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# Smithian insights on automation and the future of work

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ABSTRACT

The number of 'future of work' studies, which estimate the potential impact of automation on employment, has grown rapidly in the past few years. They have, however, received very little critical attention and warrant closer examination. One cause for concern is the shortcomings of their methodological approach, which relies on measuring the technical feasibility of automating particular occupations and tasks. Doing so, however, creates an illusory sense of certainty and discounts the role of non-technical determinates behind advances in, and the utilisation of, automated technologies. Second, the way in which they frame their policy recommendations –as balancing an unfortunate trade-off between economic growth and unemployment – obscures the benefits that fuller automation may bring. This paper argues that these particular characteristics of 'future of work' studies invites comparison with the works of Adam Smith, who explored these issues in a closely connected, yet largely forgotten, way. First, Smith emphasised the role of non-technical determinates in technological progress and in this way paints a fuller picture of how automated technologies may develop. Second, Smith provides a normative perspective that would encourage these studies to see the potential of automated technologies to actually reconcile the apparent trade-offs.

## 1. Introduction

The past few years have seen the publication of a remarkable number of 'future of work' studies which predict that automation technology will dramatically disrupt labour markets.[1] While the issue of technical change and its impact on employment has been debated among economists since the eighteenth century, and while economists have certainly not neglected the issue of automation, these recent studies are distinct from more traditionally academic approaches. First, future of work studies (FOWS) mainly originate from either international organisations — including the Office of Economic and Cooperation Development (OECD); International Monetary Fund (IMF); World Bank; World Economic Forum (WEF); and the International Labour Organisation (ILO) — or global management consultancies —including Pricewaterhouse Coopers (PwC) and McKinsey Global Institute. Second, FOWS largely share in common a specific aim and methodological approach: to assess the risk or susceptibility of jobs to automation in order to estimate the potential impact of automation. They stress that automation is a unique type of technical change; one that — aided by advancements in robotics, computerisation, big data, machine learning and AI — is expected to quicken the pace of automation and widen the range of tasks and occupations that are automatable. Many provide alarming predictions. For instance, PwC. (2017) estimates that automation could replace a total average of 31% of jobs in the US, Germany, the UK and Japan. The World Bank (2016) estimates that two-thirds of all jobs in developing countries are at risk of automation. McKinsey approximates that "half of all the

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[1] 'Future of work' studies are marked in the bibliography with an asterix.

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activities people are paid to do in the world's workforce could potentially be automated … that amounts to almost $15 trillion in wages (McNulty, 1973)". Some have made predictions up to a few years, some to the mid-2030s (PwC., 2017; Chang & Huynh, 2016), up to 2055 (McKinsey Global Institute, 2017) and even 2140 (Graeber, 2018). Third, they to a greater or lesser extent offer policy advice, advocating solutions to cope with or contain automation's effects such as a lower minimum wage, skills-upgrading, generating automation-resistant employment, the so-called 'robot tax', or universal basic income schemes (Schwartz, 2015a).

It may be helpful to comprehend FOWS as endeavouring to construct what Jens Beckert terms an 'imaginary future': "Actors use imaginaries of future situations … as interpretative frames to orient decision-making despite the incalculability of outcomes (Beckert, 2016, p. 9)". They are crafting a 'techno-future', where "images of new forms of technology are associated with future images of humans and society, often in a purely hypothetical and thus also speculative manner (Hamowy, 1968, p. 276). While it would be impracticable to measure the full reach of their impact, it is in all likelihood considerable due to their sources — powerful IOs and management consultancies — which have substantial clout among policymakers and business leaders. They have also been widely publicised, inspiring sensationalist headlines such as "Robots will take our jobs. We'd better plan now, before it's too late (Elliot, 2018)", or "The robots are coming – for as many as 800 million jobs (Grunwald, 2014)". These are undoubtedly framing the public debate and reinforcing anxiety about technological unemployment: two recent surveys by Pew Research Centre have found that significantly more Americans are worried about automation's impact than they are optimistic (Pew Research Center, 2017), and that in both advanced and emerging economies, most respondents expect that in the next 50 years robots and computers will take over many jobs currently performed by humans (Pew Research Center, 2018).

FOWS, then, warrant a closer look, especially since their reception has so far been largely uncritical. Broadly, one cause for concern is the implications of their methodological approach, which relies on numerically measuring the *technical feasibility* of automating particular occupations and tasks. Doing so, however, creates an illusory sense of certainty and discounts the role of non-technical determinates behind advancements in, and the utilisation of, automated technologies. Second, the way in which they frame their policy recommendations – as an unfortunate trade-off between economic growth and unemployment – displays a disproportionate amount of technological pessimism, and ignores a critical aspect of work — the meaning or dignity we ascribe to different types of work — and as a result obscures the benefits that automation may herald in this area.

Taken as a whole, then, FOWS are distinctive for the particular cluster of ideas that typify them: they cover an expansive range of issues in labour economics and growth theories, largely ignore what drives technological progress, and their policy prescriptions narrow the scope for seeing the opportunities automation may bring for improving jobs. And this particular cluster of ideas invites comparison with the works of Adam Smith, who explored all of these issues in a closely connected, yet largely forgotten, way. For one, Smith has traditionally been an important source of reference for labour economists. He provided the first fully systematic treatment of labour economics and it is one of his central concerns; consider alone that the first chapter of *Wealth of Nations* is entitled 'Of the Causes and Improvement in the productive Powers of Labour, and of the Order according to which its Produce is naturally distributed among the different Ranks of the People'. Smith dealt with many contemporary concerns, including "the role of human capital in economic growth; wage theory, structure, and movement; labour mobility; the motivations of the worker and the manager; collective bargaining; job content; the organization of work; the relationship between the worker's performance and the incentive structure of social institutions. All of these, and more, were part of the manpower analysis of Adam Smith, labour economist (*Muro, Maxim, & Whiton, 1973, p. 366)". Smith is also commonly referred to by theorists of technical change, figuring prominently in the work of John Hicks, Charles Kennedy, Paul Samuelson, Robert Solow and Christian von Weizsäcker (Elmslie, 1994; Foley, 2003; Forus, 2017; Levy & Murnane, 2016). This is largely because Smith was the progenitor of the concept of division of labour, which can be taken as "the historically first and conceptually simplest form of technical progress (Schlogl & Sumner, 2018, p. 806)". Smith also addresses the issue of non-technological determinates of technical change; while he is rarely acknowledged for it, Smith identifies a key determinate of technical change–human capital – and is careful to highlight the role of 'inventiveness' in technological progress. Moreover, while Smith is usually characterised as expressing an ambivalence between the beneficial role of technology in economic growth and its harmful effects on the wellbeing of workers, Smith also subtly carves out a stance – which may seem counterintuitive to a modern reader – based on the disutility of work and the potential for technology to liberate workers from onerous tasks.

The aim of this paper is to discuss Smith's ideas on technology and employment with an eye to revealing some shortcomings common among FOWS that are otherwise difficult to recognise. Moreover, Smith's insights can point to alternative approaches which go some way towards overcoming these shortcomings. This approach rests on our opinion that Smith can fruitfully be brought into what Kenneth E. Boulding termed the 'extended present'; in his memorable 1971 essay *After Samuelson, who needs Adam Smith?,* Boulding, 1971 Boulding writes:

Works like *The Wealth of Nations* … are inevitably part of an extended present, which shows no signs of coming to an end, in the sense that one can still go back to Adam Smith even after many rereadings and find insights which one has never noticed before and which may have a marked impact on one's own thought. Any writer who is capable of affecting the thought of people who are living and thinking after he is dead may be said to be seminal in this sense and also part of the extended present (p. 231).

Heinz D. Kurz adds:

While the classical authors may be criticised for not having correctly described the present and forecast the future development in sufficient detail, they deserve to be credited with having elaborated a framework and analytical concepts that allow us to describe almost *any* such development. They have enriched and deepened our understanding of the technological and economic dynamism inherent in the capitalist mode of production and have forged powerful analytical tools to deal with it (Kurz, 2013, p. 1184).

This article begins with an overview of the economic context that FOWS have predominately used to describe the potential impact of automation — specifically technological unemployment and skill-biased technical change — and describes how these concepts are employed by FOWS to frame their estimates. Smith has long been at the centre of debates about technological unemployment, and he

has also recently been referred to in discussions of skill-biased technical change. In the third section, the basic methodology that most FOWS rely on is explained in some detail, and we discuss how it is underpinned by a concept that has elsewhere been coined 'autonomous technical change': the idea that technology advances independently of human agency. Smith's views stand in stark contrast to this; his emphasis on 'inventiveness' is a clear indication that his understanding of technical change is such that it is dependent upon innovation and human capital. In the fourth part, the trade-off between growth and employment inherent in the strategies that FOWS have advised policymakers to take, are contrasted with Smith's view on the disutility of work; Smith points to an alternative perspective which emphasises the potential of technology to relieve workers of undesirable tasks and improve their wellbeing.

### 1.1. Overview of technological unemployment and skill-biased technical change

'Future of work' studies (FOWS) are situated in wider economic debates on technical change and employment, and more specifically are framed in terms of automation's impact on technological unemployment and job polarisation. Stating it simply, Chang and Huynh (2016) argue that in response to the rapid technical change throughout the industrial revolution, economists divided into two camps. "The first and largest argued that while technological progress and other factors definitely cause some workers to lose their jobs, the fundamentally creative nature of capitalism creates other, usually better, opportunities for them. Unemployment, therefore, is only temporary and not a serious problem (p. 277)". In this camp are contemporary economists in the tradition of Schumpeter and Solow, who tend to treat automation as just the latest manifestation of technological progress by emphasising that market economies have historically adapted well to technical change. And like Acemoglu and Restrapo (2015), the general view among this group is that "automation, by reducing wages relative to the rental rate of capital, encourages the creation of new labour-intensive tasks and generates a powerful self-correcting force towards stability (Acemoglu & Restrepo, 2018, p. 41)".

The other camp is typified by the views of John Maynard Keynes, who in 1930 wrote: "We are being afflicted with a new disease of which some readers may not yet have heard the name, but of which they will hear a great deal in the years to come—namely, *technological unemployment*. This means unemployment due to our discovery of means of economizing the use of labor outrunning the pace at which we can find new uses for labor (Kurz, 2010; in Chang & Huynh, 2016, p. 278)". However, this view is largely condemned by mainstream economists, who have labelled it a "Luddite Fallacy" (Chang & Huynh, 2016, p. 280). Nevertheless, and unlike mainstream economists, most FOWS have adopted Keynes' more pessimistic view of automation's potential to disrupt the labour force, arguing that as automated technologies become increasingly capable of performing more complex tasks, their ability to replace more jobs than they create is unprecedented. Taken to its theoretical extreme, automation could lead to such a "perfectly labor-saving production function where labor drops out entirely as a factor of production. In that case, output would be produced solely by non-human production factors." (Schwartz, 2015a, p. 8). For instance, Frey and Osborne (2017) were among the first to quantitatively forecast the effects of computerisation and state that they were inspired by "Keynes's frequently cited prediction of widespread technological unemployment (Frey & Osborne, 2017, p. 2)". The OECD sums up the prevailing view among FOWS:

Concerns over automation have increased in recent years because of technological progress in so-called artificial intelligence. This has made it possible to automate tasks that could previously only be done by humans. One widely held view is that digital advances have been so great that they have affected workers' comparative advantage, vastly reducing the number of tasks to which human labour is required. Thus, digital can potentially lead to the automation of a wide range of tasks that have, until now, been shielded from automation (Pew Research Center, 2017, pp. 37–38).

Alongside the topic of technological unemployment, the trend among many of the most recent FOWS is to factor in the heterogeneity of the labour market in terms of skills, and on the apparent skill-biased nature of technical change (McKinsey Global Institute, 2017; Nedelkoska & Quintini, 2018; OECD, 2016; OECD 2017b, 2018). Skill-biased technical change leads to higher demand for skilled labour and lower demand for unskilled labour, and assumes that people with high levels of human capital (i.e. education and training) adapt better to new technologies than those who do not (Acemoglu & Autor, 2011; Autor et al., 1998, 2006; Levy & Murnane, 2016). Moreover, automation technologies are predominately capable of performing *routine* cognitive and manual tasks; the more an occupation is comprised of routine tasks, the more vulnerable to automation it is believed to be (Acemoglu & Autor, 2011; Autor et al., 2003; Frey & Osborne, 2013).

The effects of technical change in general and automated technology in particular is also believed to be a major contributing factor in two global labour market trends, both symptomatic of polarisation. The first trend is a polarisation of wages and job skills: there has been a significant decline in middle-wage, middle-skill employment as a share of total employment in OECD countries (OECD, 2018), Meanwhile, the share of high-wage, high-skill jobs, and low-wage, low-skill jobs, are increasing. One simple explanation is that middle-skilled workers tend to perform many routine tasks (e.g. bookkeeping, clerical, and administrative), and are therefore most at-risk of automation, and most at-risk of depressed relative wages (Autor et al., 1998;Goos, Manning, & Salomons, 2014 Gordon, 1959; OECD/ILO, 2017).

Alongside this, there is the question of who 'captures' the productivity gains from automation: "In advanced economies as a whole, technology, proxied by the declining relative price of investment goods and the initial exposure to routinization, has been the largest contributor to the decline in labour shares, accounting for almost half of the overall decline (IMF Blog, 2017, p. 136)". Since "capital tends to be concentrated in the upper ends of the income distribution, falling labour income shares are likely to raise income inequality (Keynes, 1963)". The OECD has also noted how sharply the share of wages within national income is declining in several advanced industrialised countries (OECD, 2017). Automation may play a significant role in this: as the price of automated technologies decrease, workers may be forced to accept lower wages to compete for jobs. Technological progress in automation is expected to compound this, and as workers receive lower wages, a larger proportion of national income will be concentrated with the

owners of those technologies (Freeman, 2015; Acemoglu & Restrapo, 2015; Dao et al., 2017; David & Salomons, 2018).

### 1.2. Smith on technological unemployment and skill-biased technical change

Smith, in this context, has traditionally been assigned a place in the optimist camp in terms of technological unemployment, putting him at odds with most FOWS. The starting point for evaluating Smith's views on this topic is that his concept of division of labour can be considered a technology, or at the very least a particular form of technology (Mandeville, 1988). Division of labour is essentially a technique, and widespread adoption and deepening of division of labour — technological progress — represents a particular organising principle of the capitalist economic system. Smith also frequently refers more specifically to 'machines', which is his "preferred concrete analogy for illuminating his notion of system (Autor, Katz, & Kearney, 2012, p. 488)". According to Smith, division of labour increases productivity for three reasons:

This great increase of the quantity of work, which, in consequence of the division of labour, the same number of people are capable of performing, is owing to three different circumstances; first, to the increase of dexterity in every particular workman; secondly, to the saving of the time which is commonly lost in passing from one species of work to another; and lastly, to the invention of a great number of machines which facilitate and abridge labour, and enable one man to do the work of many (WN, 17).

Smith may on the surface appear to be suggesting that machines are a substitute for labour, and the division of labour — by 'saving time' and enabling 'one man to do the work of many' — also. Smith, however, argues precisely the opposite: "A certain quantity of materials, and the labour of a certain number of work-men, which had before been employed in supporting a more complex and expensive machinery, can afterwards be applied to augment the quantity of work which that or any other machinery is useful only for performing (WN, 287)". As Mandeville (1988) notes, Smith's "… notion of technical progress is defined by the characteristics of the economies of specialization … Above all, mechanization, like specialization, is supposed to 'facilitate and abridge labour', but not to displace the worker who performs it (p. 136)".

It should be noted that Smith's understanding of mechanization, however generously one may wish to interpret it, does not display the hallmarks of automation, "in the sense of production processes that operate more or less autonomously with respect to labour (Autor et al., 2006, p. 485)". However, Smith does describe a 'simplification process' by which jobs are progressively reduced to simple tasks, tasks which could conceivably increase "the scope for machines to replace labour (Autor et al., 2006, p. 486)":

… the improvement of the dexterity of the workman necessarily increases the quantity of the work he can perform, and the division of labour, by reducing every man's business to some one simple operation, and by making this operation the sole employment of his life, necessarily increases very much the dexterity of the workman (WN, 17).

In the progress of the division of labour, the employment of the far greater part of those who live by labour, that is, of the great body of the people, comes to be confined to a few very simple operations; frequently to one or two. (WN, 781).

However, despite Smith's optimistic views on technological unemployment, he has — in a recent and insightful interpretation by Florian Brugger and Christian Gehrke — been interpreted as a pessimist in terms of the skill-bias inherent in technical change:

… classical economists were aware of the fact that labour displacement and compensation are not the only important aspects of the impact of technical change on the conditions of workers. Even if innovations do not lead to mass unemployment, they nevertheless change employments dramatically — in terms of working conditions, demands for professional skills, bargaining positions, etc. In the works of Adam Smith, … we find at least some hints on how, when, and why technical change is likely to increase, diminish, or shift the demand for skilled and unskilled labour. (Brynjolfsson & McAfee, 2014, p. 664).

Smith's description of division of labour's 'simplification process' leads Brugger and Gehrke to claim that he held a view of technical change as having an overall 'deskilling bias':

In Smith's view, technical change is not detrimental to labour as a whole—it increases overall employment—but this holds good only for a certain kind of labour, namely for unskilled labour. At the same time, however, the improvements and introduction of machinery that accompany the increasing division of labour are a substitute for skills. Thus, in Smith's view, technical change is predominantly unskilled-biased 'in nature' (Brynjolfsson & McAfee, 2014, p. 669).

They are careful to note, though, that Smith also maintained that increasing division of labour could be skill enhancing: "the increasing division of labour provides scope for gaining specialized experience and thus for acquiring, developing, and enhancing particular skills (Brynjolfsson & McAfee, 2014, p. 668)". Smith writes:

When any expensive machine is erected, the extraordinary work performed by it before it is worn out, it must be expected, will replace the capital laid out upon it, with at least the ordinary profits. A man educated at the expence of much of labour and time to any of those employments which require extraordinary dexterity and skill, may be compared to one of those expensive machines. The work which he learns to perform, it must be expected, over and above the usual wages of common labour, will replace to him the whole expence of his education, with at least the ordinary profits of an equally valuable capital. It must do this too in a reasonable time, regard being had to the very uncertain duration of human life, in the same manner as to the more certain duration of the machine (WN, p. 118).

Nevertheless, given Smith's historical context in which "common labour" or unskilled labour vastly outnumbered skilled labour, Smith believed that the impact of technical change on society would on the whole be deskilling (Brynjolfsson & McAfee, 2014).

In relation to contemporary economic debates, then, while Smith's optimistic views on technological unemployment run counter to the majority of FOWS on automation's impact on employment overall, Smith's perspective on the deskilling tendency of technical change aligns with several recent FOWS which have taken a more granular approach to automation's impact on employment. Admittedly, Smith has little in the way of a novel contribution to make to this specific debate beyond stating that he does anticipate, and certainly engages with, the topics of technological unemployment and skill-biased technical change. However, restricting one's

reading of Smith to only this aspect of technical change is to do him a great disservice. For Smith, some of the most interesting features and consequences of technical change lay at the intersection of technological progress and human agency and morality. While he was of course attentive to the impact of technical change on the labour market, his range was considerably wider than most contemporary economists and he ventured into the same territory as FOWS: he was attentive to the human factors involved in driving technical change itself, the moral questions raised by the socio-economic impact of technological progress, and he questioned the very nature and value of work.

### 1.3. Autonomous technical change

Separate from questions about technological unemployment and skill bias is the antecedent question of what drives or enables technical change itself, and this issue is largely left unexamined by FOWS, and indeed by most mainstream economists. And this represents a major shortcoming: if one wishes to measure the potential or predict the future impact of automation, simply knowing a workforce's vulnerability or resilience to automation is inadequate. Some account for the expected pace or extent of technological advance should be offered, which in turn would require some explanation as to what the determinates of technological advance are.

The majority of FOWS take as their starting point a simple task categorisation by Autor et al. (2003): a 2 × 2 matrix differentiating between routine v. non-routine tasks, and between manual v. cognitive tasks. Under this task-based approach, routine tasks are considered to be more automatable than non-routine tasks, and manual more so than cognitive. However, rapid advancements in technology are making it increasingly uncertain what may be automatable in the future. Acknowledging this, Frey and Osborne (2017) take "a technological capabilities point of view, to determine which problems engineers need to solve for specific occupations to be automated. By highlighting these problems, their difficulty and to which occupations they relate, we categorise jobs according to their susceptibility to computerisation. The characteristics of these problems were matched to different occupational characteristics … allowing us to *examine the future direction of technological change in terms of its impact on the occupational composition of the labour market, but also the number of jobs at risk should these technologies materialise.* [our italics] (p. 5)

Ultimately, their operating assumption is that the primary and tangible limit to automation is technological feasibility: simply put, if it is technically feasible that a task can be automated, it is assumed that it will be; if it is not technically feasible, it is assumed it will not. Consequently, tasks are differentiated according to how difficult they are to automate; Frey and Osborne identify the most difficult as those which involve perception and manipulation, creative intelligence, and social intelligence. Occupations are then classified as high-risk, medium-risk or low-risk according to their task composition: occupations that are over 70% comprised of automatable tasks, for instance, are classified as high-risk.

While they conclude that 47% of total US employment is at risk of computerisation, their method of arriving at that figure has proven to be the most influential feature of their study; nearly all subsequent FOWS adopt this method, or at least use it as a foundation for a more granular approach. OECD (2016), for instance, use the Survey of Adult Skills Survey administered by the OECD's Programme for the Assessment of Adult Competencies (PIAAC) which provides individual level data and which permits researchers to identify the skill composition of each person's occupation. Following Frey and Osborne (2017), they identify certain skills or tasks among the PIAAC variables that are 'automation bottlenecks', that is, tasks that are automation-resistant. From this, they estimate the risk of automation for occupations throughout OECD countries. McNulty (1973) also use Frey and Osborne's basic framework, and identify "18 performance capabilities required to carry out the range of work activities and the current state of the technology for those capabilities as measured against human performance (p. 71)", which they group into five general categories: sensory perceptions; cognitive capabilities; natural language processing; social and emotional capabilities; and physical capabilities.

Despite these variations in methods and levels of analysis, the core assumption among feasibility studies, common to all of their methodologies, is that if a technology reaches a level of sophistication where it could replace some task, then it likely will replace that task. And a second, more implicit, assumption is that automated technologies are becoming increasingly capable of automating more and more complex tasks, and that this is largely happening at its own pace. The only limit, it seems, *is* the pace of innovation. In the main, forecasters of automation's impact have not accounted for what may direct innovation, nor what affects the pace at which it proceeds or where it may be utilised. Simply put, they do not identify any determinates of technical change.

By neglecting the determinates of technical change, FOWS have, perhaps unwittingly, defaulted to a more fundamental stance whereby technical change is itself considered autonomous. Their understanding of technical change is effectively one of 'autonomous technical change', the idea that technological inventions are not simply creating automated technologies, but rather that technological progress has itself become autonomous, independent of human agency. As Langdon Winner describes it, the idea of autonomous technology is "the belief that somehow technology has gotten out of control and follows its own course, independent of human direction", and is "… no longer guided by human purposes, is 'self-directing,' or has 'escaped all reasonable limits. (Winner, p. 13)'". Autonomous technology is such that it is no longer "controlled by the desire and rational ends of human beings, technology in a real sense now governs its own course, speed and destination (Winner, p. 16).

The role of 'autonomous technology' in FOWS is reminiscent of the biologist René Dubos' statement in 1968: "Technology cannot theoretically escape from human control, but in practice it is proceeding on an essentially independent course (cited in Winner, 1977, p. 14)". Again, consider Frey and Osborne (2017):

… we focus on advances in fields related to Machine Learning (ML), including Data Mining, Machine Vision, Computational Statistics and other sub-fields of Artificial Intelligence (AI*), in which efforts are explicitly dedicated to the development of algorithms that allow cognitive tasks to be automated.* In addition, we examine the application of ML technologies in Mobile Robotics (MR), and thus the extent of computerisation in manual tasks (Frey & Osborne, 2017, p. 17; our italics).

What is not properly addressed by Frey & Osborne, nor by subsequent FOWS, is *why* efforts are, have been, or will continue to be,

explicitly dedicated to the development of automated technologies. Is it the case that it 'just so happened', or that it was inevitable, that technology has become progressively more capable of performing routine tasks? What reasons are there for assuming that innovations in automated technologies will continue at the current pace, or even at all? It seems more likely that there is some mixture of motives and inducements which have and will continue to guide technological innovations along those lines. Certain tasks may be more at risk of automation, but perhaps not primarily because automation technology will be capable of replacing them, but instead because innovations in automation technology have been motivated by a desire or by incentives to replace those particular tasks. Were that motivation to change, the inducements cease, or the disincentives intensify, the pace of automation, and the range of tasks that are replaced, could be significantly different from current expectations.

### *1.4. Smith on inventiveness*

A largely overlooked feature of Smith's discussion of division of labour is the role it plays in encouraging inventiveness and what the determinates of inventive activity are. There is, as we will argue below, a startlingly close resemblance of Smith's account to the so-called 'new growth theory' described by Paul Romer, who argues that technological progress and human capital should be considered main determinates of economic growth. Inexplicably, however, while Smith has been recruited to support all manner of other economic growth theories, references to Smith are conspicuously absent from discussions of new growth theory. Nathan Rosenberg's 1965 article – which sought to highlight the function of innovation in Smith's notion of technical change – is a good starting point for remedying this neglect. According to Rosenberg, Smith suggests that division of labour spurns advancements in techniques and machinery because "[t]he worker's perception of mechanical deficiencies and of possibilities for improving the efficiency of an operation is heightened by the unrelieved intensity in the focus of his attention (Schefold, 1976, p. 129)". Smith writes:

The division of labour no doubt first gave occasion to the invention of machines. If a man's business in life is the performance of two or three things, the bent of his mind will be to find out the cleverest way of doing it; but when the force of his mind is divided it cannot be expected that he should be so successful. (Lectures, 167).

One famous passage also suggests Smith believed *motivation* to be a key ingredient in inventive activity:

In the first fire-engines, a boy was constantly employed to open and shut alternately the communication between the boiler and the cylinder, according as the piston either ascended or descended. One of those boys, who loved to play with his companions, observed that, by tying a string from the handle of the valve, which opened this communication, to another part of the machine, the valve would open and shut without his assistance, and leave him at liberty to divert himself with his play-fellows. One of the greatest improvements that has been made upon this machine, since it was first invented, was in this manner the discovery of a boy who wanted to save his own labour (WN, 20–21).

Smith — in keeping with his general view that "institutional arrangements structure the decision-making of the individual (Schefold, 1976, p. 129)"— also applied this to the determinates of inventiveness. For example, a large landowner, 'corrupted by his easy and luxuriant style of life (Schefold, 1976)", has far less motivation to improve his holdings than does a small proprietor:

To improve land with profit, like all other commercial projects, requires an exact attention to small savings and small gains, of which a man born to a great fortune, even though naturally frugal, is very seldom capable. The situation of such a person naturally disposes him to attend rather to ornament which pleases his fancy than to profit for which has so little occasion (WN, p. 385).

A small proprietor … who knows every part of his little territory, who views it all with the affection which property, especially small property, naturally inspires, and who upon that account takes pleasure not only in cultivating but in adorning it, is generally of all improvers the most industrious, the most intelligent, and the most successful (WN, p. 423).

The clearest indication of Smith's attempt to understand the determinates of inventive activity is evident in his explanation of the 'capacity to invent' (Rosenberg, 133). For Smith, while labourers may design small improvements to the performance of their tasks, "invention at the highest levels involves acts of insight, creative synthesis, and the capacity to draw upon diverse fields of knowledge. The most important inventions of all are the works of philosophers, who perceive and exploit new relationships and natural phenomena to human advantage (Rosenberg, 133)".

Smith, elsewhere, defines what he means by philosophy, as

the science of the connecting principles of nature … as in those sounds, which to the greater part of men seem perfectly agreeable to measure and harmony, the nicer ear of a musician will discover a want, both of the most exact time, and of the most perfect coincidence: so th more practised thought of a philosopher, who has spend his whole life in the study of the connecting principles of nature, will often feel an interval betwixt two objects, which, to more careless observers, seem very strictly conjoined (Adam Smith, 'History of Astronomy', in Essays on Philosophical Subjects, pp. 19–20).

And a philosopher is

One of these people whose trade it is, not to do any thing but observe every thing, and who are upon that account capable of combining together the powers of the most opposite and distant objects. To apply in the most advantageous manner those powers, which are already known and which have already been applied to a particular purpose, does not exceed the capacity of an ingenious artist. But to think of the application of new powers, which are altogether unknown, and which have never before been applied to any similar purpose, belongs to those only who have a greater range of thought and more extensive views of things than naturally fall to the share of a meer artist (*Early Draft,* pp. 337-8*)*.

This hints to something very much alike to two core concepts used in modern accounts of innovation — 'human capital' and 'recombinant innovation' — and in the following passage Smith describes the relationship between them:

In a civilized state … though there is little variety in the occupations of the greater part of individuals, there is an almost infinite variety in those of the whole society. These varied occupations present an almost infinite variety of objects to the contemplation of

those few, who, being attached to no particular occupation themselves, have leisure and inclination to examine the occupations of other people. The contemplation of so great a variety of objects necessarily exercises their minds in endless comparisons and combinations, and renders their understandings, in an extraordinary degree, both acute and comprehensive (WN, p. 39).

Rosenberg's synopsis nicely captures the centrality of the 'capacity to invent' in Smith's account of technical change:

In short, the 'capacity to invent' cannot be assessed or measured in absolute terms; the concept is meaningful only in relation to the complexity of the existing technology and the degree of creative imagination required in order for new 'breakthroughs' to occur … Major inventions involve the ability to draw upon diverse areas of human knowledge and experience and to combine them in a unique fashion to serve some specific purpose (Rosenberg, p. 134).[2]

To summarise, Smith's views on inventiveness point to particular determinates of innovation, which is in turn a chief driver of technological progress. The most relevant of these in the context of new technologies are the conditions and institutions that limit or encourage inventiveness, and the process of innovation as a recombining of multiple sources of information, where progress depends on the current stock of knowledge and technology, and is directed towards and guided by human motivations. The general point here is that Smith's description of inventiveness suggests an alternative to the consensus view among FOWS that technical feasibility is the principal factor under which widespread automation could occur. But following Smith, technological progress itself — its pace, its extent and its course — is likely largely determined by non-technical factors.

### 1.5. Innovation and non-technical determinates

FOWS have excluded non-technical determinates in much the same way as mainstream economic theories on technical change have. Neoclassical economists typically take technical change to be the chief determinate of economic growth over the long run, but it is treated as an exogenous variable, or in other words, the traditional approach has "typically left technological progress in a black box by treating its growth rate as a parameter that in general could be varied, but in any particular instance was exogenously given—'for free' as it were (West, 1964, p. 332)". There have been noteworthy exceptions to this; in their account of the neoclassical approach to 'induced' technical change, Brugger and Gehrke raise the point that "Although technical progress was, and still is, very often treated as exogenous in economic theory, it is quite natural for a neoclassical economist to ask whether the market mechanism is capable of influencing, and perhaps of providing guidance for, the direction of technical progress (Brugger & Gehrke, 2017, p. 730)". Nevertheless, by far the majority of attempts to address the 'black box' of technical change have been undertaken outside of the neoclassical approach.

One of the most influential alternative approaches is Paul Romer's, which came to be associated with so-called 'new growth theory'. Briefly, Romer made his central argument in a paper entitled *Endogenous Technical Change* (1990) and is based on three premises: (i) technical change should be considered a main determinate of economic growth; (ii) technical change is driven by human actions in response to market incentives; and (iii) "… instructions for working with raw materials are inherently different from other economic goods" in that they "can be used over and over again at no additional costs (Romer, 1990, p. 572)". This adds up to a simple premise: "the stock of human capital determines the rate of growth (Romer, 2008, 571)".

Romer proposes that the process by which human capital leads to such 'instructions', or more simply inventions, happens "whenever people take resources and rearrange them in ways that make them more valuable. … possibilities do not merely add up; they multiply (P. Rosenberg, 1965)". This process has been widely coined 'recombinant innovation'; Martin Weitzman defines it as "the way that old ideas can be reconfigured in new ways to make new ideas. The underlying thesis is that the metaphor of recombinant innovation is an insightful way to model the production of new knowledge as a natural centerpiece for a theory of endogenous aggregative growth (Weitzman, 1998, p. 333)". Consequently, "… the ultimate limits to growth may lie not so much in our ability to generate new ideas, so much as in our ability to process an abundance of potentially new seed ideas into usable form (ibid)". More recently, Erik Brynjolfsson and Andrew McAfee in *The Second Machine Age* have revitalised the concept to address the uniqueness of new technologies, claiming that "digital innovation is recombinant innovation in its purest form. Each development becomes a building block for future innovations. Progress doesn't run out; it accumulates (Brynjolfsson & McAfee, 2014, p. 130)".

Coming back to Smith, as we have seen, his treatment of technological progress provides surprisingly relevant insights into these concepts and contemporary debates. For Smith, technical change is determined first and foremost by a human activity: inventiveness. The invention of technology is directed by human motivations, and quite remarkably, Smith describes the inventive process in a way which bears an uncanny resemblance to 'recombinant innovation'. Nor would it be difficult to apply this Smithian perspective to the more specific issue of automation and FOWS. Even if one wished to avoid the complexities involved in evaluating a society's 'capacity to invent' for indications of how automated technologies may advance, one could quite easily identify non-technical determinates that might play a role. For instance, in their review of the literature on automation-related studies, Schwartz (2015a) point to other conceivable types of 'determinates of the feasibility of automation' which warrant more attention than they currently receive: economic ('economic risks and returns given capital and labour costs; intensity of competition'); legal ('labour and capital regulation (e.g. job protection; patents and their ownership); political ('e.g. unionization of the workforce; questions of public versus private ownership of production and technology'); and sociocultural ('e.g. corporate legitimacy and social expectations'). McKinsey Global Institute (2017) also lists four non-technical determinates beyond technical feasibility: "the cost of developing and deploying

[2] In addition to Rosenberg, Bruce Firpo et al. (2011) interpreted Smith in a similar fashion, indicating that Smith believed ""A country with a division of labor highly developed enough to support philosophers will generate many more inventions … than a country without well-developed markets. Furthermore, this lead seems to be cumulative, or at least sustainable for long periods of time (Elmslie, 662)".

solutions; labor market dynamics; economic benefits; and social and regulatory acceptance (p. 65)". These are certainly important, yet the significance that the McKinsey report assigns them could certainly be increased. Another fairly obvious but largely overlooked non-technical determinate is only hinted at by Frey and Osborne: "Workers can … be expected to resist new technologies, insofar that they make their skills obsolete and irreversibly reduce their expected earnings. The balance between job conservation and technological progress therefore, to a large extent, reflects the balance of power in society, and how gains from technological progress are being distributed. (Frey and Osborne, p. 9)". They, and subsequent FOWS, have not factored this in, but they are right that the public's perception of automation should not be discounted. PEW Research Centre's 2017 survey *Automation in Everyday Life* is a step in the right direction; it revealed that the American public expresses a number of concerns when asked about the likely outcomes they anticipate from these technological developments. For instance, 76% of Americans expect that economic inequality will become much worse if robots and computers are able to perform many of the jobs that are currently done by humans. A similar share (75%) anticipates that the economy will not create many new, better-paying jobs for humans if this scenario becomes a reality. And 64% expect that people will have a hard time finding things to do with their lives if forced to compete with advanced robots and computers for jobs. (Pew Research Center, 2017, p.3)

Unsurprisingly, the study also found broad support for public policies intended to limit the impact of automation on the workforce. Moreover, if public attitudes can affect the impact of automation, so too can employers'. The World Economic Forum (2018), for instance, relied on an employer survey to get a sense of their plans for implementing automated technologies, and this, from a Smithian perspective, represents a promising approach.

Given that such non-technical determinates have not been widely considered — not to mention the many more that have yet to be considered at all — speaks to the value of introducing a Smithian perspective to automation. Simply put, Smith's views on the determinates of technical progress and innovation serve as an effective reminder that technological progress is not in itself autonomous, but rather is directed by human agency and conditional on society's 'capacity to invent', meaning that it is far from being 'out-of-control' or unalterable. Extending this principle, FOWS should better account for the role that non-technical determinates may play in the advance and utilisation of automated technologies.

### 1.6. Automation and forced trade-offs

FOWS contend they are informing policymakers, business leaders and the public about the threat to the workforce – whether overblown or warranted – posed by automation, and almost without fail they offer policy recommendations. This intent suggests that FOWS are inherently normative endeavours, and from a Smithian perspective this is laudable; Smith consistently and persistently raised normative questions throughout his works. William S Gray (2017) is one of many Smith scholars to stress the importance of, and inseparability of, the positive and normative aspects of his thought. Quoting from Alvin Hansen's *Standards and Values in a Rich Society*, Gramm stresses that economics must "concern itself with social priorities. In other words, it must, in a sense, become a branch of moral philosophy, as Adam Smith indeed had it (Gramm, 1980, p. 134)".

What the prescriptions of FOWS actually are, however, is another matter, and they can generally be grouped into two overarching strategies: coping or containment (Schwartz, 2015a). Coping strategies are those that maintain that the overall benefits of automation outweigh the harms, and so whatever disruption to the labour market it may entail, individuals can and should be helped to adjust or at least to cope; this includes policy prescriptions such as skills-upgrading, generating automation-resistant employment, and investing in labour intensive sectors or public works programs. Containment strategies, however, hold that the harms automation pose to individuals are so potentially severe that they need to be contained. Suggestions include decreasing labour costs through tax cuts on labour, wage subsidies or a lower minimum wage; job protection legislation; and taxes on automation (the so-called 'robot tax'), or regulation that complicates the implementation of automated technologies.

More broadly, both strategies are attempts to balance the trade-offs between economic growth and employment; the primary benefit is seen to be economic growth, the primary threat is to jobs. Perceiving the trade-offs in such a way, however, conceals a transformative opportunity: automation has the potential to allow workers to focus on more *fulfilling* work. Smith perceived of the trade-off forced by technological advance in just such a way: his views on labour go well beyond the question of whether technical change will result in more or fewer jobs, and he is more inclusively concerned about the nature of work itself, the character of workers, civic engagement, and even human fulfilment.

### 1.7. Smith, technology, and the moral trade-offs

At the heart of Smith's theory of division of labour is a normative outlook about the benefits of division of labour, about the benefits of specialisation and technological progress, which he couches in terms of the 'opulence' it delivers. According to Aspromourgos (2010),

'Opulence' is the ultimate normative purpose of political economy for Smith: '[i]t proposes to enrich … the people' (WN: 428). But what precisely *is* opulence? In short, opulence is high consumption — and universal or general opulence is the extension of high consumption to all of society in general (WN: 53; cf. 88 and 209-10). It is division of labour that brings about the rising output per worker, which, at least in 'well-governed' societies, effects a '*universal* opulence which extends itself to the lowest ranks of the people', so that 'a general plenty diffuses itself through all the different ranks of the society' (WN: 22; emphasis added; also 25, 35 and 134). (Aspromourgos, 2012, p. 1175).

Productivity, then, is valued not for its own sake but for the extent to which it supports people's livelihood. Aspromourgos (2012) finds Smith's clearest expression of this in Smith's 'Early Draft of Part of *The Wealth of Nations*':

In an opulent and commercial society labour becomes dear and work [i.e., output] cheap … The high price of labour is to be considered not merely as a proof of the general opulence of society which can afford to pay well all those whom it employs; it is to be regarded as what constitutes *the very essence* of public opulence, or as *the very thing in which public opulence properly consists.* That state is properly opulent in which opulence is easily come at, or in which a little labour, properly and judiciously employed, is capable of procuring any man a great abundance of all the necessaries and conveniences of life. … National opulence is the opulence of the whole people, which nothing but the great reward of labour, and consequently the great facility of acquiring, can give occasion to. (edWN: 567; emphasis added; also 575).

Two things are important to emphasise from this passage. First, note that Smith is not suggesting that one's livelihood ought to be conditional on exertion or effort, but quite the opposite: an opulent society is one in which only a 'little labour' guarantees economic wellbeing for workers. Second, opulence must be distributed equitably across society; the very essence of opulence is that it is public or general. Elsewhere Smith presses the point: "No society can surely be flourishing and happy, of which the far greater part of the members are poor and miserable. It is but equity, besides, that they who feed, cloath and lodge the whole body of the people, should have such a share of the produce of their own labour as to be themselves tolerably well fed, cloathed and lodged (WN, 96).

In short, for Smith, the benefits of division of labour should be expressed in terms of 'opulence' — distributed reasonably and equitably in exchange for a little labour. The value of technology is to be judged for its ability to ensure a high level of consumption and standard of living for the majority of the population, ideally without demanding much effort on the part of workers.

However, Smith's normative perspective on technology is not limited to opulence nor is it entirely positive; he also expresses deep concerns about the effects of division of labour on the character of workers and its impact on society. This is underpinned by his view of work: for most workers it is simply an unfortunate necessity:

It is the interest of every man to live as much at his ease as he can; and if his emoluments are to be precisely the same, whether he does, or does not perform some very labourious duty, it is certainly his interest, at least as interest is vulgarly understood, either to neglect it altogether, or, if he is subject to some authority which will not suffer him to do this, to perform it in as careless and slovenly a manner as that authority will permit. If he is naturally active and a lover of labour, it is his interest to employ that activity in any way, from which he can derive some advantage, rather than in the performance of his duty, from which he can derive none (WN, 760).

Moreover, it is not only work in general that is generally disagreeable; as division of labour progresses the *types* of work become increasingly so. Specialisation, in particular, diminishes the labouring classes' "intellectual, social and martial virtues":

The man whose whole life is spent in performing a few simple operations, of which the effects too are, perhaps, always the same, or very nearly the same, has no occasion to exert his understanding, or to exercise his invention in finding out expedients for removing difficulties which never occur. He naturally loses, therefore, the habit of such exertion, and generally becomes as stupid and ignorant as is possible for a human creature to become. The torpor of his mind renders him, not only incapable of relishing or bearing a part in any rational conversation, but of conceiving any generous, noble, or tender sentiment, and consequently of forming any just judgment concerning many even of the ordinary duties of private life. Of the great and extensive interests of his country, he is altogether incapable of judging; and unless very particular pains have been taken to render him otherwise, he is equally incapable of defending his country in war. The uniformity of his stationary life naturally corrupts the courage of his mind, and makes him regard with abhorrence the irregular, uncertain, and adventurous life of a soldier. It corrupts even the activity of his body, and renders him incapable of exerting his strength with vigour and perseverance, in any other employment than that to which he has been bred. His dexterity at his own particular trade seems, in this manner, to be acquired at the expence of his intellectual, social, and martial virtues. But in every improved and civilized society this is the state into which the labouring poor, that is, the great body of the people, must necessarily fall, unless government takes some pains to prevent it (WN, 782).

It is no exaggeration, then, to say that Smith thought the effects of division of labour had devastating psychological and social consequences. Amongst his contemporaries he was not alone in this; Smith seems to have borrowed Adam Ferguson's assessment of the psychological and societal costs of division of labour and specialisation (Hansen, 1962, p. 257), and Bernard Mandeville expressed concern for how human autonomy may be compromised by specialisation (McKinsey Global Institute, 2017).

Previous scholars have tried to reconcile Smith's ambivalence in several ways, and three stand out. E. G. West has argued that Smith simply wears two hats: he approaches the issue largely as an *economist*, but at other points, as a *psychologist* (Winner, 1977). Rosenberg has argued that Smith looks at the effects of division of labour from two perspectives: its (beneficial) *social* effects, and its (harmful) effect on *individuals* (Schefold, 1976). McNulty argues that whatever Smith's methodology or perspective, Smith's first-order concern is for the well-being and personal development of workers; that is, to *mitigate the plight of workers* by countering the adverse psychological and societal effects wrought by division of labour (Muro et al., 2019). McNulty notes that "Smith's criticisms of the effects of the division of labour on the worker came in his chapter on the education of youth, and that his real purpose was to point out that the deleterious effects of division of labour could be overcome or eliminated by governmental programs supporting educational or cultural programs in which the labouring poor could participate (Muro et al., 2019, p. 361)". McNulty correctly notes that Smith lays emphasis on educational or cultural programs, the "total development of the worker as a person (Muro et al., 2019)", but this should not be taken to mean merely job training or 'up-skilling'. Consider Smith's stern criticism of apprenticeships:

The institution of long apprenticeships has no tendency to form young people to industry. A journeyman who works by the piece is likely to be industrious, because he derives a benefit from every exertion of his industry. An apprentice is likely to be idle, and almost always is so, because he has no immediate interest to be otherwise. In the inferior employments, the sweets of labour consist altogether in the recompence of labour. They who are soonest in a condition to enjoy the sweets of it, are likely soonest to conceive a relish for it, and to acquire the early habit of industry. A young man naturally conceives an aversion to labour, when for a long time he receives no benefit from it. The boys who are put out apprentices from publick charities are generally bound for more than the

usual number of years, and they generally turn out very idle and worthless (WN, 139).

This criticism is not based on whether or not labour is being allocated efficiently, but rather is "grounded in the belief that they had a deleterious effect upon the worker as an individual member of society (Muro et al., 2019, p. 362)". Indeed, Smith's chief concern here is how to motivate workers, by ultimately allowing them to 'relish' and enjoy the 'sweets of labour'. Smith was, in short, an advocate of interventions to counter the adverse psychological effects on labourers, and when proposing or criticising labour policies, he was concerned less about "the structure of the labour market" than he was "the character of the individual worker (Ibid.)".

### *1.8. The nature of work and Smith's technological optimism*

Ultimately, Smith's view of work is strongly associated with disutility, and he even sought a quantifiable measure of wellbeing that factored this in. *Grace, Salvatier, Dafoe, Zhang, and Evans (1959) writes, "Smith proposes to assign an absolute number to every commodity, the amount of labour time required to purchase it, on the grounds that there is a certain constancy in the pain cost, or psychological disutility, of an hour's labour (Gordon, 1959, p. 467)". Gordon adds, "Smith usually calls the absolute value of a commodity 'real price', sometimes 'real value'. It serves a somewhat similar function for Smith that modern welfare economics does. It enables him to estimate whether an individual or society is better off over changes in time and place. (Ibid.)". While division of labour increases productivity, Smith stresses the inherent disutility of work, and laments that specialisation worsens the quality of work and the character of workers.

Were we to adopt a Smithian perspective, then, automation should be judged not only on its ability to generate economic growth, not only on whether the productivity gains can equitably be distributed to guarantee the livelihoods of individuals, but also on its potential to decrease the amount of work necessary to provide one's livelihood and on its ability to alleviate the plight of workers engaged in mundane, repetitive and dangerous tasks. Automation has presented an opportunity to question the very nature and value of work. Like Smith, some researchers are attentive to the psychological and social effects of the potential 'disappearance of work' and are asking whether "saving work is more important than saving any particular job (Thompson, 2015)". Yet Smith has drawn criticism from certain quarters for expressing disdain for work as 'inevitably joyless drudgery (Schwartz, 2015b)". Barry Schwarz, for instance, embellishes Smith's responsibility for the incentive structure of the modern workforce:

Adam Smith was mistaken about our attitudes and aspirations regarding work. But as capitalism developed in his shadow, under the sway of the "incentive theory of everything," a mode of work evolved in which all the other satisfactions that might come from it were neglected or eliminated. And so it came to be that all over the planet, people trudged off to work each day with little expectation of meaning, engagement, or challenge. Because there was no reason to work except for the paycheck, they worked for the paycheck. So it came to be that Smith's mistaken idea about why people work became true (2015b, Schwartz, 2015a, p. 11).

Inspired by Voltaire's famous statement "work saves a man from three great evils: boredom, vice and need", Brynojolfsson and McAfee fear that schemes such as universal basic income, made possible by the economic growth gained from automation and to compensate for job loss, will deprive people of the non-material benefits of work: "It's tremendously important for people to work not just because that's how they get their money, but also because it is one of the principal ways they get many other important things: self-worth, community, engagement, healthy values, structure, and dignity, to name just a few (Chang & Huynh, 2016)". Also worried about the disappearance of work on the life of communities, they quote sociologist William Julius Wilson:

The consequences of high neighborhood joblessness are more devastating than those of high neighborhood poverty. A neighborhood in which people are poor but employed is different from a neighborhood in which many people are poor and jobless. Many of today's problems in the inner-city ghetto neighborhoods—crime, family dissolution, welfare, low levels of social organization, and so on—are fundamentally a consequence of the disappearance of (Chang & Huynh, 2016).

In sharp contrast to this view are 'accelerationists' such as Nick Srnicek and Alex Williams. In their manifesto *Inventing the Future: Postcapitalism and a World Without Work*, they argue in favour of a fully automated economy, an economy with an "aim to liberate humanity from the drudgery of work while *simultaneously* producing increasing amounts of wealth … With automation … machines can produce all necessary goods and services, while also releasing humanity from the effort of producing them (The Executive Office of the President of the United States, 2016; Srnicek and Williams, 2015)". Their support for full automation leads them to advocate several policies that could speed things along: "more state investment, higher minimum wages and research devoted to technologies that replace rather than augment workers (Ibid.)".

Such advocates of fully automated technology — while they often claim to be inspired by Marx — have a view that is undoubtedly Smithian in spirit. Automation has the potential to widely liberate workers from mundane tasks, enabling them to cultivate their 'intellectual, social and martial virtues'. That said, as David and Salomons (2018), automation may have led to — because the productivity benefits have not allowed as many people to enjoy unemployment as perhaps ideally could or should have — "a form of paid employment that is so completely pointless, unnecessary, or pernicious that even the employee cannot justify its existence even though, as part of the conditions of employment, the employee feels obliged to pretend that this is not the case (Heller, 2018; IGM Panel, 2014)

Whatever the case, Smith's perspective on the trade-offs between productivity and work is valuable and unconventional: if automation enabled 'opulence' without requiring the degeneration of individual and social values, Smith would presumably be an enthusiastic advocate. Automation and new technologies very well might have the potential to reconcile Smith's ambivalence between the economic benefits of technology and its harmful psychological and social effects. Were FOWS to at least entertain such a perspective, some interesting questions could be raised in their studies. Studies could ask not only which jobs *can* be automated, but ask which *should* be automated. Within occupations, FOWS could ask not only which tasks are 'at-risk' of automation, but also which

tasks workers would gladly be rid of. They could also lessen the stigma of automation by emphasising that it does indeed increase productivity, and that it also has the potential to free workers from the more undesirable tasks of their occupations, note that lost work hours equate to gained leisure hours, and seriously explore the ways in which employers, benefitting from increased productivity, could maintain salaries while decreasing work hours.

## 2. Conclusion

Future of work studies (FOWS) that attempt to estimate the potential impact of automation are increasing in number, and there is certainly a large and attentive audience for them. The 'imagined future' they are constructing, however, shares certain characteristics, assumptions and attitudes that should not go unchallenged. FOWS have largely left questions about what determines the pace and extent of automated technology unanswered; they reinforce the sense that the impact of automation is inevitable and independent of non-technical factors; and their policy recommendations are informed by a perceived trade-off that automation forces society to make between growth and employment. Adam Smith, however, offers a comprehensive alternative view. Smith recognised that technology does not advance independently of human agency, nor that its impact is unavoidable, and he described a determinate of technical change that shares much in common with 'new growth theory' and its attendant concepts of human capital and recombinant innovation. Smith also lays the groundwork for an updated normative perspective that would see the potential of automation to reconcile the trade-off between growth and employment: adopting a Smithian perspective would encourage an assessment of automation based on its ability to generate economic growth, whether and how it can equitably guarantee the livelihoods of individuals, its potential to decrease the amount of work necessary to provide one's livelihood, and its ability to alleviate the plight of workers engaged in mundane, repetitive and dangerous tasks. At the very least, and as he has been elsewhere, there is a strong case for bringing Smith into the 'extended present', engaging with his ideas in the context of automation and the future of work.

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