just a decade in setting the playing field for SMEs or newcomers. However, how to translate the notion of antitrust into a data-driven economy with a few mega-platforms dominating much of the setting is far from clear and marks a legal and political challenge for years to come.

Secondly, with regards to the lack of transparency in the complexities of data-collection markets, the consumer-protection authorities, in addition to data-protection authorities, could be more active players, particularly given the lack of incentives for most market players to be more transparent. The consumers themselves are seemingly too weak and too ill-informed to become a true balancing force. This is a point raised also elsewhere (Rhoen, 2016; for the case of Sweden, see Larsson & Ledendal, 2017) and discussed by Pasquale in terms of "qualified transparency" (2015, p. 160–165), which calls for a "need to equalize the surveillance that is now being aimed disproportionately at the vulnerable" (2015, p. 57). This would require both regulatory approaches for reaching more transparency in the data-driven handling, in order to enable supervision, but also likely data-driven and digital methods developed by the entities implementing supervision. In order to study the outcomes of automated services based on pattern recognition and address accountability for these outcomes likely requires combinations of legal and data expertise. This could, at best, stimulate better competition in the markets where more players offer tools and services that more clearly address the flaws of the "non-informed consent" cultures (Bechmann, 2014) on digital consumer markets.

9 [accessed 25 October 2017].




However, **thirdly**, there are also concerns relating to accountability over algorithmic and automated services that require much further study to be adequately understood (cf., Zarsky, 2016), e.g. how to redress phenomena like predictive privacy harms (cf. Crawford & Schultz, 2014), a point also raised in socio-legal studies (Larsson & Svensson, 2017). The more autonomous agencies and artificial intelligence that are developed within data-driven platforms and applications with legal, cultural and social effects, the more important the question of how to understand algorithmic accountability arguably becomes.

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CHAPTER 7



THE (UNIVERSAL) BASIC INCOME: FUTURE-PROOFING INCOMES IN THE FACE OF AUTOMATISATION AND DIGITALISATION



JAN VAN CAUWENBERGHE

INTRODUCTION: THE (UNIVERSAL) BASIC INCOME – A (NOT ENTIRELY) NEW CONCEPT

The universal basic income (UBI) is defined by the Basic Income Earth Network as “a periodic cash payment unconditionally delivered to all on an individual basis, without means-test or work requirement” (BIEN). This broad definition encompasses a multitude of basic income proposals with a lot of variation concerning the amount of the cash payment and the extent to which the basic income replaces existing welfare and social security payments.

The notion of a basic income has been around for quite some time. Its earliest proponent was American founding father and political activist Thomas Paine. In his essay on “Agrarian Justice”, published in 1797, he defends the property rights of land owners, but argues at the same time that “those who have been thrown out of their natural inheritance by the introduction of the system of landed property” should be compensated (Paine, 2011). Almost two centuries later, in the 1960s and 1970s, five field experiments were held in North America. US president Richard Nixon even proposed a nationwide basic income in 1969. Two consecutive proposals passed the US House of Representatives, but didn’t make it through the Senate (Surowiecki, 2016).

In the past couple of years, the basic income has received an increasing amount of attention. Experiments are being rolled out in Finland and the Netherlands. In Switzerland, a referendum on the basic income was held on June 5, 2016. In May 2017, Mark Zuckerberg came out in support.

The renewed focus on the universal basic income coincides with the expectation that, in the coming decades, digitalisation and automatisisation will have a big impact on labour markets. Different studies point to the fact that a lot of jobs and even entire employment sectors are at risk of automation. Some authors argue that between 30% and 60% of jobs in developed countries can be automated, while others find the share to be between 6% and 12% in OECD countries (Bergström & Wennberg, 2016)

Proponents of the basic income argue that it provides citizens whose jobs are automated with a guaranteed income, allowing them to retrain themselves or become an entrepreneur. They envision a hyper-productive economy, where robots do most of the work and people are freed from having to perform an economic activity. Instead of having to *earn* a livelihood, it is provided for them by the basic income. This means that they can dedicate themselves to performing non-economic activities, such as caretaking, artistry, volunteer work and social engagement.

In this chapter, we assess how high a basic income in Belgium could realistically be, by analysing current social security and welfare expenses and statistics and determining how much of them could be eliminated. We compare this amount to comparable research that was carried out by the OECD for other countries. We then move on to a more qualitative analysis, employing practical, political and ideological arguments to present both a liberal case *for* and a liberal case *against* the basic income. Finally, we present some concluding remarks.

A BELGIAN UNIVERSAL BASIC INCOME: IS IT AFFORDABLE?

The main point of contention between advocates and opponents of the universal basic income is whether it's affordable or not.

Advocates contend that a basic income could eliminate a lot, or even all, social-security and welfare benefits. It would also lead to a leaner government. Handing out the same amount of money to all citizens, no strings attached, is administratively quite easy. Current social-security systems however, typically encompass multiple types of benefits, each with their own set of eligibility conditions and their own administrative institutions. Large numbers of government employees are needed to make sure all these systems run smoothly, and all benefits are paid out on time. At the same time, they need to actively investigate instances in which benefits are improperly paid to people that try to defraud the system.

Opponents retort that, while you could indeed eliminate a lot of administrative and overhead costs with a basic income, it would still be more costly to pay out a benefit to all your citizens rather than paying it out only to people who need it. And while social security is indeed complicated, part of the reason for that is that it is tailored to meet the different needs of different people.

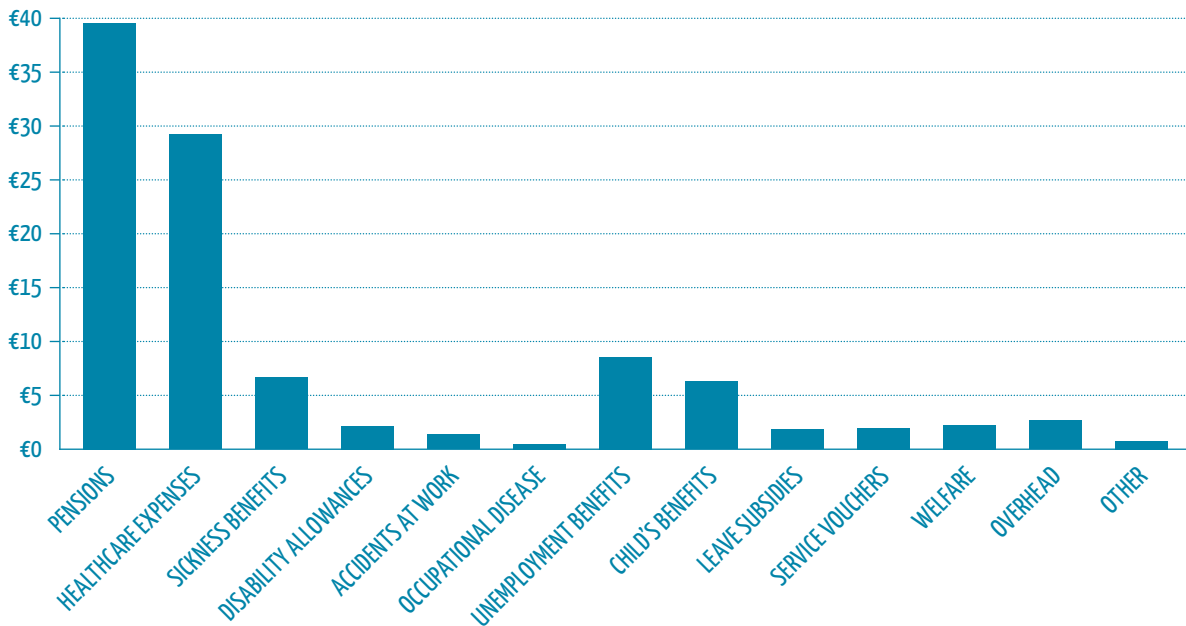
In this section, we would like to render this discussion in a more objective way by using Belgium as a test case. Belgium has a social security system that is quite bewildering in its complexity. For historical reasons, the payment of unemployment, sickness, disability and child benefits is outsourced to trade unions, health insurance funds and child benefit funds. It seems that replacing social security and welfare by a basic income would indeed save a lot of money.

For our analysis, we choose a basic income equal to the poverty line. For Belgium, this corresponds to €1,085 per month¹ per person² (Eurostat, 2017). Using population statistics (Statistics Belgium, 2014), we can easily calculate that a basic income of this magnitude, provided to all inhabitants of Belgium aged 18 or older, would have cost **€115.64 billion** for the year 2014.

1 For Belgium, the 2014 poverty line for a single person is equal to a yearly income of €13,023 which corresponds total €1,085 per month. For two adults with two children younger than 14 years the poverty line is equal to a yearly income of €27,348 or €2,279 per month. In our basic income scenario a household with two adults would receive €2,170 (= 2 x €1,085) and child benefits worth €257.33 per month. In total such a household would receive €2,337.05 per month, which is above the poverty line.

2 For this and all other amounts cited 2014 is the reference year.

2014 BELGIAN SOCIAL SECURITY AND WELFARE EXPENSE (in € bn)



The graph above shows the different components of Belgian social security and welfare expenses. It is immediately apparent that pensions and healthcare expenses are far greater in importance to all other categories. Also, overhead costs make up a comparatively small amount of the total.

Which expenses could be eliminated in the basic income scenario? Take a look at **pensions** first. In theory, the basic income could replace pensions. When retired, people would then have an income consisting of the basic income on the one hand, and periodic payments from a private³ pension plan or other types of income on the other. However, for most current Belgian retirees, the pension funded by social security is, if not their only, then at least their most important, source of income.

The average pension for private sector employees and self-employed individuals amounts to €854.44 per month for single people and €1,449.79 for married couples. So, on average, these retirees would be better off if their pension were replaced by a basic income of €1,085 per individual. As is often the case however, this average masks a lot of variation. In fact, 36.99% of private sector⁴ pensioners have a pension that is higher than the basic income proposed here and would therefore be worse off. In the public sector, where pensions are much higher, this would even be the case for 86.10% of pensioners (RVP, 2014) (PDOS, 2014).⁵

³ i.e. not government-funded

⁴ i.e. private-sector employees and self-employed individuals

⁵ calculation by the author based on pension statistics provided in:

a / Rijksdienst voor Pensioenen (RVP) – Jaarlijkse statistiek van de uitkeringsgerechtigden – 2014

b / Pensioendienst voor de Overheidssector (PDOS) – Jaarverslag 2014

Reducing existing pensions is nigh on impossible from a political point of view. Citizens have rightful expectations regarding the pension they have worked and paid social contributions for over periods spanning 40 years or more. They rightly feel that their pension is effectively theirs and therefore not something that a government can take away. From a legal point of view, lowering existing pensions probably wouldn't even be permissible. The most that would be possible would be for the pension system to be phased out over multiple decades.

The only sensible short-to-medium term basic income scenario therefore has to include a top-up for all individual pensioners currently receiving a pension higher than €1,085 per month, so the sum of the basic income and the top-up is equal to the pension they receive today. Based on this assumption, applied both to regular pensions and widow's pensions, we calculate the total amount of pensions that can be saved equals **€26.88 billion** or **71.44 %** of the total expense.

The second-biggest component of social security is **healthcare expenses**. Costs incurred when visiting a doctor, being hospitalised, undergoing surgery, buying medicines are largely reimbursed by this component of social security. It is also used for subsidising hospitals directly and to fund special medical programs.

It is highly unlikely that even a small part of these expenses would be eliminated in a basic income scenario. The purpose of a basic income is to provide people with a guaranteed income so that they have the freedom to lead their lives they want to. However, if you have the misfortune to catch a serious disease, and your medical expenses are no longer covered by social security, then a large part of your basic income will go to paying doctor's and hospital bills. Eliminating some or all social security-funded healthcare, would mean that the basic income would be partly funded at the expense of sick people.

The same goes for benefits paid out following an **accident at work** or the occurrence of an **occupational disease** as well as for **disability allowances**. These cover medical expenses and income losses and compensate for reduced working capacity due to disability.

We can make a similar argument for **sickness benefits**. Private sector employees absent from work due to illness receive a benefit worth 60% of their paycheck. Self-employed people receive a sickness benefit that ranges between €900 and €1,450 per month, depending on whether they're single or have children.⁶

Scrapping sickness benefits in a basic income scenario would be unfair towards people that have the misfortune to fall ill. Sickness benefits compensate for the temporary inability to earn an income. Even when every citizen has a basic income, you need this compensation. Eliminating it would – again – amount to funding the basic income in part by financially setting back sick people relative to healthy people.

However, considering that in the basic income scenario every citizen is already provided with a monthly income of €1,085, it is obvious that only a fraction of the current budget for sickness benefits would be needed to establish the same levels of compensation. For example, consider a private-sector employee with a monthly pre-tax income of €2,000. If he or she falls ill, he or she will receive a monthly sickness benefit worth €1,200. Next, consider a private sector employee with an equal monthly income of €2,000 in the basic income scenario. If he or she falls ill, he or she will still have a basic income of €1,085. To arrive at an income of €1,200 only needs a sickness benefit of €115.

⁶ In the public sector there are no social-security funded sickness benefits as workers continue to receive their pay check while absent due to illness.

So in the same way as used above for pensions, we can perform a calculation to determine how much money can be saved in sickness benefits in the basic-income scenario. This amounts to **€5.36 billion** or **84.5 %** of the total (RIZIV, 2012&2013, 2014).⁷

We must point out that there is a lot of uncertainty surrounding this calculation. This stems from the fact that it is not known how wages and other types of income will change in a basic income scenario. It seems likely that total incomes⁸ will rise compared to the pre-basic income situation. This then means that extra funds will be needed to provide the same level of income compensation for sick people relative to healthy people and the amount calculated in the paragraph above will decrease.⁹

In a basic income scenario **unemployment benefits** and **welfare** could be eliminated completely. This yields **€10.45 billion** in savings. Most basic-income scenarios also contain a basic income for minors; it is typically a fraction of what adults receive. For sake of simplicity, we argue in our scenario that the existing budget for **child benefits** can be used in its entirety to fund a fractional basic income for Belgian minors.

Next are **leave subsidies**, of which there are many different types in Belgium. They allow for private and public sector employees to temporarily interrupt their occupation or reduce working hours, with the wage loss partly being compensated by a subsidy. Most of these subsidies can be eliminated in a basic income scenario. The basic income is designed to give citizens the freedom to lead their lives as they want to; for some people this will mean working less, for instance by switching from full-time to part-time work. It would be odd to provide a basic income and then provide an extra subsidy when working hours are reduced.

There are particular types of leave subsidies for people providing care for a seriously ill family member. It could be argued that these should also be scrapped. After all, the whole point of the basic income is that it frees people from the necessity of earning a living; if they want to perform non-economic activities instead, like providing care to family, they can do so. Therefore, no extra subsidy is needed.

On the other hand, one could argue that caring for an ill member of your family is often a matter of necessity, not of choice. The same goes for funeral leave, when someone is bereaved of an immediate family member. For this simulation, we have chosen to keep both kinds of leave subsidies in place.¹⁰

Different leave subsidies relate to having children. They can be categorised as either short-term maternity and paternity leave subsidies, or longer-term parental leave subsidies. In a basic income, it seems reasonable to maintain short-term leave subsidies¹¹ but to eliminate parental leave subsidies.

With all the above taken together, we calculate that **€1.20 billion** in leave subsidies can be saved, which represents **78.26 %** of total leave subsidy expenses.¹²

7 For this calculation, we used the following statistics provided by the Rijksinstituut voor Ziekte- en Invaliditeitsverzekering (RIZIV).

8 i.e including the basic income

9 For example, the total monthly income of the private-sector employee might increase from €2,000 to €2,500 as a result of the introduction of the basic income. When he falls ill, an income compensation of 60% would correspond to €1,500. This means that the basic income would have to be complemented by a sickness benefit of €1,500 minus €1,085 = €315.

10 However, instead of maintaining them at their current levels, they can be replaced by a lower amount to top up the basic income.

11 Idem

12 For this calculation we used statistics provided by the Rijksdienst voor Arbeidsvoorziening (RVA).

Service vouchers are not handouts, in fact they're part of a subsidised employment programme that is included in the social security budget. It is reasonable to expect that this programme will be maintained in a basic income scenario.

That leaves us with **overhead costs**. Eliminating unemployment benefits, welfare and certain other components of social security would of course also mean eliminating the overhead costs associated with them. Yet from what was laid out above, it follows that many overhead costs will remain in place. With regards to healthcare expenses, nothing will change. Pensions and sickness benefits expenses will be lower, but they will still have to be calculated on an individual basis, meaning that not a lot of administrative savings will be generated in those domains. Overall, we can estimate a **30%** reduction in overhead costs, which amounts to **€0.58 billion**.

Adding all savings together, we calculate a total amount of **€44.47 billion**. Above, we calculated the total cost for the basic income to be €115.64 billion. This means that **€71.17 billion** must be found to fund a monthly basic income of €1,085. Belgium's government spending is already at 55.1% of GDP. To cover the additional cost for the basic income would require savings and/or extra revenues worth 16.9% of GDP (OECD, 2017a).

We can also perform the same calculations for basic incomes at lower levels.¹³ This yields the following results:

BASIC INCOME LEVEL (PER MONTH)	TOTAL COST	SOCIAL SECURITY SAVINGS	NEEDED	NEEDED (% OF GDP)
€300	€31.97 bn	€19.32 bn	€12.65 bn	3.0%
€400	€42.63 bn	€22.95 bn	€19.68 bn	4.7%
€600	€63.94 bn	€30.04 bn	€33.91 bn	8.0%
€800	€85.27 bn	€36.29 bn	€48.97 bn	11.6%
€1,085	€115.64 bn	€44.47 bn	€71.17 bn	16.9%

This leads us to conclude that an affordable basic income level for Belgium would be in the range of €300 to €400 a month. And even then, substantial savings and/or extra taxation would be needed to cover the full cost of such a scheme.

MONTHLY BASIC INCOME AMOUNTS THAT WOULD COST THE SAME AS EXISTING BENEFITS AND TAX-FREE ALLOWANCES

	ADULT	CHILD (<18)	POVERTY LINE FOR SINGLE PERSON
Finland	€527	€316	€1,074
France	€456	€100	€909
Italy	€158	€158	€737
United Kingdom	€230	€189	€702

Note: Hypothetical reform where a basic income would replace most existing working-age benefits, as well as the tax-free allowance.

¹³ For these calculations, we used the same assumptions as for the original calculation with the basic income at a level of €1,085 per month, with one exception. If unemployment and welfare benefits are eliminated completely, then a basic income at a level below the poverty line would inevitably lead to an increase in poverty. We therefore included and budgeted adjusted unemployment and welfare top-ups.

This conclusion fits well with the results of recent research undertaken by the OECD, as evidenced above (OECD, 2017b). The OECD concludes that “converting all or most existing income supports into a flat-rate, “no questions asked” transfer at modest levels would require substantial additional tax revenues. Even then a BI (= *Basic Income*) may result in losses for substantial parts of the population, and would not significantly reduce poverty from existing levels.”

THE LIBERAL CASE FOR A UNIVERSAL BASIC INCOME

We now turn away from statistics and budget lines and explore a series of practical, political and ideological arguments concerning the basic income. We start by presenting a liberal case in its favour. We will argue that a universal basic income increases freedom, reduces inequality and makes for a smaller, less intrusive government.

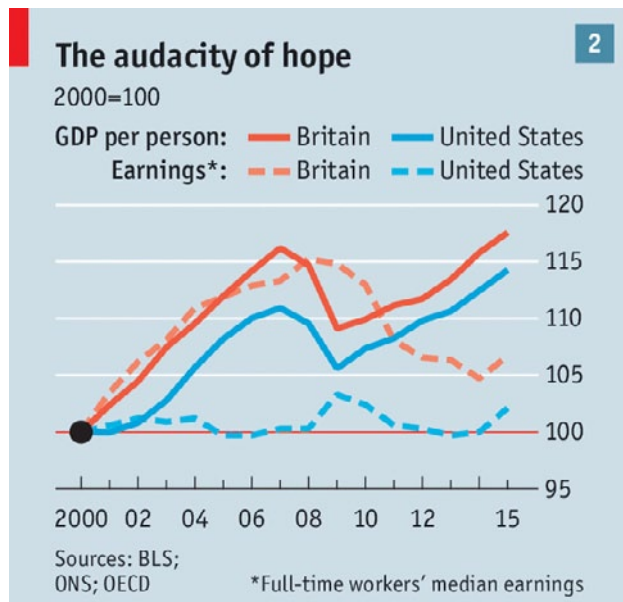
The basic income enhances **freedom** in a fundamental way. Liberal democracies already guarantee an extensive set of fundamental freedoms to their citizens. Freedom of speech, freedom of assembly and freedom of religion are constitutionally protected. Materially however, people are not free (Widerquist, 2017). To be able to lead their life as they want to, they need to earn an income. For most of them, this means they have to work.

That is not to say that earning an income is the *only* reason why people work. Work can provide people with structure and a purpose in life, as well as a sense of belonging and contributing to society. Many derive pleasure from the intellectual stimulation, the social interactions and the personal development associated with their occupation. But there are also many others who consider their job to be a necessary evil from which they would happily escape, given the chance. A guaranteed income would give them the freedom to do just that.

With a basic income, people can more easily switch to an occupation that is more to their liking (Lijnen, 2017). As happy workers are more productive workers, this would benefit the economy. People would also have the opportunity to return to education later in life and reorient themselves towards new types of activities. Those activities would be guided by their own dreams and desires, and not by the necessity of putting food on the table.

“Fifty years from now...it will seem ridiculous that we used fear of not being able to eat as a way to motivate people”, is how Silicon Valley entrepreneur Sam Altman puts it (*The Economist*, 2016). More people will have the freedom to start their own business, thus boosting entrepreneurship. As the link between income and paid work becomes less important, unpaid labour, such as household commitments and other activities that are valuable to society, but not rewarded financially, will gain in relevance.

Another argument for the basic income is rooted in the fact that in recent years wages haven't kept up with economic growth (see graph).



Digitalisation and automatisisation in the internet age mean human labour is becoming less important to overall growth. This is reflected by the phenomenon referred to as “job polarisation”: the share of employment in occupations in the middle of the skill distribution range has declined in the US and Europe (Boehm, 2014).

Job polarisation has been accompanied by a rise in **inequality** as ever more capital is concentrated in the hands of wealthy investors and entrepreneurs. In 1964, the four largest corporations in the US employed 430,000 people on average. By 2011, this number had decreased by a factor of 4. In 2012, Kodak, a company employing 145,000 people at the end of the 1980s, went into bankruptcy. The same year, the mobile photo-sharing app Instagram was sold to Facebook for €1 billion. It employed 13 people at the time (Bregman, 2014).

The basic income is a means to make sure that all citizens share the fruits of the progress of society as a whole. This harks back to the basic income proposed by Thomas Paine in 1797 (see above). He argued that the earth, in its natural uncultivated state, was “*the common property of the human race*”. To compensate for the fact that some members own land and others don't, Paine proposed that every proprietor of cultivated land would pay a “ground rent” to the community. In other words, he proposed a land tax to pay for a basic income (Paine, 1797).

Applying Paine's logic to today's society and substituting capital for land, a basic income funded by a wealth or capital gains tax can be seen as new and drastic way to redistribute wealth and reduce inequality. In other words, a shift of taxation away from wages and towards capital and capital gains, could serve two goals. First, it could be used to fund a basic income. Second, with the wage share of the economy declining and the capital share increasing, such a shift would shore up the tax base. A variation on this line of thinking is the taxation of robots. This might seem outlandish at first. But consider the following statement by Bill Gates, who supports the idea: “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 a similar level (Quartz, 2017).

And if all this isn't enough for some Liberals to fully embrace the universal basic income, then they should consider the following. As every citizen is entitled to a basic income, the bureaucracy required to operate it is only minimal, especially when compared to modern-day social security systems. A basic income therefore combines redistribution with a small and non-intrusive government (Lijnen, 2017).

Another feature of social security benefits is that they lead to unemployment traps, whereas no such thing exists when people are provided with an unconditional guaranteed income. And finally, in a basic income scenario, there is no longer any need to maintain economically stifling minimum wage regulations.

THE LIBERAL CASE AGAINST A UNIVERSAL BASIC INCOME

Before rushing towards the basic income with open arms, we should recognise that there's also a liberal case to be made *against* the basic income. We choose not to focus on the question whether the basic income will cause people to **work less**. A number of experiments with a limited basic income have already taken place or are being rolled out. Hopefully, these will shed a light on this important issue.

The first argument against the basic income is that it might be **a solution to a non-existent problem**. There's no denying that labour markets will change profoundly as a result of automatisisation, robotisation and digitalisation. It is far from certain though whether these changes will result in mass unemployment. Ever since the Industrial Revolution, people have been worried about a future in which machines and robots render human labour redundant. Two and a half centuries on, those expectations have never held true. Of course, automatisisation and digitalisation have caused certain types of jobs to disappear. On the other hand, new technologies tend to lead to the creation of new types of occupations, the likes of which can't even be imagined before they arise.

A much-cited paper by Carl Benedikt Frey and Michael A. Osborne states that 47 % of US employment is at risk of computerisation (Frey & Osborne, 2013). However, a more recent paper (Arntz, Gregory & Zierahn, 2016) estimates that job automatibility in 21 OECD countries is only 9%. The reason is that a lot of the jobs considered at risk in the first paper also require some face-to-face interactions.

Also, there's a difference between establishing that a job can be automated and predicting that it *will* be automated. Take-up of new technology is often slow, because of practical and legal hurdles, but also because of customer preferences and because new technology isn't necessarily cheaper than human labour.

The second argument concerns the **cost** of the basic income. The analysis above shows that in Belgium, a basic income at the level of the poverty line is not affordable presently, nor in the foreseeable future. The same goes for other developed countries, as evidenced by the OECD research already cited (OECD, 2017b). It is not known how the basic income would influence wages and inflation. But it seems probable that wages will fall, reducing the tax base and making it even harder to finance the basic income and other government expenses. The only way to make the basic income happen is by sharply increasing taxes, which would hurt the economy so much that beneficial effects of the basic income would be outweighed. A basic income would then become just an alibi for a massive redistribution of wealth.

A much lower basic income, in the order of €200 to €400 per month, is feasible financially. However, it's not possible to lead a decent life in Belgium with an income of only €200 or €400. Therefore, such a basic income seems contrary to the very essence of the concept, which is to provide all citizens with an income that is high enough for them not to have to work. Indeed, if that is the aim, then a basic income should probably even be a lot higher than the poverty line. Ask a representative sample of Belgium's inhabitants the level at which their income would leave them without financial worries, and chances are that you end up with a basic income of €2,000 or more. Such a basic income would be so expensive that even with massive government savings and/or tax increases, it would be entirely impossible.

Thirdly, even though **social security systems** are far from perfect, it should be recognised that their emergence has been a defining feature of social progress in developed countries. Replacing social security with a basic income would be a very drastic step into uncharted territory. Fixing its problems is a better idea than throwing out the baby with the bathwater. Incremental changes are better than radical revolutions.

There is a fundamental difference between social security and a basic income. The first is an insurance against unemployment, sickness and old age taken collectively by all members of society. Benefits are paid out only to citizens that need them. The second is a universal entitlement paid out to all citizens alike, whether they need it or not.

A universal basic income seems fair at first glance, as everybody receives the same amount of money. But it can also be argued that it's not such a fair system after all. People are born in poor, rich or middle-class families and with unequal levels of natural ability and talent. Some of them lose their employment because of bad luck, or have the misfortune to become ill. Is it fairer to hand out the same amount of money to all of them, or to focus government support on the basis of need?

Of course, this can partly be mitigated by leaving certain elements of social security such as pensions, health care and disability allowances in place. In that way government support based on need and a universal basic income can be combined. In effect, the calculation made above was based on the realistic assumption that social security would be partly maintained if and when a universal basic income would be implemented. But that doesn't detract from the fact that in such a scenario, government support would largely shift towards a universal entitlement and away from helping people who need it most.

Fourth, quoting Milton Friedman, **there's no such thing as a free lunch**. *Money for Nothing* might be a popular Dire Straits song, but it remains questionable whether it should be introduced as a natural right to all citizens. After all, government and the people are bound together financially; a government can only pay a basic income to its people out of the money it has collected from the same people through taxes. We would essentially be paying ourselves with money from our own pockets.

This fundamentally constrains the freedom that the universal basic income is supposed to enhance. The basic income is paid for by tax revenues. Therefore, the freedom of one individual *not* to perform any economic and therefore taxable activity has an impact on the freedom of another individual to do the same. If more people choose not to supplement the basic income they individually receive by earning an extra income, the tax burden will inevitably rise for the others. After all, the basic income is funded by the taxes paid on what *they* earn extra.

And finally, even if a basic income would indeed put more value on non-economic activities, there is a flip side: it would **weaken** the **market system**. Free markets have their defects, but they are essential in connecting demand for products and services with supply. Economic activities such as human labour and self-employment are priced according to demand; if demand for a certain product or service is too low, then it won't be profitable to produce or provide it. Markets allocate money to value creation. With a basic income, money will also flow to people performing activities for which there is no need or desire.

CONCLUSION

The basic income remains a fascinating concept. It transcends ideological fault lines: you'll find adamant supporters but also strong-willed opponents on the left and the right. Maybe the basic income will even end up bridging a division that in many minds has already become quite obsolete.

Many questions remain though, first and foremost concerning cost. Up to now, basic income proponents have failed to come up with a sustainable way to finance a basic income that is high enough to meet its stated goal of providing all citizens with material freedom.

On the other hand, in a maybe not-so-distant a future, this might change. Maybe the robot age will bring enough wealth to society for paid work to no longer be a necessity for most people. In such a brave new world, a basic income might be considered as ordinary as water coming out of the tap. Only time will tell.

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OUTRO



CONCLUSIONS

The preceding chapters have provided us with a lot of food for thought. Here, we take a look at what they can teach us about possible guiding principles for Liberals when it comes to resolving the issues faced by our economies.

In general, new technology will lead to some jobs disappearing and greater differences in wage shares, but can also be expected to make our economies greener by, for instance, providing solutions for a better-functioning circular economy.

Regulation is needed, but it is important to clearly define what it is expected to resolve before implementing it, something that has been mentioned several times throughout this publication. Therefore, it is important for political decision makers to take into consideration all the repercussions of any decision. In the case of a labour-market transformation, and of the economy as a whole, we can conclude with a toolbox for policy makers to consider.

1 / CLEARLY DEFINE THE SHARING AND CIRCULAR ECONOMY

One of the key questions we must answer and agree on is what we consider the sharing and circular economy to actually be. Once we have that definition, then we can make useful legislation. This publication has shown that the answers are required sooner rather than later in order for the EU to be able to confront the major issues. At the moment, we have no clarity and no coherence at EU level, which leads to insecurity among employers and employees, lost business opportunities, grey markets, and growing pollution and waste.

2 / BASE PREFERENCES ON DATA AND FACTS

Terms like automation, robotisation and digitalisation are very commonly used and might seem terrifying. Nevertheless, we need to look beyond the terms themselves and use the study of empirical data to focus on the actual effects on the labour market. In the chapter by Sabrina Dorn, we can see that there seems to be a clear correlation between digitalisation and the future of the labour market. However, this cannot be assumed without studies like the one presented in chapter two of this publication.

Universal basic income seems like an expensive alternative using current calculations. This might change with time (it will for instance be very interesting to see the results from the current experiment in Finland) and it is very difficult to predict exactly how the labour market and the economy as a whole would react to a universal basic income. The basic income as an idea can be very appealing from a liberal perspective. However, the data available at the moment seems to point to the necessity for states to focus on creating labour markets that function as well as possible, instead of providing everyone with a monthly allowance. New jobs that could survive the fourth industrial revolution are needed for that to come about, which is where the sharing and circular economy plays a pivotal role.

3 / PASS EASY-TO-FOLLOW AND FAIR REGULATION

Once we have gathered enough data on which to base our decisions, regulation should follow that is designed to provide clarity and fairness, and as a result, better-working economies. Enhancing these growth possibilities requires legal definitions that are accurate and easy for everyone to follow, and that can be amended as easily as possible. The options are the same as before; restrictive legislation on activities that are harmful to our society, or positive legislation, such as tax breaks and subsidies, to encourage activities that are positive for our society.

The key is to create entrepreneur-friendly legislation that supports a real circular economy, innovation and fair competition, instead of the current situation in which big companies dominate the resources to collect the greatest amount of available data and to deal with the resulting bureaucracy. We must take into consideration the kinds of activities that are most useful for the economy and for society as a whole.

Often our legislation depends on how companies register themselves and the discussion on legislation for the sharing or platform economy too often focuses on solely the technology itself. Legislation must take into consideration not just the size of a business, but the social aim and the effect of the nature of its activities. It is a company's activities and how people are affected by them, that matters from a societal point of view, not what the companies themselves say they do or what technology they use to reach their goals.

So-called superstar companies can bring a lot of jobs and are able to invest in research and development in a way that others can only dream of. This can be useful in certain economies. At the same time, they increase wealth inequality in our societies and pose a big risk to the way we view data privacy. When the labour market is changing in such a drastic manner, entrepreneurship and life-long learning needs to be favoured.

There is no time to waste. Yet, having said that, the first two points must be resolved first. At the moment, we do not seem to have enough relevant data to know exactly the kind of regulation that would be preferable for all aspects of the economy.

The economy, just like regulation, has not been static throughout history and this is something we need to keep in mind before jumping to conclusions on some of the challenges we face, both now and in the near future.

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