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Robots and us: towards an economics of the 'Good Life'

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ABSTRACT

(Expected) adverse effects of the 'ICT Revolution' on work and opportunities for individuals to use and develop their capacities give a new impetus to the debate on the societal implications of technology and raise questions regarding the 'responsibility' of research and innovation (RRI) and the possibility of achieving 'inclusive and sustainable society'. However, missing in this debate is an examination of a possible conflict between the quest for 'inclusive and sustainable society' and conventional economic principles guiding capital allocation (including the funding of research and innovation). We propose that such conflict can be resolved by re-examining the nature and purpose of capital, and by recognising mainstream economics' utilitarian foundations as an unduly restrictive subset of a wider Aristotelian understanding of choice.

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1. Introduction

The strenuous purposeful money-makers may carry all of us along with them into the lap of economic abundance. But it will be those peoples who can keep alive, and cultivate into a fuller perfection, the art of life itself and do not sell themselves for the means of life, who will be able to enjoy the abundance when it comes.

– J M Keynes (1930) *Economic possibilities for our grandchildren*.

The 'ICT Revolution' – in particular the integration of artificial intelligence, robotisation, nanotechnology and bioengineering – may prove far more

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disruptive and divisive than technological revolutions of the past. If human labour is 'on the way out', what will happen – asks Porter (2016) along with many others – if the economy no longer provides an income for the majority of people? 'How will the economy spread money around' so that people can afford to pay their necessary expenses (Porter 2016)?

'A once "stupid" concern gains respect', claims Porter, reminding of the Luddite rebellion of 1811. Aware of the problem, policy-makers justify their policies with reference to the 'inclusive and sustainable society' they will bring about, especially through technological breakthroughs and a continual launching of new products that may meet new demand and create new work,¹ even when this goal seems increasingly elusive.² The prospect of technological mass unemployment also raises questions regarding the 'responsibility' of technology and innovation; however, to date the debate on 'Responsible Research and Innovation' (RRI)³ has paid scant attention to such questions.

As we argue in this paper – taking ICT as an example – 'inclusive and sustainable society' may prove impossible to attain unless we examine a possible conflict or paradigmatic inconsistency between the ethical outcomes that are aimed at and the normative economic principles that have been assigned to give direction to economic behaviour, in particular to the allocation of capital. It is time to ask, therefore: When we demand 'inclusive and sustainable society', what is our theoretical basis? How do ethical societal aims relate to the principles that guide capital and influence which initiatives are and which are not funded?

If, as we aver, the main aim or motive of human beings is to use and develop their capacities, and if the criterion for 'inclusive and sustainable society' is the degree to which it gives individuals opportunities to so do, then the question posed in the beginning would become: how will the economy 'spread money around' to support individual's initiatives, enabling them to use and develop their capacities? As we explain in this paper, the utilitarian foundations of today's mainstream economics, and the normative prescriptions derived from them,

¹E.g. European Commission (2013, 2011), World Economic Forum (2009).

²In principle, both *product innovation* (technological breakthroughs such as the steam engine, electricity, the automobile, and communication and information technology) and *process innovation* (a new division of labour) tend to displace labour. However, historically, *product innovation* has often had secondary effects (such as the creation of railroads, highways and communication networks) so that the labour that was displaced as a result of *process innovation* could find new work. In contrast, today's 'ICT revolution' is expected to accelerate job loss and to result in a *net* reduction in work (e.g. Acemoglu and Restrepo 2017; Frey & Osborne 2013; Spence 2014; Vogel *et al.* 2015). In countries with limited social welfare arrangements, information and communication technology (ICT) may result not in a net reduction in work but in individuals whose labour is obviated being forced to accept work in low-quality services (e.g. Hassel 2011) or 'alternative work arrangements' (Katz and Krueger 2016). See also Case and Deaton (2017) for data on increased morbidity and mortality ('deaths of despair') as a result of 'cumulative disadvantage' triggered by 'progressively worsening labour market opportunities'.

³While the terms 'responsible innovation' (RI) and 'responsible research and innovation' (RRI) have received particular visibility in an E.U. policy context (e.g. <https://ec.europa.eu/programmes/horizon2020/en/h2020-section/responsible-research-innovation>), they are heirs to earlier discussions in Europe and the U.S.A. about research integrity and the wider dimensions and societal implications of science and innovation (e.g. Owen, Macnaghten and Stilgoe (2012); Owen, Bessant and Heintz (2013).

do not allow for the freedom in the allocation of money or capital that such 'spreading around' would require.⁴

The consequences become visible (as we explain) in *three related phenomena*: (a) an (unqualified) acceleration of the replacement of human physical and increasingly also routine mental labour by technology, in particular ICT; (b) a corresponding rise of 'excess liquidity' or 'superabundant capital';⁵ or the growth of a financial surplus that does not have an immediate use in physical production;⁶ and (c) a displacement of original, creative mental work (as distinguished from routine mental labour), possibly resulting in a reduction in the power of the human mind, itself arguably the source of all progress.

If technological progress continues unchecked, the result may be a 'future [that] doesn't need us' (Joy 2000). A solution to unbounded technological progress requires a reconsideration of capital and indeed of progress itself. As we explain, the three phenomena reflect an underlying structural change in society – namely, a growing non-material economy relative to the (conventional) physical or material economy – and a failure to recognise the nature, let alone deep significance of this evolution.

The aim of economic activity is traditionally said to be to provide for the material livelihood of human beings – an end that is hardly controversial. Technology contributes to this end in two ways: by contributing to the development of products that make life easier ('product innovation'), and by improving production processes ('process innovation'). As we take hold of economic life by way of invention and innovation, we further the division of labour (between human beings, and between human beings and machines), which tends to make work lighter. Labour-saving technological progress belongs to the standard course of history, whereby humanity has always made efforts to alleviate and where possible eliminate the 'drudgery' of life. To date, this advance in our condition has mainly concerned physical or manual and, more recently, also routine mental labour.

Nowadays, however, it is extended even to original, creative mental capacities. A risk involved in the 'new technologies' including ICT taking hold of *mental activity* is that not just the production and transportation of goods, but also spheres which depend wholly on the human mind (science, education, health care, the judiciary) are put out of balance by an impersonal engineering approach that increasingly displaces thinking, conscious, cultural activity including discretionary judgement making.⁷ As even original, creative mental activity

⁴Free' in 'free market' refers to negative freedom, or freedom *from* obstacles to the pursuit of self-interest (or the maximisation of profit or shareholder value), on the assumption that overall welfare will be maximised when capital is used in ways that maximise profits or shareholder value (rather than human capacities).

⁵E.g. Rüffer and Stracca (2006), Bain and Company (2012a).

⁶Besides labour-saving, ICT is also capital-saving. ICT-based technology tends to become both more powerful and cheaper over time (Elsby *et al.* 2013; Lawrence 2015). Any cheapening effect of ICT on capital will add to the financial surplus.

is increasingly displaced by technology – a process in which profit-maximising capital plays a significant role – technological progress *threatens to undermine the source of all progress*. With its curious disregard of the further development of human capacities, in particular creative mental capacities, society appears to be undermining its own foundation.

It would be possible to create economic space for the use and further development of human capacities if the financial surplus referred to above, or more specifically the capital that is freed from production by the productivity growth that arises from technological progress – a consequence of the growth of human knowledge, ingenuity and consciousness – were linked to the further growth of human capacities.⁸ However, this is unlikely to happen without a corresponding evolution in theoretical frameworks, in particular a widening of our understanding of economic freedom. In this paper, we sketch an approach that provides grounds for *a wider concept of freedom* based on an Aristotelian understanding of choice that would provide a theoretical basis for ‘linking capital to capacities’.

The basis of this wider concept of freedom is threefold: philosophically, a full conception of the end or *telos* of human life – here understood as the full development of human capacities, and more specifically ‘character’⁹ in accord with Aristotelian *eudaimonia*; economically, an understanding of capital as having a dual role, regarding production and *telos*; and technologically, innovation shaped in accordance with the values and tasks of the sphere for which it is designed, or *sphere-appropriate technology*.

This paper is structured as follows. In Section 2, we present data for the Eurozone for the period 1970–2007 which show how labour-saving technological progress – a consequence of the continuing growth of human intelligence and consciousness – has reduced the hours of labour needed in the production of goods required for *material* existence. Simultaneously, work that creates *non-material* value (such as education, science, the arts, health care, the judiciary, and so on, typically known as ‘services’) has increased correspondingly. However, as a result of today’s focus on maximising *financial* returns to capital, these activities (hitherto considered ‘non-market’) are opened up to financial capital on precisely those conditions, leading to a one-sided focus on expense reduction involving standardisation, automation and robotisation and the displacement of original, creative mental work. If the financialisation and consequent computerisation of these mental activities continues *routinely*, and hence unchecked, the result will be *an acceleration of technological un(der)-employment*; moreover, there is a real possibility that it will also *undermine the (further development of the) human mind*. However, both results are by no means

⁷Think, for example, of the idea of replacing judgement with rules in finance, on the grounds that subjectivity will usurp the ‘objectivity’ of algorithms and statutes.

⁸A solution discussed in Houghton Budd (2011), Naastepad and Houghton Budd (2015).

⁹Aristotle (2000).

inevitable; they depend on how we shape technological change. But *how much freedom do we have in choosing sphere-appropriate technology in a social context which permits only solutions that are in agreement with the normative prescriptions of today's mainstream economic theory?*

In Section 3 we address this question, which has two aspects. First, what does freedom amount to in the context of conventional economics? Second, if our understanding of freedom were widened to include the possibility to choose between alternative socio-technological trajectories, how would alternatives that today are rejected because they do not meet 'benchmark' financial returns be financed? When, as a result of the application of human intelligence to production processes,¹⁰ labour is obviated, the money that was used to remunerate the now obviated labour also becomes free. Using this money, or *freed capital*, – the money that is freed from production by human intelligence – to enable those whose labour is obviated to further develop and use their capacities, we suggest, would solve three problems simultaneously – technological unemployment, the riddle of 'super-abundant capital', and the possible atrophying of the human mind if it is not active (due to an overdose of ICT).

In Section 4, we explain that using 'freed capital' in this way depends on an *extension of the Benthamite-utilitarian perspective on the end or purpose of human life (homo economicus)*. From this will follow also a purpose for capital and technology, which will enable the human being to give direction to both. We discuss an Aristotelian view on the central driving force in human life which leads to a view on the purpose of the economy as *providing the material conditions that enable people to*, in Aristotle's terms, 'live well' and do 'fine actions'; in short, to *realise their telos* or purpose. If capital and technology were recognised as belonging to both – material conditions *and* the *telos* of human life – freed capital could fund the growth of human capacities required to realise such *telos*, which would then also become the criterion for responsible use of technology.

In Section 5 we propose that the corresponding widening of today's narrow (Benthamite-utilitarian or Friedmanite) concept of freedom – as the principle to guide the allocation of capital – starts with making visible the 'invisible hand' that is believed to coordinate the self-interested actions of atomistic individuals into a harmonious whole. An alternative to this semi-conscious, deistic concept, we suggest, would be a conscious combination of the strengths of the two conventional approaches to the problem of social order – the private initiative of the market and the coordination hitherto entrusted to the state – based on a concept of freedom that includes responsibility for others; this, however, does not come automatically and requires *ethos* or 'character'.

As an aid in this process, the individual will need *guidelines for judgements concerning the responsible use of capital*. Focussing on ICT, Section 6 gives a first

¹⁰See, for example, Adam Smith's well-known illustration (quoted in Baetjer and Lewin 2007) of the embodiment of knowledge in early steam engines.

sketch of an approach for judging the responsibility of research and innovation (a requirement for making judgements about which research and innovation should and which should not be funded), based on Aristotelian freedom and grounded in Aristotle's notion of the 'golden mean'. The Aristotelian idea of a *telos* for human life (*eudaimonia* or the 'good life') implies that mere instrumental reasoning is insufficient; it involves intrinsic virtues and skills, the precise formation of which, however, is up to the individual. Positive freedom, then,¹¹ is not freedom *from* constraints on satisfying (material) desires, but rather freedom to shape one's own implementation of the good life according to one's own talents and conscious choices. This constitutes a first step towards a practical integration of the three dimensions of our approach: the philosophical (the human *telos*), the economic (a wider concept of capital) and the technological (culminating in 'sphere-appropriate technology'). Section 7 concludes.

2. The elimination of human labour ... and the human mind?

As human intelligence takes hold of production processes, it tends to make work lighter. As a result, labour is obviated worldwide. In the present social and economic set-up, the obviated labour tends to take the form of either *un*-employment or being without work, or *under*-employment (the transference of those whose labour is obviated into low-skill, low-paid jobs).¹² When, due to ongoing innovation, production requires progressively less labour, it will be ever harder to achieve inclusive economic, social and cultural existence through growth in production.

This is illustrated in Figure 1, which gives data for hours spent labouring in the countries of the Eurozone between 1970 and 2007. Figure 1 gives data for the *physical aspect of economic life*, i.e. the *goods-producing economy*.

As Figure 1 shows, humanity increasingly liberates itself from the need to work for material livelihood only. In just 37 years, GDP in the 'physical economy' has more than doubled, while the hours worked declined.¹³ This rather spectacular saving of labour is the result of applying human intelligence to labour, due to which labour becomes more effective (the productivity of labour rises).¹⁴ As a result, a person working one hour in 2007 could produce nearly three times as much GDP in 2007 as would have been the case in 1970.

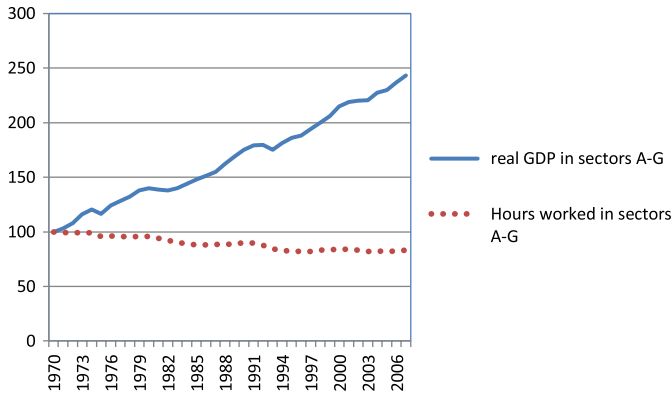
This growth in productivity entails a choice: as productivity increases, one can either produce the same level of output with less labour, or one can keep

¹¹Compared to negative freedom; see footnote 5.

¹²See footnote 3.

¹³More precisely: GDP increased by 143 per cent in the period 1970–2007, while hours worked declined by 17 per cent.

¹⁴Labour-saving technological change (also known as labour-enhancing or labour-augmenting technological change) typically derives from process innovations (adding capital to labour), which increase *effective labour* (Jones 1981).



Source: E.U. KLEMS Growth and productivity accounts.

Note: production sector A = agriculture, B = hunting, forestry & fishing; C = mining & quarrying; D = manufacturing; E = electricity, gas & water supply; F = wholesale & retail trade; G = transport, storage & communication. Not included is construction, which shows a similar picture but less pronounced than the other sectors.

Figure 1. Hours spent labouring to produce Eurozone GDP, 1970–2007.

Note: Period 1970–2007: From the first year of the KLEMS database (1970) until the year before the beginning of the financial crisis.

labour constant and produce a higher level of output. This gain in terms of either additional goods (which may raise living standards) or a reduction in the working day (permitting us to pursue other dimensions in life), is called the *productivity dividend* (e.g. Schor 1993). As Figure 1 shows, the countries of the Eurozone have used their productivity dividend in part to reduce hours of work, and in part to increase GDP per person. The goods that are needed are produced by progressively fewer people, and as a result, a growing part of the labour that used to be needed to produce goods is no longer needed for that purpose.

If we look at these data from the point of view of ‘inclusive growth’, and the E.U. strategy to achieve it (‘growth, growth, growth’),¹⁵ what do we see? Arguably, an aspect of a society that regards itself as ‘inclusive’ is the opportunity it gives to its citizens to participate in society through work. According to the European Commission, ‘inclusive growth’ can be brought about by ‘a larger and more powerful manufacturing sector’ which would ‘control costs and labour demands’ through rising productivity. However, if ‘inclusive growth’ is to be achieved through increased productivity, or a reduction in labour required *per unit of output*, how fast would output have to grow to compensate for the declining labour requirements per unit? Hours of work will remain constant only when output grows at a rate equal to the rate of productivity growth. The faster the growth in *productivity*, the higher must be the rate of growth in *production* in order to compensate for the labour thereby obviated. On the basis of the data given in

¹⁵If the EU economy is to return to the path of sustainable and inclusive growth and find solutions to the pressing societal challenges of the 21st century, we need a larger and more powerful manufacturing engine to take us there’ (European Commission 2013: 3, 4).

Figure 1, the output of Eurozone manufacturing and other goods-producing sectors would have to triple every 37 years to keep hours per person constant!¹⁶

Even if such a strategy were realistic from the point of view of ecological sustainability, it is increasingly likely to meet with another phenomenon: *saturation of demand*. As living standards increase, and material needs are increasingly met, the demand for goods levels off – as can already be observed in the richest parts of the world today – thus reducing the potential for growth of the traditional kind, based on goods production and ‘jobs’ creation.

There are two main signs that suggest that demand is levelling off. One is the continual invention of an endless stream of new commodities in an attempt to influence and shape the tastes and preferences of consumers. In part, innovative activity meets true needs, but in part it may also point to a development described as ‘want creation’ by John Kenneth Galbraith in his book *The Affluent Society*.¹⁷ This includes now familiar phenomena such as launching new versions of existing commodities that render older, but still functional, versions obsolete. For instance, new software that is incompatible with older hardware makes it impossible to keep using older hardware that is technically in good working order but rendered obsolete by the new inventions, a phenomenon known as *planned obsolescence* (e.g. Slade 2007). Another sign is the remarkable growth of money spent on increasingly sophisticated and often unscrupulous advertising techniques (e.g. Schor 2005). Such phenomena suggest that a strategy of promoting economic growth in order to offset the obviation of labour is likely to run into a boundary set by human beings’ eventually limited need for material goods¹⁸ – a limit which reduces not just opportunities for, but perhaps also the very need for further growth.

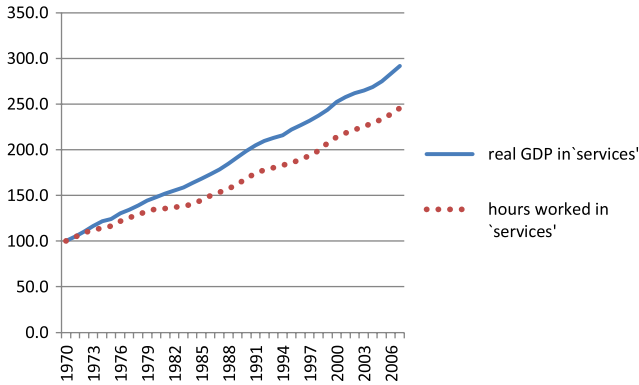
In sum, therefore, a strategy relying on low-cost growth in the manufacturing sector to bring about ‘inclusive society’ is increasingly likely to face two constraints. The first is the reduced need for labour in goods production, or ‘jobless growth’ – that is, a continuation of growth (supported by a continual introduction of new goods with the help of product innovation) but at increasingly lower levels of employment (due to labour-saving process innovation); the second is a saturation of demand which could prevent further growth altogether. That is the ‘bad news’, in terms of work.

But is it really bad news? Productivity growth implies that the task of the economy – i.e. to produce the goods which people need for their material

¹⁶Assuming constant population growth. At higher rates of population growth, output would have to increase even faster to keep hours per person constant.

¹⁷Galbraith (1958 [1999]) argued that producers of goods and services create ‘wants’ instead of satisfying ‘needs’, and predicted someday the process would fail. Companies seduce consumers to buy goods they don’t really need, and today these are often offered and bought on credit; a major problem lays in the mushrooming (and ever-riskier) debt incurred to pay for it.

¹⁸Of course, one can point to worldwide poverty and economic deprivation, but not on aggregate. Those are the result of maldistribution, not insufficient productive capacity.



Source: E.U. KLEMS Growth and productivity accounts

Note: In order to capture the 'intelligence' or 'mind' aspect of economic and social life, 'services' are calculated as the KLEMS 'services' sector minus work that is, or contributes directly to production (electricity, gas & water supply; wholesale & retail trade; transport, storage & communication). 'Services' in Figure 2 include cultural activities (education, research, health care, art, design); social-judicial activities (law-giving, regulation, the judiciary); and some production-related services (customer service, accounting, financial services², consultancy).

Figure 2. Decomposition of Eurozone GDP growth in 'services' in terms of hours and labour productivity, 1970–2007.

Note: Including 'financial services' under 'mind' or 'intelligence' may come as a surprise, in view of their contribution to the onset of the financial crisis. However, 'mind' does not necessarily mean 'good'; ideas can also be wrong. Therefore, how we educate the mind is crucial.

existence – is achieved with progressively less labour. In principle, this opens up new possibilities. As humanity increasingly liberates itself from the need to work only for material livelihood, it becomes free to pursue other aims in life.

Indeed, as Figure 2 shows, hours that were obviated in the production of goods have been used to support the growth of education, science, health care, the arts and so on, in short, the creation of non-material value. The more productivity growth frees human beings from the physical and routine mental labour required to provide for material existence, the more they are free to take on original, creative mental work.

Is this the significance of the obviation of labour in production: that it frees people to pursue new aims in life? Intellectual work, the creative activity of the mind, of understanding and consciousness, implies continual expansion. If, as Aristotle said in the famous opening sentence of his *Metaphysics*, 'by nature, all men long to know' (a point of view that will be discussed further below), then humanity finds its meaning in the development of the powers of the mind, whose development then becomes the very point of human existence.

Cultural activities such as education, research and health care, besides being valuable in themselves as a source of reflection and consciousness, also contribute to economic life as the intelligence that invents new products and production processes, educates people, and takes care of justice and people's health. It is thanks to the intelligence that is embodied in physical capital, and

to the intelligence of good teachers, doctors and judges that people can be productive in their work; intelligence makes labour more effective. This intelligence is, ultimately, the capital of society¹⁹ (as in the expression: 'the capital of a business is ideas').²⁰

Indeed, there will increasingly be *physical-capital-saving* innovations (Lowe 1988: 98); capital will increasingly consist of 'mind' (such as the intelligence that writes computer code; e.g. Benzell *et al.* 2015; Sachs and Kotlikoff 2012) rather than matter. To build these diverse forms of capital, however, people are needed; hence the rise of hours of work in cultural activities.

So far, so good. Today, however, the common understanding is that work in these areas should disappear as well, because, as is often said, its costs are becoming 'too high for the economy to bear' (e.g. Bain and Company, 2012a, 2012b). The solution suggested by policy-makers to deal with 'typically low-productivity services such as health care and personal services'²¹ is productivity growth with the help of ICT (standardisation, automation, robotisation). Health care, education, research, the judiciary, even art – so the argument runs – should be reorganised following the example of manufacturing and other goods-producing businesses where, over time, costs have been successfully reduced mainly through the obviation of labour.

Shortage of funds due to decades of tax reduction and the 'bank bail-outs' during the financial crisis have led governments to increasingly allow domains such as research, education, health care and jurisdiction to be 'opened up to the market' on conditions set by the latter. In health care, standardisation ('protocollisation'), automation and robotisation of aspects of diagnosis and treatment that hitherto were the province of doctors is introduced as part of attempts to reduce expenses and raise profits. As Bain and Company (2012b) make clear, such measures are an important condition for capital owners to enter the so-called 'health care market': 'To win in a shifting profit pool, companies need to improve how healthcare is delivered'.

Breaking down 'cognitive' jobs into smaller and smaller tasks with the help of data-processing technology opens the way to automation of 'white-collar work', including legal, medical, teaching and research professions; according to Brynjolfsson and McAfee (2014) 40–50 per cent of white-collar jobs is likely to disappear within the next 10 years. Frey and Osborne (2013) speak of 47 per cent of job categories being open to automation within two decades and this concerns mainly mental work. When, in this way, human intelligence becomes increasingly displaced by technology, entire realms within which human beings

¹⁹E.g. Wilken (1982), Daastøl (2011).

²⁰The importance to the economy of intelligence (ideas, education) is acknowledged also by new growth theorists; see Romer (1990, 1993, 1994), Jones (2002), Jones and Romer (2010); Alvarez *et al.* (2013). However, new growth theory tends to treat the growth of human intelligence ('human capital') as instrumental in the creation of material value (higher economic growth) rather than *also* a value in itself.

²¹European Commission (2013) *European Competitiveness Report 2013. Towards knowledge-driven rein-industrialisation*, p. 118; see also Figure 1.18 on p. 28.

typically develop and exercise their mental capacities may no longer offer such opportunities.

There are many examples of more or less dystopian or even apocalyptic images of what too much emphasis on technological advancement for commercial purposes may lead to, even, perhaps surprisingly, in writings by people who significantly contributed to technological progress themselves. In his article 'Why the future doesn't need us', for example, Bill Joy (cofounder and chief scientist of Sun Microsystems until 2003) considers a vision of a future society in which human work is no longer necessary and the majority of people are seen as 'superfluous, a useless burden on the system'. 'Our most powerful 21st century technologies – robotics, genetic engineering, and nanotech – are threatening to make humans an endangered species', Joy (2000) comments.

Cowen (2013) envisions a bifurcation into a small group of workers with skills highly complementary to machine intelligence, who take ever more advantage of machine intelligence, and the rest, whose skills have been mastered by computers and who will see their prospects shrink. The impact of ICT could be a reduction in the *quantity* or the *quality* of work, or a combination of both. Graeber (2013, 2015), for example, sees this in terms of an elite or ruling class that keeps control over the lives of others through stultifying low- and mid-level 'screen-sitting' that serves simply to occupy them. He observes an increase in jobs

... that are, effectively, pointless. Huge swathes of people, in Europe and North America in particular, spend their entire working lives performing tasks they secretly believe do not really need to be performed. The moral and spiritual damage that comes from this situation is profound. It is a scar across our collective soul. Yet virtually no one talks about it. (Graeber 2013)

ICT replaces work in certain sectors or types of activity and is complementary to work in others. However, in both cases it tends to take over or displace increasingly complex mental work. Work involving complex interaction between individuals is automated by standardising processes and translating them into specific rules, thus transforming creative human relationships into routine procedures (Lakshmanan 1989; Pramudita 2015). In the data, this may show up as productivity growth or increased 'efficiency' (measured as costs per unit of output), but how do software and robots compare to (real) doctors, teachers and judges in terms of the *quality* of work?

Adverse effects on human capacities are becoming visible, for example, in the computer business systems (CBSs) described by Head (2014) as a fusion of *Corporate Panoptics* (CP), a continuous and pervasive vertical monitoring of business processes encompassing all occupational hierarchies, and *Business Process Reengineering*, an equally constant activity of reshaping those processes – based on data and *Key Performance Indicators* received through CP – to make them run faster. Head concludes that CBSs (a modern version of Taylorist 'scientific management') in the U.S. deteriorate employee knowledge and experience even

in the physical (goods-producing) economy (compared to German skill-based systems), because they restrict education, knowledge and high remuneration to a narrow layer of management.²² Are individuals really empowered by information technology as 'knowledge workers' in a 'knowledge economy' asks Head (2014: 12), therefore; and is the deterioration in U.S. education at all levels related to CBSs which are 'used to marginalise employee knowledge and experience and where employee autonomy is under siege from ever more intrusive forms of monitoring and control?'

While CBSs reduce capacities even in the goods-producing economy, they become 'outright counterproductive' (Head 2014) when they are transplanted to the cultural sphere. In universities, CBSs create thick layers of bureaucracy ruling over what researchers should research and what teachers should teach, thus discouraging creative, original thinking (Head 2011). In health care, CBSs are used to create protocols where health maintenance organisation (HMO) case managers determine how patients are diagnosed and treated, taking over the tasks of doctors; the impact will depend on the knowledge and motives of managers vis-à-vis doctors (Head 2014). For Head, these are examples of *misindustrialisation*.

According to a growing number of studies, the increased computerisation of cultural life is not without impact on the human mind; it reduces our ability to learn, memorise and solve problems (e.g. Carr 2014; Hoff 2011; Spitzer 2012). If the displacement of the human mind by technology takes place unconsciously, it may undermine the very basis for genuine progress (including technological innovation), as well as the strategy of reaching inclusive society. And the bitter irony is that the problem this would result in implies precisely that it will not be recognised as such. So, in Carr (2014)'s words, it is 'time to regain the art of thinking'.

However, the aim of this paper is not to resolve definitively the debate over whether or not automation, standardisation and robotisation increase or lower the capacities of the human mind. Our focus is, rather, on the question: How much space is there to shape technological change in ways that bring about inclusive and sustainable society? As we indicated earlier and go on to explain in the next section, the imperative of neoclassical economic theory (and modern strands of thought based on it) to maximise financial returns on capital plays a decisive role in bringing about a particular type of division of tasks between human beings and technology.

3. Free to choose? Towards a wider concept of capital

If today's technological progress is biased towards technological solutions that result in unemployment and the suppression of mental life, this is not, we would

²²And this not for economic reasons; according to Head, both types of systems are profitable.

argue, an inevitable consequence of technological progress. It is a consequence of a technology and an economics informed by a narrow (conventional economic) conception of progress that focuses on material welfare and does not see the value of a free mental life.

A focus on material welfare is understandable in conditions of low living standards as prevailed for example in seventeenth- and eighteenth-century Britain where today's dominant economic perspective emerged. However, in the last two-and-a-half centuries these conditions have been modified considerably consequent on productivity growth. As Keynes speculated in his 1930 essay *Economic possibilities for our grandchildren*, if average living standards were eight times higher in 2030 than in 1930, 'the economic problem' would be solved, and people would have enough income to turn their attention to other things in life besides material existence.

However, at this point in history, what will humanity do, asked Keynes with dread:

If the economic problem is solved, mankind will be deprived of its traditional purpose. Will this be a benefit? If one believes at all in the real values of life, the prospect at least opens up the possibility of benefit. (Keynes 1930: 366)

Beyond the point where mankind has solved the problem which was hitherto the 'primary, most pressing problem of the human race' – the struggle for subsistence – further accumulation of capital for purposes of expansion of physical production would make no sense. Rather, we would 'devote our further energies to non-economic purposes' (Keynes 1930: 365). However, this would require a 'readjustment of the habits and instincts of the ordinary man, bred into him for countless generations' (ibid.: 366), and Keynes asked 'with dread' whether man would be able to discard such habits 'within a few decades'.

Almost 90 years after *Economic possibilities for our grandchildren*, the most productive parts of the world have come close to this historical point, at least in terms of *average* incomes.²³ At the same time, a novel phenomenon has made its appearance which has been named 'excess liquidity' (e.g. Rüffer and Stracca 2006), 'superabundant capital' (Bain and Company 2012a) or 'cash pools' (Pozsar 2011) – that is, liquidity apparently in excess of what is needed to finance investment in the real economy. Are the two phenomena related? Although super-abundant capital is notoriously hard to measure – it is variously measured as the value of global *financial* assets (which tripled over the past two decades)²⁴,

²³Obviously, a justified objection would be that today many household incomes, even in the rich countries of the world, are not sufficient to cover material necessities because, while economic growth has boosted incomes per capita in contemporary western societies, median incomes have stagnated (Skidelsky 2010: 143). Most people in Western societies earn much less than the average income, and in recent decades significant parts of national income have been redistributed from lower incomes towards the top of the income scale (Piketty 2014) which cannot be explained by corresponding changes in productivity (Stiglitz 2013). However, rather than being proof that Keynes was premature in his analysis, distributional issues are part of the problem (Naastepad and Houghton Budd 2015).

²⁴Bain and Company (2012a), Figure 1.1.

financial sector liabilities in excess of GDP,²⁵ growing global institutional cash pools,²⁶ or the size of the shadow banking system²⁷ – the idea is that today, there exist savings, or liquidity or liquid capital, that do not have an immediate use in the economy. What is the counterpart to this capital? ‘Superabundant capital’ places economists of various persuasions before a riddle that yet has to be solved.

Within the neoclassical model, savings are the source of financing investment in the means of production; conversely, investment in the productive base of the physical (goods-producing) economy is the *raison d’être* of savings. *But how is one to explain an increase in global liquidity?* Puzzled by this phenomenon (e.g. Pozsar 2011), most neoclassical economists do not ascribe it to the usual suspects: ‘market failure’ or inefficiency due to government intervention. It is sometimes argued that the increased liquidity is used for hedging and arbitraging, and so plays a useful role in resource allocation and investment; but this leaves unanswered the question why the economy today requires a much higher liquidity-to-GDP ratio than in the past. Moreover, clear empirical evidence of positive consequences in the economy of hedging and arbitraging is lacking (e.g. Epstein and Crotty 2013).

For Keynesians, increased liquidity reflects that the circular flow of income is not closed: not all savings are reinvested in production. What explains this ‘leakage’ from the circular flow of income? For Keynesians, it reflects the inherent instability of markets (Keynes 1936) due to the existence of fundamental uncertainty (Keynes 1923; Knight 1921), or more specifically the rise of the ‘rentier’ (Keynes 1936; Palma 2009) whose ‘liquidity preference’ tends to depress investment and increase unemployment. The conventional Keynesian (though perhaps not Keynes’s) solution would be to absorb financial surpluses through taxation and create work via the state. However, such a solution may be more adequate for *cyclical* unemployment than for the *structural* obviation of labour due to the new technologies.

For Marx(ists), the accumulation of capital in financial markets would reflect class struggle over the ownership of surplus capital, or a ‘capital surplus absorption problem’ (Harvey 2011: 26). Unfortunately, however, a ‘class-struggle’ approach emphasises what divides labour and capital and eclipses what will become increasingly needed over time: awareness of humanity’s common interest. It would be possible to step out of the class struggle (that is built into modern NAIRU theory and the monetary policy institutions based on it) if labour and capital were conceived as mutually reinforcing or supporting (rather than opposed): while capital raises labour productivity, the increase in the ‘productivity dividend’ creates new opportunities for everyone.²⁸ Naturally, this may

²⁵Chen *et al.* (2012).

²⁶Pozsar (2011).

²⁷Pozsar and Singh (2011), Pozsar *et al.* (2010; revised 2012).

²⁸E.g. Storm and Naastepad (2012), Ch. 8.

entail a significant change in ‘power relations’,²⁹ especially as regards capital allocation. However, the main power question, as we explain below, regards the power of the individual to take into account the interest of others in addition to his own. ‘Class struggle’ is unlikely to overcome today’s familiar stalemate positions until we ask not to *whom* the surplus belongs, but to *what* it belongs. To what purpose is or should it be put?

Capital super-abundance, we suggest, cannot be understood or adequately dealt with unless we understand its relationship with technological progress. When labour is obviated by technological progress – an effect of the working of human intelligence in production – the money that was used to remunerate the now obviated labour is also freed from its current use in production.³⁰ A significant part of today’s (and future) ‘super-abundant capital’ arguably originates in this money, which can perhaps be called *freed capital* – money freed by technological progress, as a consequence of growth in, and increased application of, human intelligence in production. But does freed capital, in turn, support the further growth of human knowledge, ingenuity and consciousness, to which, arguably, it ‘belongs’?

The separation of money capital from the real economy reflects an underlying structural change of whose significance *we have yet to become fully aware*. Driven by old ideas and ‘habits’ (Keynes 1930) – in particular, a concept of freedom that describes as irresponsible any behaviour of ‘corporate officials ... other than to make as much money for their stockholders as possible’³¹ – owners of capital continue to use it for maximising financial returns. With only limited high-yielding investment possibilities in a stagnating physical economy, and reduced trust in financial markets since the financial crisis, this has led to a growing demand for safe investment opportunities elsewhere. Apart from trading in land (von Braun and Meinzen-Dick, 2009; Deiniger and Byerlee, 2011; Sassen 2014) and commodities (e.g. Helbling and Roche 2011; Schmidt 2016), cultural domains such as care for physical and mental health, justice, research, and education, hitherto considered ‘non-market’,³² are increasingly used as ‘instruments’ for generating returns (e.g. Bain and Company 2012b; Berman 2012) rather than protected and cultivated as a source of future progress. One of the reasons for ‘old economic habits’ invading non-economic realms of society – a phenomenon which has been named ‘economic imperialism’ (Fine 2002; Frey 1993; Landes 1961; Lazear 2000) – is the lack (real or imagined) of other perspectives on these issues.

²⁹As described in, for example, the four volumes of Michael Mann’s *The Sources of Social Power*.

³⁰As explained by the late University of Freiburg professor of economics Folkert Wilken. Wilken (1982) calls this money ‘free capital’, money that is no longer needed in production and therefore free to move on to a new destination. ‘Freed capital’ can be understood as capital freed by the application of human intelligence to production.

³¹Few trends could so thoroughly undermine the very foundations of our free society as the acceptance by corporate officials of a social responsibility other than to make as much money for their stockholders as possible’ (Friedman 2002).

³²See, for example, European Commission (2013): 54.

In 1930, Keynes was concerned whether, a 100 years from then, humanity would find anything more amusing to do than continue to chase money and capital:

... for the first time since his creation man will be faced with his real, his permanent problem – how to use his freedom from pressing economic cares, how to occupy the leisure, which science and compound interest will have won for him, to live wisely and agreeably and well (Keynes 1930: 367).

Adherence to a narrow conception of progress would throw up serious problems:

To judge from the behaviour and the achievements of the wealthy classes today in any quarter of the world, the outlook is very depressing! (ibid.: 368).

Would humanity recognise ‘the love of money as a possession’ or *homo economicus* for what it is,

a somewhat disgusting morbidity, one of those semi-criminal, semi-pathological propensities which one hands over with a shudder to the specialists in mental disease. (ibid.: 369)

Keynes knew very well that unto itself economic theory does not provide answers to the question of humanity’s ‘permanent problem’. He himself hinted at qualities of life beyond material existence – suggesting, indeed, that these are more ‘real’ than the struggle for material existence itself. However, he failed to formulate a full answer, because it seems not to have occurred to him to relate the *free time* that productivity growth would bring – which today takes the form of technological unemployment or underemployment – to the capital that is also freed by it.³³

Unless this *freed capital* – money freed from its current use in physical production as a result of the working of human intelligence, and no longer needed in such production – finds a socially and scientifically acknowledged counterpart, one should not be surprised if, to use Keynes (1941)’s words, ‘loose funds sweep round the world disorganising all steady business’. Rather than using the money that is no longer needed in production for material welfare, and so is free to fund our enjoyment of ‘the arts and values of life’, to paraphrase Keynes (1930) and Russell (1935),³⁴ we permit it to enter the cultural sphere in a way that reduces its very source (original, creative mental activity) to a ‘cost factor’ to be eliminated in order to serve the further accumulation of material (and often merely financial) wealth.

³³Naastepad and Houghton Budd (2015).

³⁴Some of the possibilities opened up by the decline in the hours needed in production for livelihood (thanks to the growth of human intelligence) are described by philosopher Russell (1935) as:

Medical men will have the time to learn about the progress of medicine, teachers will not be exasperatedly struggling to teach by routine methods things which they learnt in their youth, which may, in the interval, have been proved to be untrue

and

Young writers will not be obliged to draw attention to themselves by sensational pot-boilers, with a view to acquiring the economic independence needed for monumental works, for which, when the time at last comes, they will have lost the taste and capacity.

Contrary to what could be happening, the imperative of accumulation increasingly brings the non-material dimensions of life – previously described, for instance by sociologists such as Max Weber³⁵ as belonging to non-economic realms, in particular culture – under the sign of profit maximisation. Unless the creation of non-material value is seen as both a sign and the source of progress, including economic progress, it will, in the end, disappear or be adapted wholly to the demands of the current narrow concept of capital, to which however it does not belong.³⁶

Before closing this section, it is important to note that not all ‘excess liquidity’ or ‘superabundant capital’ is *freed capital*. Financial capital is continuously generated from various sources besides productivity growth. Part of the financial capital accumulated in the past three decades arguably results from paying too-low prices for goods and labour (wages), and also, for example, from ‘free riding’ on the environment and from speculation. As a result, many households, even in the richest countries of the world, cannot fund even their material necessities. Such liquidity is not truly ‘superabundant’, if by that term one understands money that the physical economy cannot accommodate and has no use for. It is withdrawn, rather than abundant. It exists because not everyone’s needs have been met, not by a long way. Indeed, capital that is formed by withdrawing money from these sources is not truly capital, if by capital we mean wealth that originates in, or reflects the ingenuity, creativity and inspiration, or productive mental activity that gives rise to and guides economic activity.³⁷

Our question with respect to the counterpart of ‘excess liquidity’ regards only straightforward economic sources of capital formation, in particular regular innovations in production. This capital will continue to be created, and unless we identify its counterpart – a counterpart that *uses it up* rather than preserves it, for it will continue to come about – the real possibility exists that it will result in new financial bubbles and crises, in addition to technological un(der)employment and the suppression of mental activity. For the problem that brings about these crises, we suggest, is not the loosening of liquidity, or financial capital, from the physical economy per se, but the lack of a perspective which tells us how ‘loose’ or ‘loosened’ capital originating in regular (economic) types of capital formation can be used, more precisely used up, productively.

Once we realise that the creation of non-material value is as real and as important as, if not greater than, the value connected to goods production, ‘freed

³⁵Or more recently in Michael Mann’s neo-Weberian approach (see Heiskala 2016).

³⁶Romer (1990, 1993, 1994) has argued that knowledge, an aspect of culture, can be commercially developed. Although this may be true for knowledge that, in the short to medium run, yields the demanded financial returns, the development of knowledge that does not yield ‘benchmark’ financial returns is likely to be neglected (e.g. Berman 2012).

³⁷E.g. Houghton Budd (2011), Daastøl 2011, Wilken (1982).

capital' can be linked to the further growth of human knowledge, understanding and consciousness – or, as we suggest in the next section, to Aristotelian 'character'. Thus, capital would be recognised as serving two purposes rather than one: financing the means of production for providing material welfare, and funding the growth of non-material welfare, or 'the real values of life' (Keynes 1930).³⁸ If it is important to the human being to use his or her capacities, be educated, and be of value to others in this way; that is, if the end or purpose of a human being is non-material growth and material growth is a *means* to this end, then capital and technology must serve both.

However, such a wider understanding of capital and technology requires a concept of freedom that allows or encourages individuals to allocate capital to further both purposes. Whether such freedom is perceived as necessary depends on one's perspective on the end or purpose of human life. As noted at the outset of this paper, it is on a wider understanding of these three – capital, freedom and human life – that a full theoretical basis for 'inclusive and sustainable society' depends.

4. Capital and character

Unless we arrive at a standpoint from which we can determine a purpose for human life, it will prove impossible to define progress and make judgements about the responsibility of research and innovation. But such standpoints have been rejected at least since the Enlightenment (MacIntyre 1981 [2013], 2009), and are therefore hard to find both in contemporary economics and in philosophy.

Reflections on these issues are, nevertheless, found with some of the founding fathers of the economics discipline and in new lines of research which have picked up threads spun by, for instance, Mill, Marx and Aristotle (to take examples from different colours within the spectrum of economics).

For John Stuart Mill, the ultimate end of human existence is the full development of human potentialities (Downie 1966): '... the end of man is the highest and most harmonious development of his powers to a complete and consistent whole' (Mill 1859: 50). Karl Marx's analysis is conventionally interpreted as an analysis of the capitalist system, at whose root lies what he saw as the contradictions of the capitalist system – the commodification of labour and its associated alienation. However, rather than the overthrow of the capitalist system, the unfolding and development of the individual appears to be primary; ideally, therefore, Marx's theory is first and foremost a philosophy of man (Copleston 2003).

In emphasising the full unfolding of human nature, both Mill and Marx came close to the philosophers of Greek antiquity, in particular to Aristotle, whose

³⁸An idea also explored in Houghton Budd (2011), Wilken (1982), Naastepad and Houghton Budd (2015).

work is also being revived in new lines of research in economics and business.³⁹ For Aristotle, human beings have a specific nature that determines their proper goal or *τέλος* (*telos*, end), in life. This goal is *εὐδαιμονία* (*eudaimonia*, happiness), a term which is also translated as ‘the good life’ or ‘flourishing’. Crucially, *eudaimonia* is not the maximisation of anything,⁴⁰ but consists in the full unfolding of human nature, by living as human beings ought to live (we return to this in the next section). The end, in the sense of purpose, of any kind of life is to develop as fully as possible the full range of potentialities (*δύναμις*, *dunamis*) that belong to such a life. For most birds, for example, this will include the ability to fly, for fish the ability to swim, for trees the ability to be well rooted – and for humankind it includes developing the ability to attain insight and to act accordingly.⁴¹ Thus, *eudaimonia*, happiness, requires the development of all the interdependent elements that it entails. For humankind the elements of *eudaimonia* include the possibilities of acquiring *τέχνη* (*technè*, practical skills), of developing *ἀρετή* (*aretè*, virtue) and of aspiring to *ἐπιστήμη* (*epistèmè*, knowledge) and *σοφία* (*sophia*, wisdom). Reaching one’s *telos* does not happen automatically, however; it requires the development of *ἦθος* (*ethos*, a virtuous character), or an inner sense of what is right and worthy in human life – which is nothing other than consciousness of one’s own *telos*.⁴²

The history of moral philosophy from the Enlightenment onwards is, as MacIntyre paints it, a history of attempts to ground moral requirements in something other than the human *telos*, as, for example, ‘Hume attempted to do by arguing that moral judgements are grounded in our capacity for fellow-feeling’ (Voorhoeve 2009); or Jeremy Bentham, who grounds moral judgements in utility. These attempts, MacIntyre claims, have all failed. He concludes that ‘it is only by trying anew to formulate an end for human life in the Aristotelian tradition that we can hope to arrive at a standpoint from which we can *rationaly* evaluate claims about what is morally required’ (Voorhoeve 2009: 114, 115).

In the modern literature, the development of character (e.g. Grant 2011; Sandel 2012; Sedláček 2011; Sen 1997) and capacities or ‘capabilities’ (Nussbaum 2011; Sen 2001) are again highlighted as the highest human goal. The real need of human beings, perhaps especially of those whose material needs have been satisfied, is the fulfilment of higher goals in life, particularly the development of such higher capacities as morality, creativity and a mode of self-actualisation

³⁹See, for instance, Pack (2010a, 2010b, 2008, 1985), Solomon (2004, 1993), Ghoshal (2005), Cheffers and Pakaluk (2007), Giovanola (2009), Page (2010), Sison (2010), Houghton Budd (2011), Sedláček (2011), Giovanola and Fermani (2012).

⁴⁰Such as pleasure, or ‘happiness for the greatest number’, as in Jeremy Bentham’s interpretation of Hobbes (1651)’s and Locke (1689)’s pleasure-pain psychology.

⁴¹For a fundamental defence of this Aristotelian understanding of the realm of life, of living beings, see Mulder (2016).

⁴²Typically, the development of a virtuous character understood along Aristotelian lines consists in doing what such a character would commend – for example, one develops a just (or courageous, or friendly) character by doing just (or courageous, or friendly) deeds.

that includes responsibility for others. If, therefore, the motive to develop mentally, to realise one's intellectual, creative and moral potential, in a word, to develop 'character', is taken seriously, how can the economy and technology contribute to its realisation?

If human life has a *telos*, a state of fulfilment or completion, then so, too, will the modern economy and its essential expression – capital. Within the economics profession of the last ninety years, perhaps no one has expressed this more clearly than Keynes who, for example in his 1930 essay *Economic possibilities for our grandchildren*, hinted at qualities of life beyond material existence – suggesting, indeed, that these are more 'real' than the struggle for material existence itself. Economist Robert Skidelsky and philosopher Edward Skidelsky (2012) draw attention to Keynes's Aristotelian underpinnings – especially the idea that 'we cannot ... do fine actions if we lack resources' (Skidelsky 2009: 134). For Aristotle, the purpose of the economy is to generate the material conditions that enable the human being to do 'fine actions'.

It is in these terms, ultimately, that Keynes understood 'the economic problem'. Taking this argument to its completion requires a debate between the human *telos* and the normative foundations of conventional economic theory. As we have tried to explain above, this will include rethinking some of the most fundamental questions of economics, in particular regarding the nature and purpose of capital. It will also involve finding an alternative to the pursuit of private gain as the basis of decision-making and our economic and social order (Hirschman 1997).

5. Two concepts of freedom – or making visible the 'invisible hand'

Freedom to choose between alternative socio-economic trajectories becomes a possibility only when capital is liberated from the Benthamite⁴³ or Friedmanite compulsion to maximise personal gain, so that it becomes free to serve two purposes – material and non-material – rather than one. However, this raises a problem. If capital is no longer guided by a single, unambiguous principle – profit maximisation – how are decisions about capital allocation to be made? Are not the preferences of individuals often diametrically opposed to each other? Will not hell break loose?

The consciousness of every individual is indeed limited – an argument raised by the neoclassical school as well as by Hayek (1945), von Mises (1949 [1998]) and other members of the Austrian school in favour of markets – and not without reason. According to the Austrian school, even the imperfect markets of the

⁴³ According to Bentham (1781), not only *is* human behaviour, as a matter of fact, dictated by the pursuit of pleasure and avoidance of pain; in order to achieve the greatest happiness for the greatest number, it *should* be so dictated. This is Bentham's way of grounding moral requirements in something other than human *telos*.

real world⁴⁴ are more suited to dealing with the unlimited amount of information required to understand and manage the economic process than any lone individual, whose knowledge and ability to comprehend will always be too limited to be able to oversee the whole. It is on these grounds that markets are said to be the best solution to the problem of economic order when that order is far too complicated to be grasped by individual consciousness.

And yet proof that decentralised use of knowledge and pursuit of self-interest will automatically generate equilibrium has never been given (e.g. Schlefer 2012).⁴⁵ For the neoclassical school, the solution is to assume a 'representative individual' or 'central planner' who 'solves' the coordination problem. However, the disadvantages of centralised planning are also evident.

Both approaches – decentralised decision-making and coordination – have their weaknesses but also their strengths, so could not the strengths of both – the individual initiative associated with the market and the coordination that is conventionally entrusted to the state – be combined while their weaknesses are avoided? Could the consciousness that is required be that of non-collusively collaborating individuals working together to supplement and complement their different perspectives (Houghton Budd 2011)? Bringing together the knowledge of well-informed individuals could, in principle, enhance economic life. The Austrian and neoclassical schools reject this possibility; but they do so from the point of view of self-interested and identical, 'representative' individuals who meet each other at random (Kirman 1992). However, in reality, individuals acquire different kinds of knowledge as they enter the worlds of production, trade and consumption. Since it is hard if not impossible for a single individual to understand economic conditions from all these perspectives simultaneously, individuals communicate with each other to complement and attune each other's views and perspectives.

Thus, an image emerges of economic solutions reached through associations (Houghton Budd 2011) of individuals who come to judgements via a sum total of intelligence arrived at by looking at economic phenomena from different perspectives, resulting in 'deliberate choices' and 'spontaneous conformity' (Lowe 1988) – as distinguished from decisions enforced from outside, such as, conventionally, through either the 'discipline of the market' or coercion by the state. As informed decisions reached in many small groups operating in a subset of the economy 'propagate through the economy' (Kirman 1992), it may well be that 'the evolution of such an economy, ... [consisting of] many interacting heterogeneous agents ... may be relatively stable' (Kirman 1992).

⁴⁴In contrast to the neoclassical school, which assumes perfect markets, the Austrian school acknowledges that markets produce crisis from time to time.

⁴⁵After Arrow and Debreu (1954)'s proof of the *existence* of an equilibrium for a competitive economy, Sonnenschein (1972), Mantel (1974), Debreu (1974), Hahn (1984) and more recently Kirman (1989, 1992) have shown that, for a perfectly competitive economy, proof of a *spontaneous convergence towards* a unique equilibrium cannot be given. See also Rizvi (2006), Offer and Söderberg (2016: 27).

Still, there will be many occasions where views and opinions differ and where it is hard to reach consensus. Indeed, 'non-conformity [is] a source of emancipatory progress' and 'some degree of disorder is the price of autonomous individuation, and thus of genuine emancipation' (Lowe 1988: 12, 13). Such situations, we propose, require two things.

First, discipline is required on the part of each individual to take into account the interest of others in addition to one's own interest. This will include the discipline to 'educate one's desires' (Keynes, quoted in Skidelsky 2009) which requires, in Aristotle's terms, 'character'. From Aristotle onwards, freedom *from* constraints on one's behaviour – freedom in the negative sense – has been contrasted with freedom or liberty in the positive sense: the freedom *to* act in responsible or humane ways (Berlin 2002). This, however, requires emancipation from the mere drive to pursue pleasure and avoid pain, and grounding actions on self-gained insight as to what *is* responsible or humane – insight, that is, into the *telos* of humankind.

Second, as part of this exercise, the individual will need a theory or guidelines that provide grounds for judgements concerning responsibility. Wider concepts of capital and freedom would not be complete without such a theory, a first sketch of which is given next.

6. Judging innovations in ICT on the basis of Aristotle's golden mean

Assuming for the time being that we widen our understanding of capital, thus permitting freedom of choice, so that we are no longer bound to one location on the technology continuum – the one that coincides with maximisation of shareholder value – how do we discern and, subsequently, choose between responsible and irresponsible innovation (and their correspondences in capital allocation)?

The basis for such a choice will be a full conception of the end or *telos* of human life. Developing such a conception is, indeed, part of the purpose of human life itself. After all, as Aristotle wrote, human beings long to understand – themselves, as well as the world they find themselves in.⁴⁶ Taking Aristotelian *eudaimonia* (as explained in Section 4) as our point of departure, this is, however, not as straightforward a matter as it might seem. For one thing, realising *eudaimonia* is a very open-ended matter: the particular articulation of skills, virtues and understanding that you or I are aiming for may differ greatly, depending on the various talents and capabilities each of us has, and on the choices we individually make.

Moreover, *per* Aristotle, happiness does not consist in *maximising* each of its components but in *balancing* them – here we are approaching Aristotle's famous

⁴⁶Aristotle (2012).

doctrine of the 'golden mean'. The human *telos* is a rich and complex but *unitary* matter: every one of its elements intrinsically depends on all the others. Let us take generosity and justice as two examples of such elements: it is clear that maximising generosity without developing justice will not result in a better life. Being generous in an unjust way is, in fact, a recipe for trouble.⁴⁷

Something similar holds for the elements of happiness internally. A virtue like generosity does not consist in, say, maximising giving one's possessions away, but in giving appropriate amounts in the right circumstances to the right people. And that entails Aristotle's concept of the 'golden mean'. In Aristotle's own words:

finding [the mean] is difficult, especially in particular cases, since it is not easy to determine how one should be angry, with whom, for what reasons, and for how long; indeed we sometimes praise those who fall short and call them even-tempered, and sometimes those who flare up, describing them as manly. ... This much, then, is clear – that the mean state is in every case to be praised, but that sometimes we must incline towards the excess, sometimes towards the deficiency, because in this way we shall most easily hit the mean, namely, what is good. (Aristotle, *Nicomachean Ethics* II.9, 1109b14-29)

In search of the 'golden mean', one navigates the space between two extremes. This navigation has little to do with calculation; it is in essence a qualitative kind of estimation. It does not aim instrumentally at some fixed quantity (such as shareholder value, or overall utility), but rather aims at being in accord with the whole of human nature – that is, with *eudaimonia*.⁴⁸

The norms that guide our decisions reside, according to this Aristotelian view, in our very nature. But not only in our *own* nature: given our capacity for insight in the natures and *telos* of the things and phenomena around us, we can come to understand what would be in accord with their natures, too, and act accordingly. It is, of course, not at all easy to arrive at genuine insight into the nature of anything, perhaps least of all into our own nature, and hence here again there is no basis for a fool-proof calculation that will tell us what to do. Still, we should take our striving for understanding seriously. And that holds

⁴⁷Strictly speaking, then, it is impossible to develop generosity without justice; being generous in an unjust way is simply not being generous at all. Or, as Anscombe (1993: 153) writes, 'helping your neighbours *is* doing well [i.e. *eudaimonia*], but killing someone for them is not helping them'. These observations illustrate the way in which the elements of the human *telos* are interdependent. See also Rödl (2007) and Wiggins (2009).

⁴⁸A defender of utility maximisation might argue that all this can be included in the utility function – reflecting that the individual attaches high utility to, say, acts that are courageous, generous or just. This, however, effectively treats objective measures of goodness as brute, subjective preferences ('Ah, you prefer generous acts? Nice. I personally prefer apple pie over generosity'), thus tacitly distorting the logical character of those 'preferences' as elements of *eudaimonia*. Aristotelian freedom is thereby excluded: maximising utility does not leave room for genuine choice, since the utility derived from one good can always be traded for the utility given by another, beyond moral commitment. This philosophical point also raises questions of (neoclassical) economic methodology. Do the mathematical properties of the neoclassical model permit commitment to moral values? In the neoclassical model, individuals substitute smoothly between goods in response to relative prices, thus maintaining the mathematical properties of the (convex, continuous, monotone) utility function; it is not possible to always prefer good *A* over good *B* for moral reasons (or 'commitment'; Sen 1977, 1997) independently of relative price movements, for '[if] non-convexities are allowed ... then the existence of an equilibrium is no longer certain' (Ackerman 2002).

also for our approach to the economy and technology as such: in this case, our striving for a clear understanding of their nature is ineluctably tied to our own.

Let us now apply this Aristotelian understanding of choice to our problem of choosing which direction technology and innovation should take. Without doing justice to the various perspectives on the relationship between technological development and human development we may, perhaps, distinguish two extreme positions. On the one hand, those who view the human being as an autonomous being with inherent capacities such as rationality and freedom, warn against possible destructive effects of technology on the human mind and its creations: culture, science, morality, autonomy. Taking such warnings to the extreme leads to Luddism. On the other hand, those who are prone to view man as a being who has always been shaped by his own technical instruments and artefacts, see in the new technologies exciting new chances for the evolution of the human being (as they see this). In the extreme, this leads to unquestioned optimism concerning every new technological possibility.

Thus we have identified the relevant extremes: Luddism, or a rejection of everything that smacks of technology for its own sake, on the one hand, and an unquestioned embracing of every new technological possibility on the other – extremes we may perhaps, respectively, call *technophobia*⁴⁹ and *technophilia*.⁵⁰ When we recall relevant considerations and observations concerning the nature of the economy and technology shared in earlier sections, it is easy to see what is wrong with these two extremes, just as in the case of generosity we can see what is wrong with wastefulness and avarice. *Technophobia* forgets the role technology plays in freeing human beings from the need to work (only) for material existence, thus enabling them to develop their potentialities in other directions more fully. *Technophilia* forgets the dangers to which excessive automation of human social and mental life give rise. It is not easy, of course, to arrive at the ‘golden mean’ in this case. It requires a much deeper understanding of social reality at large and in particular of the role of the economy and technology within that reality. In short, it requires a broad vision of society.

Since each shared vision starts with a vision at the level of the individual, how, then, do we come to an individual judgement? Here we reach the main point of this paper: while we need to come to a judgement as to the right direction for technological development, both individually and collectively, we lack the possibility of properly engaging with it, since, as noted earlier, the normative basis of contemporary economic theory denies us a choice. What we need, therefore, is an understanding of what it takes for the issue to be properly treated.

We emphasise that this requires, first of all, a setting that leaves or even deliberately creates room for such judgements and choices to be made. This means that solutions are neither predetermined nor excluded by the views of

⁴⁹E.g. Sale (1995), Kaczynski (2010).

⁵⁰E.g. Kurzweil (2006, 2012).

others – such as the normative prescriptions of any particular economic theory. A second condition for an adequate judgement on the direction of technological development is the following: it should secure that in future such room for exploring the technology continuum remains available. It may (or may not) turn out that extra measures are required, in parallel with technological development as envisaged, in order to maintain that dialectical space. At any rate, it requires enabling people to *acquire and maintain* the cognitive, social and other skills and capacities necessary to make such judgements and choices.

Our suggested theoretical basis for deciding which course technological development should take thus diverges sharply in its methodology from the decision-making that standard economic theory avers.⁵¹

Interestingly, however, there is a structural similarity between the Aristotelian and the utilitarian views. One could posit the utilitarian view as a species of Aristotelianism, albeit one that singles out but one aspect of human life – the psychological experiences of pleasure and pain – to the exclusion of all other aspects, yielding a highly watered down, reductionist conception of the end of human life. The Aristotelian conception, by contrast, is inclusive: it does not thus restrict our understanding of the human being. However, and most importantly, the utilitarian approach in fact eclipses the Aristotelian mode of thought in terms of *balancing* between two extremes, and replaces it with a one-dimensional opposition of pleasure (good) vs. pain (bad), which leads to a distorted, linear understanding of progress as the maximisation of pleasure (e.g. in the form of maximising shareholder value).

The utilitarian approach does not take the full nature of the human being into consideration, and thereby invites oppositions, such as market vs. state, or economics vs. ethics. By positing such oppositions and discussing how the apparent opposites can be reconciled or connected, one is attempting to marry a restricted, reductionist utilitarian understanding with something one (rightly) finds is missing from it. But that will make only for a shotgun wedding at best.⁵² The point is that one thereby fails to make the shift from a restricted, dualistic utilitarian understanding of the aim of human life towards an encompassing understanding in terms of balancing, of finding the ‘golden mean’. When we *do* make that shift, our understanding of economic life and technology will need to be rethought in order to fit the newly gained broader understanding of the aim of human life. (Conversely, when we understand economic life and the

⁵¹This is true even if, upon reflection, the course we decide for future technological development happens to coincide with what economic theory would have enforced. For the reasons we mentioned this appears to be a theoretical possibility only.

⁵²For example, given the prevailing financial and social order, labour-saving technological progress leads to *exclusion*. To remedy this problem, E.U. policy documents call for *inclusion*. But with unchanged economic theory, this leads to attempts to reconcile the ‘inclusive society’ with maximisation of shareholder value (also outside the economy proper, i.e. the material economy). The result is *marginalisation*, i.e. the inclusion of people in terms of jobs, but at declining remuneration and deteriorating employment conditions (see Hassel 2011; Storm and Naastepad 2015).

workings of capital in this new way we will find ourselves making, or indeed having made, that shift.)

When assessing developments in ICT, there are clear signs that thoroughgoing consideration of their resultant products, services and possibilities is required in order to determine which of these genuinely further *eudaimonia* (however sketchy our understanding of it is), and which of these do not, or may even prove harmful to it. In Section 2 above, we mentioned a few prominent writers from the domain of ICT development itself who voice worries in this direction. It is therefore likely, we should note, that the result of such assessments, on the Aristotelian basis we promote, will often be a nuanced one – neither downright condemnation, nor unquestioned glorification.

Freedom in choosing the direction of technological change may lead to a better understanding of where technology is appropriate and where it is not, and to a different degree and use of technology in different spheres, that is, to *sphere-appropriate technology*. An understanding of economic life that looks beyond the norms of one-dimensional utilitarianism will have room for such considerations. Moreover, it will be forceful enough to implement the conclusions arrived at in economic practice. That is to say, it will be in a position to implement technological innovations to the extent that they are indeed in line with further cultural development, along with the possibility for all human beings involved to live well.

7. Conclusion

What explains the discrepancy between goals that are deemed responsible, in particular an ‘inclusive and sustainable society’, and developments in ICT that reduce the likelihood of attaining them?

We have suggested that it is due to a conflict between social objectives and the normative prescriptions of conventional economic theory grounded in a narrow (utilitarian) concept of freedom. Realisation of ‘inclusive and sustainable society’ requires a wider (Aristotelian) understanding of freedom, responsibility and capital centred on furthering the non-material aspects of life in addition to meeting material needs.

Freedom of choice with respect to the direction of technological change and the ‘inclusiveness’ of society will remain an illusion unless capital is permitted to take on a dual role – as ‘financier’ of physical production *and* enabler of further non-material human evolution. This wider understanding of freedom, capital and human life will permit individuals to give direction to, rather than being directed by, technological change.

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References

- Acemoglu, D. and Restrepo, P. (2017) *Robots and Jobs: Evidence from U.S. Labour Markets*, NBER Working Paper 23285, Cambridge, MA: National Bureau of Economic Research.
- Ackerman, F. (2002) “Still Dead After all These Years: Interpreting the Failure of General Equilibrium Theory,” *Journal of Economic Methodology* 9(2): 119–139.
- Alvarez, F. E., Buera, F. J., and Lucas, R. E., Jr. (2013) *Idea Flows, Economic Growth, and Trade*, NBER Working Paper 19667, Cambridge, MA: National Bureau of Economic Research.
- Anscombe, G. E. M. (1993 [2005]) “Practical Truth,” in M. Geach and L. Cormally (eds.) *Human Life, Action, and Ethics, Essays by G.E.M. Anscombe*, Exeter: Imprint Academic, Ch. 11, p. 149–158.
- Aristotle (2000) *Nicomachean Ethics* (translated by R. Crisp), Cambridge: Cambridge University Press.
- Aristotle (2012) *Metaphysics* (translated by H. Lawson-Tancred, Rev ed, London: Penguin Books.
- Arrow, K. J. and Debreu, G. (1954) “Existence of an Equilibrium for a Competitive Economy,” *Econometrica* 22(3): 265–290.

- Baetjer, H., and Lewin, P. (2007) *Can Ideas be Capital: Can Capital be Anything Else?* Mercatus Center Working Paper 83, George Mason University, Fairfax, Virginia, USA.
- Bain & Company, Macro Trends Group (2012a) *A World Awash in Money. Capital Trends through 2020*. Available at: www.bain.com
- Bain & Company (2012b) *Health Care 2020* (by George Eliades, Michael Retterath, Norbert Hueltenschmidt and Karan Singh). Available at: <http://www.bain.com/publications/articles/healthcare-2020.aspx>
- Bentham, J. (1781) *An Introduction to the Principles of Morals and Legislation*. [2007 edition published by New York: Dover Publications].
- Benzell, S. G., Kotlikoff, L. J., LaGarda, G., and Sachs, J. (2015) *Robots are Us: Some Economics of Human Replacement*, NBER Working Paper 20941, Cambridge, MA: National Bureau of Economic Research.
- Berlin, I. (2002) *Liberty*, H. Hardy (Ed.) Oxford: Oxford University Press.
- Berman, E. P. (2012) *Creating the Market University. How Academic Science Became an Economic Engine*, Princeton, NJ: Princeton University Press.
- von Braun, J. and Meinzen-Dick, R. (2009) *"Land Grabbing" by Foreign Investors in Developing Countries: Risks and Opportunities*, IFPRI Policy Brief 13, Washington, DC: International Food Policy Research Institute.
- Brynjolfsson, E., and McAfee, A. (2014) *The Second Machine Age. Work, Progress, and Prosperity in a Time of Brilliant Technologies*, W. W. Norton & Company, New York.
- Carr, N. (2014) *The Glass Cage. Automation and Us*, New York, NY: W. W. Norton & Company.
- Case, A. and Deaton, A. (2017) "Mortality and Morbidity in the 21st Century," Brookings Papers on Economic Activity, BPEA Conference Drafts, March 23–24.
- Cheffers, M. and Pakaluk, M. (2007) *Understanding Accounting Ethics*, 2nd ed., Manchaug: Allen David Press.
- Chen, S., Liu, P., Maechler, A., Marsh, C., Saksonovs, S., and Shin, H. S. (2012) *Exploring the Dynamics of Global Liquidity*, IMF Working Paper WP/12/246, Washington, DC: International Monetary Fund.
- Copleston, F. (2003) *A History of Philosophy, Vol. 7: 18th and 19th Century German Philosophy*, London: Continuum.
- Cowen, T. (2013) *Average is Over. Powering America Beyond the Age of the Great Stagnation*, New York, NY: Dutton (Penguin).
- Daastøl, A. M. (2011) "Friedrich List's Heart, Wit and Will: Mental Capital as the Productive Force of Progress," PhD dissertation. Available at: http://www.db-thueringen.de/servlets/DerivateServlet/Derivate-29684/Dissertation_Daastoel_a.pdf; see also: <http://www.db-thueringen.de/servlets/DocumentServlet?id=24133>
- Deiniger, K. W. and Byerlee, D. (2011) *Rising Global Interest in Farmland*, Washington, DC: The World Bank.
- Debreu, G. (1974) "Excess-demand Functions," *Journal of Mathematical Economics* 1(1): 15–21.
- Downie, R. S. (1966) "Mill on Pleasure and Self-development," *The Philosophical Quarterly* 16(62): 69–71.
- Elsby, M. W. L., Hobijn, B., and Sahin, A. (2013). "The decline of the U.S. labor share," Brookings Paper on Economic Activity, Fall, 1–63.
- Epstein, G., and Crotty, J. (2013) *How Big is too Big? On the Social Efficiency of the Financial Sector in the United States*, PERI Working Paper 313, University of Massachusetts, Amherst (M.A.).
- European Commission (2011) *European Commission Staff Working Paper Accompanying the Communication from the Commission 'Horizon 2020 – The Framework Programme for Research and Innovation'*, Brussels.

- European Commission (2013) *European Competitiveness Report 2013: "Towards Knowledge-driven Reindustrialisation"*, Brussels.
- Fine, B. (2002) "'Economic Imperialism': A View from the Periphery," *Review of Radical Political Economics* 34(2): 187–201.
- Frey, B. S. (1993) "From Economic Imperialism to Social Science Inspiration," in C. Rowly, F. Schneider, and R. D. Tollison (eds) *The Next Twenty-five Years of Public Choice*, Berlin: Springer Verlag, pp. 95–105. (Reprinted from *Public Choice* Vol. 77, No. 1).
- Frey, C. B., and Osborne, M. (2013) *The Future of Employment. How Susceptible are Jobs to Computerisation?* OMS Working Paper 1, Oxford Martin School, Oxford.
- Friedman, M. (2002) *Capitalism and Freedom*, (40th anniversary ed, Chicago, IL: University of Chicago Press.
- Galbraith, J. K. (1958 [1999]) *The Affluent Society*, 5th Revised ed, London: Penguin.
- Ghoshal, S. (2005) "Bad Management Theories are Destroying Good Management Practices," *Academy of Management Learning and Education* 4(1): 75–91.
- Giovanola, B. (2009) "Re-thinking the Anthropological and Ethical Foundation of Economics and Business: Human Richness and Capabilities Enhancement," *Journal of Business Ethics* 88(3): 431–444.
- Giovanola, B., and Fermani, A. (2012) "Ethics, Economic Organizations, and Human Flourishing: Lessons from Plato and Aristotle," in G. P. Prastacos, F. Wang, and K. E. Soderquist (eds) *Leadership and Management in a Changing World. Lessons from Ancient Eastern and Western Philosophy*, Berlin: Springer Verlag, pp. 273–287.
- Graeber, D. (2013) "On the Phenomenon of Bullshit Jobs," *Strike! Magazine*, August 17, Available at: <http://www.strikemag.org/bullshit-jobs/>
- Graeber, D. (2015) *The Utopia of Rules: On Technology, Stupidity, and the Secret Joys of Bureaucracy*, New York, NY: Melville House.
- Grant, R. W. (2011) *Strings Attached. Untangling the Ethics of Incentives*, Princeton, NJ: Princeton University Press.
- Hahn, F. H. (1984) *Equilibrium and Macroeconomics*, Oxford: Basil Blackwell.
- Harvey, D. (2011) *The Enigma of Capital and the Crises of Capitalism*, London: Profile Books.
- Hassel, A. (2011) *The Paradox of Liberalisation – Understanding Dualism and the Recovery of German Political Economy*, LEQS Papers 42/2011, London: London School of Economics.
- Hayek, F. (1945) "The Use of Knowledge in Society," *American Economic Review* 35(4): 519–530.
- Head, S. (2011) "The Grim Threat to British Universities," *The New York Review of Books*, January 1358 (1). doi: [10.17323/1814-9545-2011-2-282-295](https://doi.org/10.17323/1814-9545-2011-2-282-295).
- Head, S. (2014) *Mindless. Why Smarter Machines are Making Dumber Humans*, New York, NY: Basic Books.
- Heiskala, R. (2016) "The Evolution of the Sources of Social Power, and Some Extensions," in R. Schroeder (ed) *Global Powers: Mann's Anatomy of the 20th Century and Beyond*, Cambridge: Cambridge University Press, pp. 11–37.
- Helbling, T. and Roche, S. (2011), "Rising Prices on the Menu," *Finance and Development* 48(1). Available at: <http://www.imf.org/external/pubs/ft/fandd/2011/03/helbling.htm>
- Hirschman, A. O. (1997) *The Passions and the Interests. Political Arguments for Capitalism before its Triumph*, Princeton, NJ: Princeton University Press.
- Hobbes, T. (1651 [1994]) *Leviathan*, Indianapolis/Cambridge: Hackett.
- Hoff, T. (2011) "Deskilling and Adaptation among Primary Care Physicians using Two Work Innovations," *Health Care Management Review* 36(4): 338–348.
- Houghton Budd, C. (2011) *Finance at the Threshold. Rethinking the Real and Financial Economies*, Farnham: Gower.
- Jones, H. (1981) *An Introduction to Modern Theories of Economic Growth*, Walton-on-Thames: Thomas Nelson & Sons.

- Jones, C. I. (2002) "Sources of U.S. Economic Growth in a World of Ideas," *The American Economic Review* 92(1): 220–239
- Jones, C. I. and Romer, P. M. (2010) "The New Kaldor facts: Ideas, Institutions, Population, and Human Capital," *American Economic Journal* 2(1): 224–245.
- Joy, B. (2000) "Why the Future Doesn't Need Us," *Wired*, April 8. Available at: <http://www.wired.com/wired/archive/8.04/joy.html>
- Kaczynski, T. J. (2010) *Technological Slavery*, Port Townsend, WA: Feral House.
- Katz, L. F. and Krueger, A. B. (2016) *The Rise and Nature of Alternative Work Arrangements in the United States 1995–2015*, NBER Working Paper 22667, Cambridge, MA: National Bureau of Economic Research.
- Keynes, J. M. (1923) *A Tract on Monetary Reform*, London: MacMillan.
- Keynes, J. M. (1930 [1963]) "Economic Possibilities for our Grandchildren," in J. M. Keynes (ed) *Essays in Persuasion*, London: Macmillan, pp. 358–374.
- Keynes, J. M. (1936) *The General Theory of Employment, Interest and Money*, London: MacMillan.
- Keynes, J. M., Robinson, A., and Moggridge, D. (1941) "Post-war Currency Policy (8 Sept. 1941)," in *The Collected Writings of John Maynard Keynes, Vol. XXV: Activities 1940–1944: Shaping the Post-war World, The Clearing Union*, Cambridge: Cambridge University Press, pp. 21–33.
- Kirman, A. (1989) "The Intrinsic Limits of Modern Economic Theory: The Emperor has no Clothes," *The Economic Journal* 99(395, Supplement): 126–139.
- Kirman, A. P. (1992) "Whom or What Does the Representative Individual Represent?," *Journal of Economic Perspectives* 6(2): 117–136.
- Knight, F. H. (1921) *Risk, Uncertainty and Profit*, New York, NY: Houghton Mifflin.
- Kurzweil, R. (2006) *The Singularity is Near: When Humans Transcend Biology*, New York, NY: Penguin Books.
- Kurzweil, R. (2012) *How to Create a Mind: The Secret of Human Thought Revealed*, New York, NY: Penguin Books.
- Lakshmanan, T. R. (1989) "Technological and Institutional Innovations in the Service Sector," in A. E. Andersson, D. E. Batten, and C. Karlsson (eds) *Knowledge and Industrial Organization*, Berlin: Springer Verlag, pp. 63–79.
- Landes, D. S. (1961) "Some Thoughts on the Nature of Economic Imperialism," *The Journal of Economic History* 21(04): 496–512.
- Lawrence, Robert Z. (2015) *Recent declines in labor's share in U.S. income: A preliminary neoclassical account*, NBER Working Paper 21296.
- Lazear, E. P. (2000) "Economic Imperialism," *The Quarterly Journal of Economics* 115(1): 99–146.
- Locke, J. (1689 [1997]) *An Essay Concerning Human Understanding*. An Essay Concerning Human Understanding, London: Penguin Books.
- Lowe, A. (1988) *Has Freedom a Future?* New York, NY: Praeger.
- MacIntyre, A. (1981 [2013]) *After Virtue*, London: Bloomsbury Academic.
- MacIntyre, A. (2009) "The Illusion of Self-sufficiency," in Alex Voorhoeve (ed) *Conversations on Ethics*, Oxford: Oxford University Press, Chapter 5, pp. 111–131.
- Mantel, R. (1974) "On the Characterization of Aggregate Excess-demand," *Journal of Economic Theory* 7(3): 348–353.
- Mill, J. S. (1859) *On Liberty*, London: Longmans Green, Reader, and Dyer.
- von Mises, L. (1949 [1998]) *Human Action: A Treatise on Economics*, Auburn: The Ludwig von Mises Institute.
- Mulder, J. M. (2016) "A Vital Challenge to Materialism," *Philosophy* 91(02): 153–182.

- Naastepad, C. W. M., and Houghton Budd, C. (2015) *Aristotelian Economics and Modern Finance: A Consideration of the True Counterpart to Today's Financial Markets*, CrESSI Working Paper 12/2015, Chapter 6, p. 51–86, Oxford: Said Business School.
- Nussbaum, M. C. (2011) *Creating Capabilities. The Human Development Approach*, Cambridge: The Belknap Press of Harvard University Press.
- Offer, A. and Söderberg, G. (2016) *The Nobel Factor*, Princeton, NJ: Princeton University Press.
- Owen, R., Bessant, J., and Heintz, M. (Eds) (2013) *Responsible Innovation*, Oxford: John Wiley & Sons.
- Owen, R., Macnaghten, P., and Stilgoe, J. (2012) "Responsible Research and Innovation: From Science in Society to Science for Society, with Society," *Science and Public Policy* 39(6): 751–760.
- Pack, S. J. (1985) "Aristotle and the Problem of Insatiable Desires: A Comment on Kern's Interpretation of Aristotle, with a Reply by William S. Kern," *History of Political Economy* 17(3): 391–394; reprinted in Marc Blaug (1991) *Aristotle, 384–322 B.C.*, Edward Elgar.
- Pack, S. J. (2008) "Aristotle's Difficult Relationship with Modern Economic Theory," *Foundations of Science* 13(3–4): 265–280.
- Pack, S. J. (2010a) *Aristotle, Adam Smith and Karl Marx*, Cheltenham: Edward Elgar.
- Pack, S. J. (2010b) *Capitalism as a Moral System. Adam Smith's Critique of the Free Market Economy*, Cheltenham: Edward Elgar.
- Page, C. (2010) "The Necessity of Flourishing: An Aristotelian Response to Kant's Critique of Eudaimonism," Honours thesis presented to the department of philosophy at The University of Florida.
- Palma, J. G. (2009) "The Revenge of the Market on the Rentiers. Why Neo-liberal Reports of the End of History Turn out to be Premature," *Cambridge Journal of Economics* 33(4): 829–869.
- Piketty, T. (2014) *Capital in the Twenty-first Century*, Cambridge, MA: The Belknap Press of Harvard University Press.
- Porter, E. (2016) "Jobs Threatened by Machines: A Once 'Stupid' Concern Gains Respect," *New York Times (Economic Scene)*, June 7.
- Pozsar, Z. (2011) *Institutional Cash Pools and the Triffin Dilemma of the U.S. Banking System*, IMF Working Paper 11/190.
- Pozsar, Z., Adrian, T., Ashcraft, A. B., and Boesky, H. (2010; revised 2012) "Shadow Banking," FRBNY Staff Report 458, New York, NY: Federal Reserve Bank of New York.
- Pozsar, Z., and Singh, M. (2011) *The Nonbank-bank Nexus and the Shadow Banking System*, IMF Working Paper WP/11/289, Washington DC: International Monetary Fund.
- Pramudita, D. A. (2015) "Impact of ICT on the Productivity-compensation Gap. A Study of Technology, Work, and the Role of Capital," M.Sc. thesis defended at Delft University of Technology.
- Rizvi, S. A. T. (2006) "The Sonnenschein-mantel-Debreu Results after Thirty Years," *History of Political Economy* 38(Annual Supplement): 228–245.
- Rödl, S. (2007) *Self-consciousness*, Cambridge, MA: Harvard University Press.
- Romer, P. M. (1990) "Endogenous Technological Change," *Journal of Political Economy* 98(5): S71–S102.
- Romer, P. M. (1993) "Two Strategies for Economic Development: Using Ideas and Producing Ideas," *World Bank Economic Review* 6(Suppl. 1): 63–91, Supplement 1: *Proceedings of the World Bank Annual Research Conference 1992*.
- Romer, P. M. (1994) "The Origins of Endogenous Growth," *Journal of Economic Perspectives* 8(1): 3–22.
- Rüffer, R. and Stracca, L. (2006) *What is Global Excess Liquidity, and Does it Matter?* European Central Bank Working Paper Series No. 696, Frankfurt: European Central Bank.

- Russel, B. (1935). "In Praise of Idleness," in B. Russell (eds) (1935) *In Praise of Idleness and Other Essays*, London: George Allen & Unwin, pp. 1–15.
- Sachs, J. D. and Kotlikoff, L. J. (2012) *Smart Machines and Long Term Misery*, NBER Working Paper 18629, Cambridge, MA: National Bureau of Economic Research.
- Sale, K. (1995) *Rebels Against the Future: The Luddites and Their War on the Industrial Revolution. Lessons for the Computer Age*, New York, NY: Perseus Publishing.
- Sandel, M. J. (2012) *What Money Can't Buy. The Moral Limits of Markets*, New York, NY: Farrar, Straus and Giroux.
- Sassen, S. (2014) *Expulsions*, Cambridge, MA: Harvard University Press.
- Schlefer, J. (2012) *The Assumptions Economists Make*, Cambridge, MA: The Belknap Press of Harvard University Press.
- Schmidt, T. P. (2016) *The Political Economy of Food and Finance*, Abingdon: Routledge.
- Schor, J. B. (1993) *The Overworked American: The Unexpected Decline of Leisure*, New York, NY: Basic Books.
- Schor, J. B. (2005) *Born to Buy. The Commercialized Child and the New Consumer Culture*, New York, NY: Scribner.
- Sedláček, T. (2011) *Economics of Good and Evil. The Quest for Economic Meaning from Gilgamesh to Wall Street*, Oxford: Oxford University Press.
- Sen, A. (1977) "Rational Fools: A Critique of the Behavioral Foundations of Economic Theory," *Philosophy & Public Affairs* 6(4): 317–344.
- Sen, A. (1997) Foreword to Albert O. Hirschman (1997).
- Sen, A. (2001) *Development as Freedom*, Oxford: Oxford University Press.
- Sison, A. J. G. (2010) *Corporate Governance and Ethics: An Aristotelian Perspective*, Cheltenham: Edward Elgar.
- Skidelsky, R. (2009) *Keynes. The Return of the Master*, London: Penguin Books.
- Skidelsky, R. and Skidelsky, E. (2012) *How Much is Enough? The Love of Money and the Case for the Good Life*, London: Allen Lane.
- Slade, G. (2007) *Made to Break*, Cambridge, MA: Harvard University Press.
- Solomon, R. C. (1993) "Corporate Roles, Personal Virtues: An Aristotelian Approach to Business Ethics," in E. R. Winkler and J. R. Coombs (eds) *Applied Ethics. A Reader*, Oxford: Blackwell, pp. 201–221.
- Solomon, R. C. (2004) "Aristotle, Ethics and Business Organizations," *Organization Studies* 25(6): 1021–1043.
- Sonnenschein, H. (1972) "Market Excess Demand Functions," *Econometrica* 40(3): 549–563.
- Spence, M. (2014) "Labor's Digital Displacement," *Project Syndicate – The World's Opinion Page*. Available at: http://www.global-economic-symposium.org/knowledgebase/the-future-of-jobs/virtual-library/labor2019s-digital-displacement/at_download/file
- Spitzer, M. (2012) *Digitale Demenz: [How we kill our mind and that of our children] Wie wir uns und unsere Kinder um den Verstand bringen*, München: Droemer Knauer.
- Stiglitz, J. (2013) *The Price of Inequality: How Today's Divided Society Endangers Our Future*, New York, NY: W.W. Norton & Company.
- Storm, S. and Naastepad, C. W. M. (2012) *Macroeconomics Beyond the NAIRU*, Cambridge, MA: Harvard University Press.
- Storm, S. and Naastepad, C. W. M. (2015) "Crisis and Recovery in the German Economy: The Real Lessons," *Structural Change and Economic Dynamics* 32(March): 11–24.
- Vogel, J., Kratena, K., and Hranyai, K. (2015) *The Bias of Technological Change in Europe, Welfare Wealth Work for Europe Working Paper no 98*. Available at: http://www.foreurope.eu/fileadmin/documents/pdf/Workingpapers/WWWforEurope_WPS_no098_MS217.pdf
- Voorhoeve, A. (2009) *Conversations on Ethics*, Oxford: Oxford University Press.

World Economic Forum (2009) "ICT for Economic Growth: A Dynamic Ecosystem Driving the Global Recovery," World Economic Forum Annual Meeting Report 2009.

Wiggins, D. (2009) "What is the Order Among the Varieties of Goodness? A Question Posed by von Wright; and a Conjecture Made by Aristotle," *Philosophy* 84(02): 175–200.

Wilken, F. (1982) *The Liberation of Capital*, London: George Allen & Unwin.