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SPECIAL ISSUE: ECONOMIC GROWTH

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Editorial Introduction – Special Issue: Economic Growth

DAVID SAMWAYS – EDITOR

Economic growth as an indicator of national wellbeing is almost universally, and largely uncritically, accepted, and its inevitability and desirability has become both a discursive and material axiom of modern society. This economic orthodoxy is so pervasive that it is sometimes difficult to imagine that it has ever been different. Yet economic growth itself, at least at the rate at which we have come to expect it, is mostly a modern phenomenon. Of course, human history has involved what might be understood as economic growth at various key moments. The transition from hunter gathering to settled agriculture represents one such moment, as does the emergence of the great civilisations and further refinement of the division of labour. However, past civilisations very often met environmental (and social) limits to growth that played a critical role in their demise (Diamond, 2006). In Europe, following the fall of the Roman Empire, economies first shrank and then flat-lined until the industrial revolution (Madison, 2001).

The principle economic theorists of the industrial revolution, such as Adam Smith, David Ricardo, and John Stuart Mill all welcomed the unparalleled growth of wealth created by technical and social changes associated with industrialisation. However, they acknowledged that such growth would be limited by the availability of natural resources, the growth of population and limits on increases in productivity. They believed that in the long run a “stationary state” would prevail where population and stocks of capital would remain constant. Although they thought it inevitable, neither Smith nor Ricardo welcomed the stationary state, with Smith regarding it as “dull” in comparison to the “cheerful and hearty” condition of “the progressive” (growing) state (Smith 2007 [1776] p.68). While Mill shared Smith’s and Ricardo’s view that a stationary state was inevitable, unlike

them he embraced the prospect, but thought it would only be an agreeable condition if population growth was restrained. He wrote:

Even in a progressive state of capital, in old countries, a conscientious or prudential restraint on population is indispensable, to prevent the increase of numbers from outstripping the increase of capital, and the condition of the classes who are at the bottom of society from being deteriorated. Where there is not, in the people, or in some very large proportion of them, a resolute resistance to this deterioration – a determination to preserve an established standard of comfort – the condition of the poorest class sinks, even in a progressive state, to the lowest point which they will consent to endure. The same determination would be equally effectual to keep up their condition in the stationary state, and would be quite as likely to exist.

I cannot, therefore, regard the stationary state of capital and wealth with the unaffected aversion so generally manifested towards it by political economists of the old school. I am inclined to believe that it would be, on the whole, a very considerable improvement on our present condition. (Mill, 1986 [1909], p.321).

For Mill, the link between welfare and population was absolutely clear: human numbers not only played a dynamic role in limiting the accumulation of wealth, but also diluted aggregate wealth thus lowering individual welfare. If population could be prevented from outstripping the benefits of accumulated capital, then the stationary state would be agreeable. However, the congeniality of such a state would be dependent on the wealth created by technical progress being more equitably shared, thus releasing the working classes from the drudgery of labour to live more fulfilling lives. Furthermore, Mill regarded the economic competition consequent on the pursuit of wealth as crowding-out other more virtuous pursuits:

It is scarcely necessary to remark that a stationary condition of capital and population implies no stationary state of human improvement. There would be as much scope as ever for all kinds of mental culture, and moral and social progress; as much room for improving the Art of Living, and much more likelihood of its being improved, when minds ceased to be engrossed by the art of getting on. (Mill, 1986 [1909], p.321).

Mill was also much concerned with the impact of growth on the natural world, the enjoyment of which he regarded as an essential part of an agreeable life:

Nor is there much satisfaction in contemplating the world with nothing left to the spontaneous activity of nature; with every rood of land brought into cultivation, which is capable of growing food for human beings; every flowery waste or natural pasture ploughed up, all quadrupeds or birds which are not domesticated for man's use exterminated as his rivals for food, every hedgerow or superfluous tree rooted out, and scarcely a place left where a wild shrub or flower could grow without being eradicated as a weed in the name of improved agriculture. If the earth must lose that great portion of its pleasantness which it owes to things that the unlimited increase of wealth and population would extirpate from it, for the mere purpose of enabling it to support a larger, but not a better or a happier population, I sincerely hope, for the sake of posterity, that they will be content to be stationary, long before necessity compels them to it. (Mill, 1986 [1909], p.321).

In the age of the Anthropocene, Mill's words seem astonishingly prescient.

In contrast to the other founding figures of classical economics, Thomas Malthus (1998 [1798]) was pessimistic about the ability to achieve a steady-state at all, let alone one much above the level of subsistence. Articulating an early limits to growth theory, Malthus argued that while it was possible to improve the output of agriculture that this was ultimately limited by nature. In the long run, the rate of growth of agricultural production (arithmetic) could not keep up with the rate of growth of population (geometric). Malthus' "principle of population" led him to believe, even with preventative checks (abortion, sexual abstinence, later marriage, etc.) ameliorating the misery of overshoot, that affluence for the lower classes would always be undermined by their numbers.

Deriding Malthus as a plagiarist and an apologist for the ruling class, Karl Marx argued that rather than surplus population being the outcome of a natural law, that capitalism generated a "reserve army of labour" in order to keep wages low and aid capital accumulation.

The labouring population therefore produces, along with the accumulation of capital produced by it, the means by which it itself is made relatively superfluous, is turned into a relative surplus population; and it does this to an always increasing extent. This is a law of population peculiar to the capitalist mode of production. (Marx 1954 [1890] p.591).

Thus, rather than general trans-historical laws of population...

... in fact every special historic mode of production has its own special laws of population, historically valid within its limits alone. An abstract law of population exists for plants and animals only, and only in so far as man has not interfered with them. (Marx 1954 [1890] p.592).

Far from regarding population as irrelevant, for Marx its growth, or at least its stability, was an essential component of his general theory of capitalism, its development and collapse. As Petersen observes: "If the number of people were to decline at the same rate as machines displaced workers..., then there would be no "industrial reserve army," no "immiseration," no Marxist model at all" (Petersen, 1988 p. 80).

It has generally become accepted amongst Marxist scholars that Marx did not believe that there were any limits to material growth and by extension to population (see Petersen, 1988). Moreover, his supposed "Promethianism" has been commented upon by a number of writers (see Benton, 1989; Grundmann, 1991; Löwy, 1997) who regard Marx's characterisation of human kind as "wrestling with nature", and of the forces of technology bringing nature under human control, as implying the potential social transcendence of natural boundaries. Certainly this much quoted passage seems to conform to this view:

Freedom in this field [material existence] can only consist in socialised man, the associated producers, rationally regulating their interchange with Nature, bringing it under their common control, instead of being ruled by it as by the blind forces of Nature; (Marx 1959 [1894] p. 820).

However, a number of scholars have argued that Marx's conception of the human relationship with nature was a great deal more complex and subtle than had been

formerly assumed (Burkett, 2000; Foster, 1999; Saito, 2017). It would be mistaken to think that Marx believed there were no natural limits. Recent research shows that Marx was aware of how the application of the then current capitalist agricultural techniques brought “about disharmonies in the transhistorical “metabolism” (Stoffwechsel) between human beings and nature” (Saito, 2014). While Marx would clearly, and correctly, reject the notion that population size is governed by “transhistorical” laws, it is also clear that he would not have dismissed the idea that it was subject to socio-technical *and* physical limits (see Grundmann 1991).

Regarding the stationary state economy, Marx’s position is more opaque. His historical materialism clearly rejects Smith’s, Ricardo’s and Mill’s view that capitalism can attain a steady-state. For Marx, the contradiction between the forces and relations of production lead to increasing crises and eventually the dialectical transition to the next mode of production. Marx’s analysis of both pre-capitalist modes of production and of capitalism itself constituted the vast majority of his life’s work and we have but fragmentary glimpses of his vision of the end of history in communism. Many have regarded Marx’s prescient view of the development of automated technology as implying that the scarcity problem would be transcended in the communist mode of production – Aaron Bastani’s *Fully Automated Luxury Communism* (2019) reportedly owes much to this reading of Marx (Merchant, 2015). However, the glimpses Marx provides of the good life in a communist society are far from one of excessive conspicuous consumption. In *The Critique of the Gotha Programme* Marx argues that communism will be organised around the principle of “from each according to his ability, to each according to his needs” (1972 [1875], p.165), while in the *German Ideology* he writes:

... in communist society, where nobody has one exclusive sphere of activity but each can become accomplished in any branch he wishes, society regulates the general production and thus makes it possible for me to do one thing today and another tomorrow, to hunt in the morning, fish in the afternoon, rear cattle in the evening, criticise after dinner, just as I have a mind, without ever becoming hunter, fisherman, shepherd or critic. (Marx 1972 [1846] p.33).

It is interesting to note that Marx thought that communism would require the abolition of the distinction between town and country and a more even dispersal of the population into rural areas, and certainly the above passage implies a rural existence with relatively low population density. While Marx acknowledges that the creation of wealth leads to the expansion of wants, on numerous occasions he expresses the same conviction that real "measure of wealth is ... disposable time" (Marx 2015 [1857-61] p. 628) leading to the intellectual and practical self-development of the individual within a community. The fragments of Marx's vision of life in communism are utopian, but appear much closer to a post-materialist lifestyle than one of conspicuous luxury consumption. When Marx was writing world population was little more than a billion (UNPD, 2016) and the population of Britain (including Ireland) was less than half its current level (ONS, 2015). Given his knowledge of the limiting factors of agricultural production and his essentially post-materialist vision of communism, a steady state or extremely low growth economy seems to be implied in Marx's vision of post-capitalist society.

Rejecting the notion that capitalism could not be reformed and of the inevitability its collapse, John Maynard Keynes saw Marx's reserve army of labour not as a means of suppressing wages when they encroached on profits, but as an impediment that "dampens profit expectations by reducing the expected demand for goods" (Skidelsky 2010, p.325). While Keynes thought that mass unemployment and economic disequilibrium could be managed to ensure steady growth, like the classical economists he did not appear to think that this growth would continue indefinitely. His 1930 essay *The Economic Possibilities of Our Grandchildren* gazed 100 years into the future and foresaw an end to economic growth. Like Marx, Keynes predicted that technological development would ultimately reduce necessary labour to a point where basic needs would be universally met. Indeed, somewhat like Mill and Marx, he went further and argued that a point would be soon reached where "we prefer to devote our further energies to non-economic purposes" (Keynes 1930, p. 326). Like Marx, Keynes saw this as an inevitable consequence of technological development, but achieved without overthrowing private property and capitalism. And Keynes concurred with Mill in thinking this a highly desirable condition. However, despite Keynes' great foresight regarding technological development and economic growth we are as far now from a steady-state leisure society as we were when he was writing. Why is this the case?

Keynes assumed that the population of Europe and the USA would not grow significantly. Yet he also recognised that population would be one of the key factors requiring control if his vision of future prosperity was to come to pass. In the 1930 essay he is optimistic about this, but in earlier work he is clearly concerned¹:

Before the eighteenth century mankind entertained no false hopes. To lay the illusions which grew popular at that age's latter end, Malthus disclosed a Devil. For half a century all serious economical writings held that Devil in clear prospect. For the next half century he was chained up and out of sight. Now perhaps we have loosed him again. (Keynes 1919, p. 8).

His failure to predict large increases in population in the developed world may well have been sufficient for his utopian forecast not to materialise, but he also failed to anticipate the voracious consumerism of the post-war period.

As we have seen, Keynes conceived that higher productivity would universally meet need, and that scarcity would be eradicated. However, he was also clear that this related to "absolute" rather than "relative" needs, the latter of which "may indeed be insatiable", "we feel them only if their satisfaction lifts us above, makes us feel superior to, our fellows" (Keynes, 1930, p. 326).

Looking at the experience of the post-war period, it's hard for us to comprehend why Keynes thought that relative needs would not be expressed through ever more extravagant material consumption, but once more, like Mill and Marx, his concept of status consumption seems to owe much to his wealthy upper-middle class background². For Mill, Marx, and Keynes, status consumption seems to be largely intellectual or experiential rather than material. Keynes clearly thought that material accumulation, while necessary in the development of wealth, was somewhat distasteful and vulgar, and that once a certain level was collectively achieved these proclivities would evaporate from the majority of individuals. Regarding those in which the "semicriminal, semi-pathological propensities" (Keynes, 1930, p. 329) did persist: "the rest of us will no longer be under any

1. John Toye (2000) has observed that Keynes' views on population were far from static.

2. It is interesting to note that Mill's, Marx's and Keynes' non-materialist values conform to Inglehart's (1977) observations on affluence during childhood leading to post-materialist values in adulthood.

obligation to applaud and encourage them" (ibid). It is almost as if Keynes thought that people would revert to a pre-industrial relationship with money and work. He imagined that the working day would fall to three or four hours (and even then this might be a way of meaningfully occupying time rather than as a means to an end) as people satisfied their basic needs. At the beginning of the twentieth century Max Weber had observed: "A man does not "by nature" wish to earn more and more money, but simply to live as he is accustomed to live and earn as much as is necessary for that purpose" (Weber 1930 [1905], p. 60). For Weber, what drove people to work over and above meeting their needs was the ideology of the work ethic, which he regarded as a necessary but not sufficient condition in the development of capitalism itself. Keynes was actually well aware of the power of the work ethic and the possible difficulty of suppressing it ("[f]or we have been trained too long to strive and not to enjoy" (Keynes, 1930, p. 327)).

The fact that a steady-state economy has never come close to being materialised may well be due to the underestimation of the connection between material wealth and status. Undoubtedly, the development of consumerism very much relied on articulating and strengthening this relationship to fuel post-war growth (see Higgs, 2017). For the classical economists population size relative to resources was a limiting factor to economic growth, and although his take was somewhat more sophisticated, population and the limits of natural resources were factors also recognised by Marx. Post 1945 economic experience normalised the idea of ever increasing wealth, but the realisation of the catastrophic environmental consequences of this, from the 1960s onwards, renewed interest in the connection between resource limits and population size. Writers like Kenneth Boulding (1966), Nicholas Georgescu-Roegen (1971) and Herman Daly (1973), along with the Club of Rome's *Limits to Growth* (1972) report made the connection between economic growth, limited resources and population size explicit, renewing interest in steady-state theories. Anthropogenic climate-change has added further weight to the environmental limits argument and spawned further discussion about the costs of economic growth.

The papers assembled in this special edition of *The Journal of Population and Sustainability* are representative of contemporary thinking about the necessity and desirability of challenging the orthodoxy of continuous economic growth. Current writers not only stress the existence of biophysical limits to growth but

also recognise that these limits have already been breached. They argue that without reconstruction of our economic system that the future for our civilisation is at best precarious. Issues of ecological limits, the welfare of human beings and other species, and the reconsidering of the basic political, ethical and value norms of Western civilisation are recurring themes in these papers. The concept of liberty is perhaps the link between historical advocates of the steady-state economy and present thinkers. For Mill, Marx and Keynes, the wealth created by modern production methods held the key to the creation of the good life. This was not a life of ever growing material consumption, but one of increased free time allowing self-development and the greater realisation of human potential. The concept of freedom employed by these writers was one with the individual as its end, but this individual is a social being, framed by participation in social institutions, culture, and "the Art of Living" as Mill put it. Such freedom is still a highly desirable objective, but it is only possible within ecological boundaries and, as the papers in this issue indicate, its achievement may require the restriction of other liberties which we currently take for granted.

In *Envisioning a Successful Steady-State Economy*, Herman Daly, one of the founding figures in the field of ecological economics, contends that there are two interacting arguments for a steady-state economy, the first based on biophysical limits, the second on ethical desirability. In the first argument Daly observes that in terms of energy flow, the growth of populations of human beings and their "exosomatic" capital (homes, cars, factories, farms, power stations etc.) are dissipative structures limited by biophysical externalities. Any sustainable economic system must function within these fixed boundaries and a large portion of the ecosystem must be left free of human interference to provide ecological services to ourselves and other species as well as being a low-entropy matter/energy source and high entropy waste sink. Such a sustainable economic system would therefore be a steady-state in terms of physical throughput.

Daly argues that "exosomatic" structures represent an extension of human physical evolution that has been "purpose driven" by economic growth. Economic growth has promised more for everyone, but Daly observes that this is not only ecologically unsustainable but also ethically problematic. He argues that "decision-making" elites are committed to economic growth not to provide a good life for all, but to maximise the standard of resource consumption for a small

minority at the expense of future generations, the world's poor and other species. For Daly, this is underpinned by metaphysical naturalism, a "naturalistic scientism" which leads to moral nihilism in respect of the natural world. This metaphysical naturalism, Daly argues, is the most fundamental barrier to the establishment of a steady-state economy that cares about the human impact on the natural world.

Graeme Maxton's *Rethinking Everything* proposes that the idea that economic growth has been the main driver of "progress" in the form of higher standards of living, lower unemployment and higher wages is a myth. On the contrary Maxton argues that economic growth is not a prerequisite for human progress and that it neither creates jobs in the long term, nor reduces inequality, nor helps the poor. More importantly, it rewards the rich while causing devastating ecological damage. Maxton argues that up to the 1980s rising living standards were the due to policies specifically designed to increase *well being* rather than the pursuit of growth as an end in itself. Indeed, economic growth in the post war period was an unintended consequence of increases in population and productivity, and increases in consumption were the result of growth rather than its cause. Maxton points out that, in the long run, an economy pursuing growth through increases in productivity leads to fewer jobs as mechanisation and automation lower demand for labour. Predicting the inevitable demise of the free-market economy, either due to ecological catastrophe or managed transition, Maxton argues that a truly sustainable economy must meet a number of criteria including: the need to prosper for many generations; operation within natural boundaries; ecological stability and the ability to cope with a rise in population without an increase in aggregate ecological footprint; the needs of future generations of people and of all other species must be treated as equal to those of present populations. However, a critical condition of such sustainability would be a transition to a population of around half the current size, but even at this level resource consumption would have to be held at strict limits. Stability in the economy would be critical since extreme fluctuations could lead to conflict and even collapse. Maxton foresees that in the short term, transitioning to a sustainable economy will lead to economic contraction and a fall in living standards.

In the long term, once a stable economy has been achieved, Maxton argues that economic growth would be possible (i.e. of pure services). However, what cannot grow is the use of natural resources. Ultimately, Maxton thinks that society will

become agnostic about economic growth. Growth will no longer be a goal since from the viewpoint of the majority of people it is a pointless objective. As per the title of his essay, Maxton is clear that rethinking the economy requires us to rethink everything including many of the institutions, rights and concepts that have come to define our civilisation. Democracy, freedom, happiness, our relationship with nature, will all need critical reappraisal to achieve long-term sustainability along with high standards of welfare for all.

In his paper *Agrowth Instead Of Anti- and Pro-Growth: Less Polarization, More Support for Sustainability/Climate Policies*, Jeroen van den Bergh observes that one of the major problems in tackling our current ecological problems is essentially psychological in nature. He argues that if people cannot be convinced that environmental policies will not harm economic growth then they will not support such policies. The background to this psychological attachment to economic growth lies in the belief held by the majority of economists and policy makers that economic growth always equates to progress - despite the questionable links between economic stability, full employment and economic growth. Van den Bergh points out that this discourse is reproduced in the media and education system to the extent that it is almost universally accepted that economic growth is the sine qua non for modern society.

Van den Bergh argues that to overcome this psychological attachment to growth we must not reject growth as such, but become "agnostic and indifferent about GDP growth", advocating what he calls an *agrowth* position. He argues that such an orientation to GDP growth can find popular support since GDP is a poor indicator of happiness and welfare. This argument is particularly important in rich countries since in recent decades growth in income has not led to significant increases in social welfare. Van den Bergh's position contrasts with "green growth" and "degrowth" in that it is not focused on GDP at all, but on welfare. An *agrowth* strategy would allow periods of high, low, zero or negative growth to alternate with each other, but this would be of no concern as long as environmental sustainability and social welfare were the primary policy goals. Ignoring GDP information in favour of welfare indicators allows for the possibility that potential GDP growth would be relinquished in favour of environmental goals, greater employment, lowering inequality, increased leisure or improvements in health care and so on.

In respect of population and development an agrowth strategy has important implications. Van den Bergh argues that by focussing on welfare rather than GDP, an agrowth strategy allows less developed countries to have economic growth. With welfare as the key goal the benefits of the accompanying economic growth accelerate demographic transition toward lower birth rates. This contrasts with wealthy countries with low birth rates where low economic growth is a likely transition to a low-carbon economy. However, van den Bergh is clear that an agrowth orientation should not apply to population growth which he argues must be stopped as soon as possible to avoid further overshooting of ecological boundaries.

Theodore Lianos' paper, *Steady State Economy at Optimal Population Size* addresses the issue of the connection between population and a sustainable steady-state economy. Starting from the central economic problem of scarcity, Lianos argues that the problem has been "solved" at the expense of creating ecological debts to be paid by future generations. The drivers of this ecological deficit have been overconsumption and overpopulation. Lianos shows that a number of different methodologies can be used, including energy use per capita, per capita land requirements for food production, and per capita income figures, to calculate an "optimum" population for a given standard of living. He concludes that for a good, but not a luxurious life for all, this figure lies somewhere between 2 and 3 billion people. Lianos argues that only with such a population can a steady-state economy be achieved. To attain this population a globally tradable system of reproductive "shares" could be developed. Three "shares" would be allocated to each couple (or possibly to each woman) with each share giving the right to 0.5 children. The outcome of this would be that the maximum number of children that each and every woman could possibly have would average 1.5. With replacement total fertility rate (TFR) being 2.1, lowering the TFR to 1.5 would therefore lead to a reduction in the population. The ability to trade fertility shares would mean that it would be possible for couples to choose to have a greater number of children. Lianos argues that this would probably result in a transfer of wealth from the rich to the poor and, since the system would need to be global, from the developed to the developing world. While such a system would represent a financial incentive for some, it would require enforcement through a system of fines and possibly moral sanctions which over time would ideally lead to normative compliance. Lianos recognises that, while there are obvious advantages to such a system, ultimately it is coercive. However, following

John Stuart Mill, he argues that liberty cannot be exercised if it causes harm to others, meaning that some of our present liberties must be restrained in order to avoid harm to future generations and their own right to enjoy a good life.

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Envisioning a Successful Steady-State Economy¹

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Abstract

There are two interacting types of argument for a steady-state economy: its biophysical necessity, and its ethical desirability. The first argument is made in terms of the finitude, entropy, and physical maintenance requirements of "dissipative structures" (populations of human bodies and their exosomatic extensions). The second argument considers that the evolution of the human species is now purpose-driven, no longer random, if indeed it ever was. Purpose introduces value judgments of right and wrong regarding how our economy should relate to the rest of creation – judgments ignored by both neoclassical economics and neo-Darwinist naturalism.

How do you envision a successful economy without continuous growth?

It helps to consider a prior question: how do you envision a successful Planet Earth without continuous growth? That is easy to envision because it exists! The Earth as a whole does not grow in physical dimensions. Yet it changes qualitatively, it

1. An earlier short version of this essay was published in Daly, 2014.

evolves and develops. Total matter on Earth cycles, but does not grow. Energy from the sun flows through the earth coming in as low-entropy radiant energy, and exiting as high-entropy heat. But the solar flow is not growing. Nearly all life is powered by this entropic throughput of solar energy. There is birth and death, production and depreciation. New things evolve; old things go extinct. There is continual change. But the Earth is not growing.

The economy is a subsystem of the Earth. Imagine that the economy grows to encompass the entire earth. Then the economy would have to conform to the behavior mode of the Earth. Namely, it could no longer grow, and would have to live on a constant solar flow, approximating a steady state – an exceedingly large steady state to be sure, well beyond optimal scale. The economy would have taken over the management of the entire ecosystem – every amoeba, every molecule, and every photon would be allocated according to human purposes and priced accordingly. All ‘externalities’ would be internalized, and nothing could any longer be external to the all-encompassing economy. The information and management problem would be astronomical – central planning raised to the thousandth power! Long before such total takeover and complexity, the human economy and the civilization it supports would have collapsed.

To arrive at a vision that promises success we must discard some dead-end dreams – especially the just-mentioned dream of internalizing all biospheric relationships into the monetary accounts of the economy. To keep the economy manageable we must limit its physical scale relative to the containing ecosystem. The way to do that is to leave a large part of the ecosphere alone, to limit our absorption of it into the economic subsystem – to keep a large part of the earth ecosystem *in natura* – as a source for low-entropy matter/energy inputs and as a sink for high-entropy waste, and as a provider of life-support services, including services to non human species. Laissez faire takes on a new meaning – it is the ecosystem that must be left alone to manage itself and evolve by its own rules, while the economy is carefully constrained in aggregate scale to stay within the limits imposed by the ecosystem. Environmental sources and sinks necessarily must be used to support life and production, but the rate of use must remain within the regenerative and absorptive capacities of the ecosystem. The metabolic throughput from nature cannot keep growing. Limiting the physical throughput to sustainable levels will, by lowering supply, effectively internalize the external costs of excessive

scale. Resulting higher resource prices will improve the microeconomic efficiency of allocation.

Every encroachment of the economy into the ecosystem is a physical transformation of ecosystem into economy. Growth means less habitat for other species, with loss both of their instrumental value to the ecosystem, and the intrinsic value of their own sentient life. Clearly, in addition to a maximum scale of the economy relative to the ecosystem, there is also an optimal scale (much smaller), beyond which growth becomes uneconomic in the literal sense that it increases environmental and social costs faster than production benefits. We fail to recognize the uneconomic nature of growth beyond this point because we measure only production benefits and fail to measure environmental and social costs. We ignore the fact that ‘illth’ is a negative joint product with wealth. Examples of illth are everywhere, even if usually unmeasured in national accounts, and include: climate change from excess carbon in the atmosphere, radioactive wastes and risks of nuclear power, biodiversity loss, depleted mines, deforestation, eroded topsoil, dry wells, rivers, and aquifers, sea-level rise, the dead zone in the Gulf of Mexico, gyres of plastic trash in the oceans, the ozone hole, exhausting and dangerous labor, and the unrepayable debt from trying to push growth in the symbolic financial sector beyond what is possible in the real sector.

Growth all the way to the very limit of carrying capacity has an unrecognized political cost as well. Excess capacity is a necessary condition for freedom and democracy. Living very close to the carrying capacity limit, as on a submarine or spaceship, requires very strict discipline. On submarines and spaceships we have a captain with absolute authority, not a democracy. If we want democracy, we should not grow up to the limit of carrying capacity – better to leave some slack – some margin of tolerance for the errors that freedom entails.

The spatial boundaries across which we measure migration, and within which we measure natural increase (or decrease) are principally nation states. For some purposes it is the natural increase of the globe as a whole that is most relevant, and we can neglect migration, both international and “inter-planetary”, even though the latter (e.g. terraforming Mars), while non-existent, is hailed by some as the future solution to overpopulation.

The Beatles musically longed for a “world without boundaries”, and we all know what they meant - a world of human solidarity, peace, and cooperation. Conflicts and war usually involve disputes over borders. So why not just get rid of these troublesome boundaries? Let’s have globalization – deregulated trade, capital mobility, and migration – only let’s bless them each with the adjective “free” rather than “deregulated”. Economists assure us that this will lead to peace and prosperity among rational utility-maximizing individuals, minimally governed by a benevolent World Democracy, dedicated to the post-modern values of secularist materialism, eloquently communicated in Esperanto. This vision has its serious appeal to many, but not so much to me. The anomaly of this cosmopolitan globalism, is that it is really individualism writ large – corporate feudalism in a global commons. Economic and political boundaries are necessary to achieve both national community, and a global federation of national communities living in peace and ecological sustainability.

Boundaries are both biologically and logically necessary. Skin and membranes are organic boundaries. Within-skin versus outside-skin is a basic boundary condition for life. The skin boundary must be permeable, but not too permeable. If nothing enters or exits the organism it will soon die. If everything enters and exits, then the organism is already dead and decaying. Life requires boundaries that are neither completely closed nor completely open. A nation’s borders are in many ways very different from the skin of an organism, yet neither permits complete closure or complete openness. Both must be qualitatively and quantitatively selective in what they admit and expel, if their separate existence is to continue rather than be dissolved entropically into its environment.

Logically boundaries imply both inclusion and exclusion. A world without boundaries includes everything and is often therefore thought to be warm and friendly. But “everything” must include the cold and the unfriendly as well, or it is not everything. Also, without boundaries, B can be both A and non-A, which makes definition, contradiction, and analytical reasoning impossible. So both life and logical thinking require boundaries. While “a world without boundaries” may be a poetic expression of a desired unity, and while it is possible to reason dialectically with overlapping boundaries, it is a major delusion to think that boundaries are not necessary.

It is understandable, yet ironic, that the most fundamental and dramatic boundary of all - that separating the earth from outer space – made clear in the iconic photo of the earth from the moon – seems to have led to a reaction against the very concept of boundaries on our spherical planet, since it is so obviously one whole and unified thing. Yet that beautiful and powerful vision of overall unity hides a world of diversity and difference. And we live on the earth, within that complex living diversity, not on the dead moon with no need for life-defining boundaries.

We need a non-growing economy that strives to maintain itself in a steady state within the boundary of its optimum scale. How to do that? Basically it is as simple (and difficult) as going on a diet. Cut the matter–energy throughput to a sustainable level by cap–auction–trade and/or ecological tax reform (taxing resource throughput – especially fossil fuels – rather than value added by labor and capital). We should cap or tax fossil fuels first. Then redistribute auction or eco-tax revenues by cutting income taxes for all, but first and mainly for the poor. A policy of quantitative limits on throughput (cap–auction–trade) raises resource prices and induces resource-saving technologies. The quantitative cap will also block the erosion of resource savings as induced efficiency makes resources effectively cheaper (the Jevons effect). In addition, the auction will raise much revenue and make it possible to tax value added (labor and capital) less, because in effect we will have shifted the tax base to resource throughput. Value added is a good, so we should stop taxing it. Depletion and pollution are bads, so we should tax them.

Along with a physical diet, we need a serious monetary diet for the obese financial sector, specifically movement away from fractional reserve banking toward a system of 100 percent reserve requirements. This would end the private banks' alchemical privilege to create money out of nothing and lend it at interest. Every dollar loaned would then be a dollar that someone previously saved, restoring the classical balance between abstinence and investment. This balance was abandoned by the Keynesian–neoclassical synthesis after the Great Depression because it was thought to be a drag on growth, the new panacea. But in the new era of uneconomic growth the classical discipline regains its relevance. Investors must choose only the best projects, thereby improving the quality of growth while limiting its quantity. This idea of 100 percent reserve requirements on demand deposits was championed by the early Chicago School in the 1930s, as well as

by Irving Fisher of Yale, and probably first proposed in 1926 by Frederick Soddy, Nobel Prize-winning chemist and underground economist. Also, a small, so-called 'Tobin tax, on all financial trades would reduce speculative and destabilizing short-term trading (including algorithm-based computer trading on fraction of a second price differences) and raise significant revenue.

What about population growth? If I can manage to live for a few more years the world population will have quadrupled in my lifetime (from 2 to 8 billion), and the populations of other 'dissipative structures' (cars, houses, livestock, cell phones, and so on) will have more than quadrupled. Limiting the populations of artifacts by capping the metabolic throughput ("food supply") that sustains them seems a good policy. However, limiting food supply to humans is nature's harsh limit, Malthus' positive check. There is also Malthus' preventive check (celibacy and late marriage), and the more palatable neo-Malthusian preventive check of contraception. Contraceptives should be made easily available for voluntary use everywhere.

More people are better than fewer, but not if all are alive at the same time. Population has a temporal as well as a spatial boundary. We should strive to maximize the cumulative number of people ever to live over time in a condition of sufficiency. That means no more people alive at the same time than could enjoy a per capita resource availability that is enough for a good (not luxurious) life, and sustainable for a long (not infinite) future. Exactly how many people at exactly what per capita standard would that be? We do not know, but we do know that it is not more people at a higher per capita consumption, and that is enough to get started in the right direction. For a nation's population not to grow necessarily requires that births plus immigrants equal deaths plus emigrants. A further condition, not logically necessary but politically desirable, is that every birth be a wanted birth and every immigrant a legal immigrant.

The population problem should be considered from the point of view of all populations of the human world – populations of both us humans and our things (cars, houses, livestock, crops, cell phones, etc.) – in short, populations of all "dissipative structures" engendered, bred, or built by humans. Both human bodies and artifacts wear out and die. The populations of all organs that support human life, and the enjoyment thereof, require a metabolic throughput to counteract entropy and remain in an organized quasi-steady state. All of these

organs are capital equipment that support our lives. Endosomatic (within skin) capital – heart, lungs, kidneys – supports our lives quite directly. Exosomatic (outside skin) capital supports our lives indirectly, and consists both of natural capital (e.g., photosynthesizing plants, structures comprising the hydrologic cycle), and manmade capital (e.g., farms, factories, electric grids).

In a physical sense, the final product of the economic activity of converting nature into ourselves and our stuff, and then using up or wearing out what we have made, is waste (Georgescu-Roegen, 1971)². Ultimately that is our “ecological footprint”. What keeps this from being an idiotic activity—depleting and polluting, grinding up the world into waste—is the fact that all these populations of dissipative structures have the common purpose of supporting the maintenance and enjoyment of life. As John Ruskin said, “*there is no wealth but life.*”

Ownership of endosomatic organs is equally distributed among individuals (absent slavery), while the ownership of exosomatic organs is not, a fact giving rise to social conflict. Control of these external organs may be democratic or dictatorial. Our lungs are of little value without the complementary natural capital of green plants and atmospheric stocks of oxygen. Owning one’s own kidneys is not enough to support one’s life if one does not have access to water from rivers, lakes, or rain, either because of scarcity or monopoly ownership of the complementary exosomatic organ. Therefore all life-supporting organs, including natural capital, form a unity with a common function, regardless of whether they are located within the boundary of human skin or outside that boundary.

Our standard of living is traditionally measured by the ratio of manmade capital to human beings—that is, the ratio of one kind of dissipative structure to another kind. Human bodies are made and maintained overwhelmingly from renewable resources, while capital equipment relies heavily on nonrenewable resources as well. The rate of evolutionary change of endosomatic organs is exceedingly slow; the rate of change of exosomatic organs has become very rapid. In fact the

2. Waste is too neutral a term. In fact annual production of goods that accumulate into a stock of wealth requires the joint production of “bads” that accumulate into a stock of “illth”. The negative terms are absent from the indexes of economics textbooks, and unsubtracted in national accounts. A stock of wealth requires the joint production of “bads” that accumulate into a stock of “illth”. The negative terms are absent from the indexes of economics textbooks, and unsubtracted in national accounts.

collective evolution of the human species is now overwhelmingly centered on exosomatic organs. We fly in airplanes and rockets, not with wings of our own. This exosomatic evolution is goal-directed, not random. Its driving purpose has become “economic growth,” and that growth has been achieved largely by the depletion of the earth’s resources and pollution of its spaces.

Although human evolution is now decidedly purpose-driven, we continue to be enthralled by neo-Darwinist aversion to teleology and devotion to random processes. Economic growth, by promising more for everyone, becomes the *de facto* purpose, the social glue that keeps things from falling apart. But what happens when growth becomes uneconomic, when it begins to increase environmental and social costs faster than production benefits? How do we know that this is not already the case? Studies suggest that it is.³ If one asks such questions, as Pope Francis is doing, one is usually told to talk about something else, like space colonies on Mars, or unlimited energy from cold fusion, or geo-engineering, or the wonders of globalization, and to remember that all these glorious purposes require growth, in order to provide still more growth in the future. Growth is the *summum bonum* – end of discussion!

In the light of these considerations, let us reconsider the idea of demographic transition. By definition this is the transition from a human population maintained by high birth rates equal to high death rates, to one maintained by low birth rates equal to low death rates, and consequently from a population with low average lifetimes to one with high average lifetimes. Statistically such transitions have often been observed as standard of living increases. Many studies have attempted to explain this correlation, and much hope has been invested in it as an automatic cure for overpopulation. “Development is the best contraceptive” is a related slogan, partly based in fact, and partly in wishful thinking.

3. See concepts of Index of Sustainable Economic Welfare, Genuine Progress Indicator, Global Footprint (Daly, 2015). More recently The Lancet Commission on Pollution and Health finds that the financial costs from pollution are some \$4.6 trillion annually, about 6.2% of the global economy (Landrigan et al 2017). If annual growth in Gross World Product is around 2.2%, and cost due to pollution is 6.2%, then with reasonable accounting we would have a net financial decline of some 4% annually. If that financial decline represents welfare loss, and it surely does since we are talking about reduced health and life expectancy, then the benefits of production growth are being more than cancelled out by the costs of the pollution generated by that growth. In other words, so-called “economic” growth has become uneconomic at the present margin. So far that seems to have escaped the notice of most economists!

There are a couple of thoughts I'd like to add to the discussion of demographic transition. The first and most obvious one is that populations of artifacts can undergo an analogous transition from high rates of production and depreciation to low ones. The lower rates will maintain a constant population of longer-lived, more durable artifacts. Our economy has a GDP-oriented focus on maximizing production flows (birth rates of artifacts) that keeps us in the pre-transition mode, giving rise to low product lifetimes, planned obsolescence, and high resource throughput, with consequent environmental destruction. The transition from a high maintenance throughput to a low one applies to both human and artifact populations independently. From an environmental perspective, lower throughput per unit of stock (longer human and product lifetimes) is desirable in both cases, at least up to some distant limit.

The second thought I would like to add is a question: does the human demographic transition, when induced by rising standard of living⁴, as usually assumed, increase or decrease the total load of all dissipative structures on the environment? Specifically, if Indian fertility is to fall to the Swedish level, must Indian per capita possession of artifacts (standard of living) rise to the Swedish level? If so, would this not likely increase the total load (ecological footprint) of all dissipative structures on the Indian environment, perhaps beyond capacity to sustain the required throughput?

The point of this speculation is to suggest that "solving" the population problem by relying on the demographic transition to lower birth rates could impose a larger burden on the environment, rather than the smaller burden hoped for⁵. Of course indirect reduction in fertility by automatic correlation with rising standard of living is politically easy, while direct fertility reduction is politically very difficult. But what is politically easy may be environmentally ineffective.

Even if we limit quantitative physical throughput (growth) it would still be possible to experience qualitative improvement (development), thanks to technological

4. An earlier writer, defined standard of living as "the number of desires that take precedence in the individual choice over the effective desire for offspring" (Carver, 1924. p. 34) , thus anticipating the basic idea of the demographic transition.

5. This is an empirical question. Is fertility being reduced to make room mainly for cars and refrigerators, or for parks and leisure?

advance and to ethical improvement of our priorities. Some say that we should not limit growth itself, but only stop bad growth and encourage good growth. However, only if we limit total growth will we be forced to choose good growth over bad. And furthermore, we can also have too much 'good' growth, or as it is often called 'green growth'. There is a limit to how many trees we can plant as well as to how many cars we can make. Growth beyond optimal scale is uneconomic growth, and we should stop the folly of continuing it.

If you are an optimist regarding 'soft' technologies (for example, conservation, solar) please have the courage of your convictions and join in advocating these policies that will give incentive to the resource-saving technologies that you believe are within reach. You may be right – I hope you are. Let us find out. If you turn out to be wrong, there is really no downside, because it was still necessary to limit throughput and consequently the 'hard' resource-intensive technologies (for example, fossil fuel, nuclear) that are currently pushing uneconomic growth.

Our strategy so far has been to seek efficiency first in order to avoid frugality – to keep the throughput growing. But 'efficiency first' leads us to the Jevons paradox – we just consume more of the resources whose efficiency we have increased, thereby partially or even totally cancelling the initial reduction in quantity of resource used. If we impose 'frugality first' (caps on basic resource throughput), then we will get 'efficiency second' as an induced adaptation to frugality, avoiding the Jevons paradox. Blocking the Jevons paradox is an advantage of the cap-auction-trade system over eco-taxes, although taxes have the advantage of being administratively simpler. Both will work.

Is this vision of a developing but non-growing economy not more appealing and realistic than the deceptive dream of an economy based on continuous growth? Who, in the light of biophysical reality, can remain committed to the growth-forever vision? Apparently our decision-making elites can. They have figured out how to keep the dwindling extra benefits of growth for themselves, while 'sharing' the exploding extra costs with the poor, the future, and other species. The elite-owned media, the corporate-funded think tanks, and the kept economists of high academia, Wall Street, and the World Bank, all sing hymns to growth in perfect unison, deceiving average citizens, and perhaps themselves. Their commitment is not to maximize the cumulative number of people ever to live at a sufficient

standard of consumption for a good life for all. Rather, it is to maximize the standard of resource consumption for a small minority of the present generation, and let the costs fall on the poor, the future, and other species.

Some of the elite do not realize the cost of their behavior and will change once they are made aware. Others, I suspect, are already quite aware and do not care. The former can be persuaded by argument; the latter require repentance and conversion – or revolution, as Marxists would argue. Probably this line of division in some way runs through each of us rather than only between us. Intellectual confusion is real and we need better understanding, but that is not the whole story. The elite may already understand that growth has become uneconomic. But they have adapted by learning how to keep the dwindling extra benefits of growth, while ‘sharing’ the rising extra costs.

Indeed why not, if we believe that Creation is just a purposeless happenstance, the random consequence of multiplying infinitesimal probabilities by an infinite number of trials, as taught by the reigning worldview of naturalism? I say Creation with a capital ‘C’ advisedly, certainly not in denial of the established facts of evolution, but rather in protest to the metaphysical naturalism widespread among the intelligentsia, that all is purposeless happenstance. It is hard to imagine, under such a vision, from where the elite, or anyone else, would get the inspiration to care for Creation, which of course naturalists would have to call by a different name, say, ‘Randomdom’. Imagine calling on people to work hard and sacrifice to save ‘Randomdom’ – the blind result of Epicurus’ atoms swirling and swerving in the void! Intellectual confusion is real, but the moral nihilism logically entailed by the naturalistic scientism uncritically accepted by so many, may be the bigger problem.

The working hypothesis of scientific materialism, because it is so fruitful and widely accepted, is also constantly tempted to imperially morph into an Ultimate Metaphysics - albeit a metaphysics of Chance. However, explaining everything by chance is close to having no explanation at all. Simply adding Darwinian natural selection to Mendelian random mutation does not really mitigate the dominance of chance, because the selective criteria of environmental conditions (other organisms and geophysical surroundings) is also considered to be a random product of chance. Mutations provide random change in the genetic menu from

which natural selection picks according to adaptive survival odds determined by a randomly changing environment. Many of us would insist that purpose is also causative in the physical world, and is non-random. Given purpose, change in the environment is not entirely random, and given modern genetics even mutation is no longer entirely random. However, a historical animus against teleology of any kind leads Neo-Darwinists to affirm that purpose or free will is reducible to deterministic biophysics, and that any direct subjective experience of purpose, or reasoned decision-making in pursuit of a purpose, is an "illusory epiphenomenon." It is hard to square empiricism with such a cavalier rejection of our most immediate and direct experience, that of purpose. If reason and purpose are illusory, then so is policy. Logically Neo-Darwinist biologists must be even more *laissez-faire* than Neo-Classical economists. Economists at least recognize purpose as causative, but traditionally refuse to pass ethical judgment (the individual consumer's purposes are sovereign). Biologists, or at least Neo-Darwinist materialists, deny the independent causality of purpose and therefore must consider it meaningless to pass ethical judgment on "choices" that from their perspective could not have been otherwise.

When contemplating the meaninglessness implicit (and increasingly explicit) in their materialist cosmology, some scientists seem to flinch, and look for optimism somewhere within their materialism. They invent the hypothesis of infinitely many (unobservable) universes in which life may outlive our universe. They were led to this extraordinary idea in order to escape the implications of the anthropic principle – which argues that for life to have come about by chance in our single universe would require far too many just-so coincidences. To preserve the idea of chance as reasonable cause, and thereby escape any notion of Creator, they argue that although these coincidences are indeed overwhelmingly improbable in a single universe, they would surely happen if there were infinitely many universes. And of course our universe is obviously the one in which the improbable events all happened. If you don't believe that Shakespeare wrote Hamlet, you can claim that infinitely many monkeys tapping away at infinitely many typewriters had to hit upon it someday.

Such a Metaphysics of Chance precludes explanation of some basic facts: first, that there is something rather than nothing; second, the just-right physical "coincidences" set forth in the anthropic principle; third, the "spontaneous

generation” of first life from inanimate matter before evolution can get started; fourth, the creation of an incredible amount of specified information in the genome of all the irreducibly complex living creatures that grew from the relatively simple information in the first living thing (neglecting that random change destroys rather than creates information); fifth, the emergence of self-consciousness and rational thought itself (if my thoughts are ultimately the product of random change, why believe any of them, including this one?); and sixth, the innate human perception of right and wrong, of good and bad, which would be meaningless in a purely material world. Explaining these facts “by chance” strains credulity even more than “by miracle”.

It seems that a sustainable steady-state economy, as a policy of Creation care, will not get far in a world dominated by naturalism. Naturalism denies the premises underlying policy of any kind, namely that our purposes are causative in the physical world, that Creation is not random, that our reason is capable of understanding its order, and that we can distinguish good from bad. There are many political roadblocks to a steady-state economy, but the most fundamental barrier is the metaphysical dogma of naturalism that logically, but blindly, aborts the possibility of policy of any kind.

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Rethinking Everything: A sustainable economic system requires radical change in almost everything people consider normal

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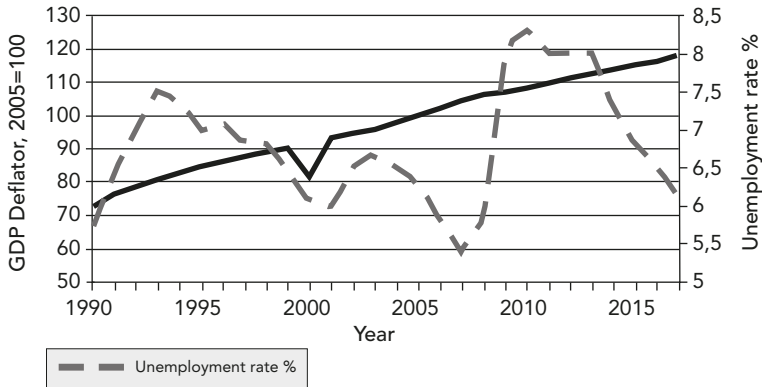
Abstract

Economic growth is not a prerequisite for human development. While economic growth appeared useful following the Second World War, its continued pursuit will result in further environmental destruction and ever-widening inequality. It risks making climate change unstoppable, with dire consequences for humanity and most other species. It is not possible to make a gradual shift to a more sustainable system, as the basic requirements for an enduring economic system are fundamentally different from those that currently exist. To avoid an environmental catastrophe, societies need to deconstruct their economies and radically rethink their purpose.

For most of the last 70 years, the world has experienced high rates of economic growth. While living standards have improved for many people in the rich world, this has come at a heavy cost, especially to nature. The gap between rich and poor has widened, particularly in the last 30 years, and the level of unemployment has

risen. It remains higher today than in 1990, despite more than 25 years of strong economic growth. In the EU28, almost one in five people under 24 is unemployed (OECD, N.D.). Species loss has accelerated (WWF, 2018) and climate change, which is a direct result of human activities, has become an existential problem.

GDP and Unemployment – Advanced Economies, 1990–2017



SOURCE: IMF WORLD ECONOMIC OUTLOOK DATABASE

In response, economists have tried to find different ways to maintain the upward trend in living standards without the need of further economic growth. They have suggested many seemingly better alternatives, such as degrowth (Degrowth.info, N.D.), low-growth and green growth (Maxton and Randers, 2016 p.144. See also Greengrowth Knowledge Platform, N.D.). Yet, to the surprise of many people, not least of all these economists, none of their ideas have had any impact. Economic growth has remained the main goal for most societies and the pace of environmental destruction has accelerated.

The proposals for change have failed for many reasons, but two are especially important. First, few economists have understood the problem properly. They have not understood that the link between human progress and economic growth is a false one. Nor have they understood how serious the environmental damage has become, and so how radical the change will need to be. Second, and as a consequence, their ideas for reform have been too timid. They have not

reflected the scale or urgency of the transition that is required. Their proposals for a gradual transition to a less destructive system are not nearly bold enough.

According to current thinking, it is economic growth that has been the main fuel that has powered modern human progress. It is economic growth that has created jobs, increased wages and boosted living standards. Economic growth is seen as the catalyst which has spurred a virtuous upwards spiral, with higher levels of demand encouraging further investment. This has led to more jobs, booming societies and improved living standards. Economic growth is currently seen as the stairway to human progress.

Coupled with free trade, economic growth is thought to help those in the poor world too. Thanks to economic growth, runs the common narrative, a billion of the world's poorest people have been lifted out of poverty (The Economist, 2013) since 1980. Tied to current ideas about democracy and freedom, economic liberalisation is depicted as the key to healthy development. If the market is left unrestrained and government interference is limited, goes the thinking, human progress will surge. Though there are clear and nasty ecological consequences, if the pace of economic growth can be sustained, and people are lifted from poverty, these side-effects can be fixed.

These economic ideas have become so widespread, that they have become part of a Gramscian "common sense" narrative (Crehan, 2016). Yet this narrative is false. Economic growth is not a precondition for human progress. It does not create jobs in the long term, reduce inequality or help the poor. It mostly rewards the rich and it creates enormous environmental destruction in the process.

The idea that economic growth is a precondition for rising living standards stems partly from the belief that it was responsible for much progress in the decades following the Second World War. But while living standards improved greatly during this time it was not the pursuit of economic growth alone that made this possible. The increase in GDP was largely a consequence of other policy objectives and actions. Growth was not the central social or political objective. The rapid pace of economic growth was mostly a consequence of other policies, as well as the need to rebuild after the war. This created high rates of growth because the base was very low.

The rate of growth in the post-war years was also inflated by a rapid rise in the population. A rising population is one of the main drivers of economic growth. Rising living standards were mostly due to the adoption of social policies that were specifically designed to improve well-being. Wealth was redistributed through the taxation system and the state improved the provision of healthcare and welfare. Much money was also spent on infrastructure, on roads and transportation networks, at public expense. The policy objective between the late 1940s and the 1980s was not to maximise the increase in GDP each year, but to provide jobs, build trade and improve living standards. Economic growth was mostly a by-product.

After the early 1980s, the economic focus of most developed countries changed. Rather than pursuing full employment or boosting living standards, the goal was simplified to the more raw pursuit of maximising the rate of economic growth. Economists, academics and organisations such as the Mont Pelerin Society, successfully argued that the pursuit of growth alone would be enough (Monbiot, 2007). They argued that it was growth that created jobs, reduced inequality and improved living standards. This message appeared logical, but it was also wrong.

A focus on economic growth does not create jobs in mature economies, where there is open trade, in the long term. To generate growth an economy needs to increase its population or boost productivity. These are the main sources of growth. Growth does not come from rising consumption. That is a consequence. Growth is the result of boosting efficiency, through businesses and governments striving for higher levels of outputs for a given level of inputs. This means there is a constant pressure to reduce the value and volume of inputs (land, materials and labour), in order to maximise the value of outputs (production and profits).

This means that an economic system focussed on growth rewards mechanisation and robotisation, and so the long term elimination of workers. Unless more work is created, which is difficult when there is free trade and businesses can move to low cost production centres without penalty, the push for economic growth means that the long term level of unemployment rises. This explains why much of the rich world has experienced stubbornly high levels of unemployment, or partial unemployment where people are forced to work part-time, for more than a generation, despite record rates of economic growth. The surplus of people in

the labour market has also led to stagnant or falling incomes in many rich world countries, as well as low job security. The push to robotise and mechanise an even greater number of jobs in the future will accelerate these trends.

Nor does the pursuit of economic growth reduce inequality. It achieves the opposite: it widens the gap between rich and poor. This is the central theme of Thomas Piketty's (2014) best selling book, *Capital in the 21st Century*. As the economic system is currently formatted, the rewards flow disproportionately into the pockets of the rich, and then they stay there. Those with money earn by investing it and receiving dividends and asset appreciation in return. They also earn money by lending their wealth, through the banking system, and earning interest. These sources of income are not available to the poor. Rather, they are the people who borrow, and so pay part of their incomes to the rich in the form of interest. According to the OECD, the result of this is structural imbalance is that the gap between rich and poor in the developed world is higher today than it was in 1914 (Michail, at al., 2014). The gap between the rich world and the poor world has widened too, and is now greater than it was in 1820, almost 200 years ago (ibid).

Economic growth has not released a billion people from poverty either, despite the claims of the World Bank and The Economist magazine. While the nominal figures support the claim that there are a billion fewer people living on less than \$1 a day, when inflation is properly accounted for, the number of people in the world living on \$1 a day, in 1980 terms, has actually increased slightly (Maxton and Randers, 2016, pp. 189-190). The only exception to this is in China, where many hundreds of millions of people have experienced a vast improvement in living standards. But this is not the result of a push for economic growth alone. China's progress has been greatly state directed.

Pre-industrial history supports the idea that economic growth is not a necessary pre-condition for human development either. For 800 years before 1800, the rate of economic growth in Europe was barely above zero, 0.3% a year on average (The Maddison Project, 2010), most of which was the result of the very gradual rise in population. Yet societies developed, new technologies were invented and the arts and societies flourished, certainly at times. The gap between rich and poor may have been very great, but there was still development.

The unitary drive for ever more economic growth has also proved especially destructive to the environment, though it has also been made much worse by the effects of the human population more than doubling during the last 50 years. This has greatly increased human demands on nature, and led to much higher levels of pollution, especially of the seas and atmosphere.

Because the push for economic growth has required an ever-greater throughput of raw materials, to dig these up, process them and transform them into goods has required ever more energy. As that energy has been fossil fuel derived for most of the last 200 years, and remains 80% fossil fuel derived today (BP, 2018), the push for economic growth has been the direct cause of the rising levels of greenhouse gases in the atmosphere. In other words, the current economic system is the cause of climate change.

Despite so many scientific papers and warnings about the consequences of this, most people, especially those in the English-speaking world, still appear to believe that global warming is a problem which will need to be addressed by future generations. They think that there can be a gradual transition to a non-fossil energy world over perhaps 30 years. In reality, humanity has less than 20 years left to fix the climate problem. If it does not, and continues to emit gasses at the current rate, then it will kick off a chain reaction in the early- to mid-2030s which will be impossible to stop. The resulting change to the atmosphere and the planet will continue for centuries.

If humanity does not take a different path then, by the end of this century, the changes will be so large that it will be extremely difficult for human life to continue in anything like its current form. According to the World Bank (Rigaud, at al., 2018; See also World Bank, 2012), the rise in temperature expected by 2100, even under the Paris Agreement, would be "incompatible with an organised global community" (Kevin Anderson, quoted in Dunlop and Spratt, 2017 p. 5). The Potsdam Institute in Germany says that it would be difficult to sustain a human population of more than 1 billion in such circumstances (Kanter, 2009). This is a near 90% reduction in human life. Other estimates suggest that barely 500 million

people could survive¹, advising that this sort of temperature increase is “beyond adaptation”. Nor do these projections account for the consequences of the conflicts which will arise as people fight for their survival, as they battle for access to water, food and shelter in the face to rising sea levels and droughts.

To avoid this future requires humanity to dismantle much of what has been constructed. It will require the rapid closure of most of the fossil fuel industry, as well as the cement industry and many other energy dependant business sectors. It will mean heavy restrictions on the use of conventional cars, aircraft and ships, until clean alternatives are available. Once all this has been done, humanity will need to rethink the economic system, and create a model of development which is sustainable. What, then, does humanity need? What would a sustainable economic system look like?

A sustainable economy is hard to conceive for several reasons. First, there is no clear definition of what the word “sustainable” means (Kho, 2014). It has become a word with countless interpretations, that morphs into the whatever is needed. In some languages the concept does not exist at all. It has also become a marketing buzz-word, used by big corporations to greenwash their activities. Not knowing what to aim for makes sustainability a hard target to hit.

Secondly, a sustainable economic system is hard to conceive because most people are used to thinking short term. Even those who try to look decades into the future are unused to thinking much further. Yet for any economic system to endure, it should be designed to last for centuries, perhaps millennia.

Third, and perhaps most importantly, if humanity is to progress in a more balanced way, this is not a good place to start. In the long sweep of time, the free market economic system, with its focus on growth, has proved particularly transient and destructive. It will probably only last a few decades in its current extreme form, before it has to be dismantled or causes irreversible ecological destruction. Given

1. Kevin Anderson, as Deputy Director, Tyndall Centre for Climate Change Research, “considers that “a 4°C future [relative to pre-industrial levels] is incompatible with an organised global community, is likely to be beyond ‘adaptation’, is devastating to the majority of ecosystems, and has a high probability of not being stable”. He says: “If you have got a population of nine billion by 2050 and you hit 4°C, 5°C or 6°C, you might have half a billion people surviving” (Dunlop and Spratt, 2017 p. 5).

that, societies cannot simply tweak the existing system to make it sustainable. A radical re-think will be needed, from the ground up.

To be genuinely sustainable, the economy of the future will need to be able to prosper for many generations. It will need to respect the boundaries of nature. Its ecological condition will need to be stable so that the human footprint does not rise even if the population increases. The needs of future human generations, as well as all other species, will need to be regarded as equal to those that are living.

To achieve this will require the economy to exist with very little consumption of non-renewable resources. Pollution will have to be limited to what nature can easily absorb. It will need to exist without exponential growth in the use of anything which cannot be easily reproduced.

Characteristics of a sustainable “equilibrium” economy

- Long term, with the capacity to endure for many centuries
- Within the bounds of nature
- Stable ecologically
- Capable of satisfying the basic needs of all people fairly, as well as the needs of other species, in an enduring way
- Fixed maximum human ecological footprint, regardless of the population
- Highly restricted use of scarce resources
- The rights of future generations and other species equal to those living
- Very low levels of pollution which can be absorbed quickly and easily
- Progress measured differently from today
- Planned leisure time
- Free and universal access to contraception
- No industrial weapons
- Low variability in economic activity - no boom and bust
- Inequality possible, but limited
- A right to privacy, but a limited right to freedom
- An upper limit on the population, though this can probably change a little
- Strict constraints to avoid exponential growth in non-renewable resource use and pollution generation

An equilibrium economy would need to place strict constraints on the use of non-renewable resources, as well as the production of pollution, so that they are never able to grow exponentially. They must not be allowed to create any serious hazard for future generations, even many centuries into the future. That means that the number of people in the world would have to be limited too, though the actual limit might vary according to society's technological capacity. A more efficient economy might allow for more people. In which case the human population may be able to rise progressively, but always within an upper limit, which would determine the living standard that could be achieved by everyone. Fewer people would mean higher average living standards.

To manage the population successfully, access to contraception would need to be free and universal, and be 100% effective. The number of children per couple would need to be restricted, though there could be the opportunity to "trade" between couples so that those who want more children could strike a deal with those unable to have children or those who do not want them. The average family size would need to be globally limited to the replacement rate, or below.

Given the ecological footprint (Global Footprint Network, N.D.) of 7.6 billion people today, it seems likely that the maximum population would need to be much lower than this, regardless of technological developments. According to the 1972 book, *The Limits to Growth* (Meadows, et al., 1972), the population would need to be around half the current level. Even then, the use of natural resources would need to be held within very tight limits. If consumption breached the limit, due to an increase in the population, either one or both would need to be reduced to bring the system back into equilibrium. There would also need to be some sort of mechanism to maintain stability in the economy, something which would stop violent swings in activity and so eliminate the possibility of collapse and conflict.

The first objective of the agricultural sector would need to be maintaining the stability of the land for future generations. Food production would have to come second. The use of non-renewable fertilisers or pesticides which damage the land, erode the soil or pollute the atmosphere in their production or use, for more than a few years, would not be possible in a sustainable economy. Urban organic waste, cleaned of any chemical residues, would need to be the main source of soil nutrition. This would also remove it from towns and cities, reducing pollution there.

When it comes to physical goods, manufacturers would need to be strictly limited in the resources they could use. The longer the society or civilisation wanted to last, the fewer non-renewable resources industry could use, and the less long-lasting pollution it could create. Most goods would need to be made from recycled materials, or renewable ones, with the level of waste and pollution strictly controlled. A major and vital business sector would be the design of products, so that they could be re-manufactured, recycled and repaired simply, without the use of complex non-renewable equipment. Equipment and items manufactured would need to last for as long as possible. This means too, that the amount of capital devoted to production would probably need to decline progressively. As producers increased efficiency, the gains would need to be offset through a reduction in manufacturing capacity, rather than an increase in production, so that the throughput of resources did not rise.

Energy would obviously need to come from renewable resources, though even here there would need to be very heavy restrictions on how it could be produced. The current approach to the generation of renewable energy, and its storage, is highly resource intensive. Solar panels, wind farms, hydro power and wave machines all use vast quantities of non-renewable resources in their manufacture, as does current battery technology and the distribution network. None of this would be possible.

At first glance, this image of a what a sustainable economy requires might appear rather depressing, like a reversal in human history of several thousand years. Without big factories and the push for ever higher output, it might even seem frightening. Such an economic system would certainly be very hard to manage and control, requiring creativity, flexibility and great self-discipline, and the development of skills that do not exist today. To bring a controlled end to the current sort of economic growth, and maintain this, would be a considerable challenge too, especially without the lessons which will come from the ecological collapse humanity is still trying to avoid.

To move ahead, and build something sustainable, global society will first need to find some mechanism to reduce its current ecological footprint. Only then can it start to think about creating something more enduring. That process will inevitably damage the economy and reduce living standards for many people in the short term.

Any transition will be made harder by the fact that very few people are willing to act for the long term and even fewer understand properly what is needed. The transition to a sustainable system will require exceptional leadership. It will need vision and a single-mindedness to focus first on one objective – to reduce the human ecological footprint and bring it back into balance with nature, almost regardless of the cost. It will require strength to resist the temptation of half-way solutions.

Humanity will also need to radically change the way it thinks. It will need to accept that there are limits to what it can achieve. That will be especially difficult because nature's limits have been viewed as hurdles to overcome. Before they can build new foundations, societies will have to accept that there are constraints, and that these have been breached. This is an enormous undertaking. Those who lead society will first need to understand that humanity is in ecological overshoot and then help their people embrace the consequences.

Yet what societies have to do is within human capabilities. It does not require anyone to invent anything. Humans have all that is physically needed to stop the current ecological destruction and create a new form of society, one which can endure. All that is required is for some people to come together and make a series of (albeit very difficult) decisions in the interests of all. Humanity faces a social and organisational challenge. It is a question of human will, and the application of greater wisdom that will determine the outcome.

A stable economy does not mean a stable society. Humanity can still develop. Rather than boosting material consumption, it can grow artistically, culturally, intellectually and technologically. It can focus on improving average well being, life expectancies, health and happiness. Sports and religion can flourish. It is only the resource flow that needs to be kept in a constant state, so that scarce non-renewable resources are not depleted to any measurable degree and the environmental degradation never breaches natural limits.

A stable economy can even enjoy economic growth, if that is thought useful. The GDP can continue to rise or fall, because the value of goods and services being produced can still change. As well as the provision of care and services, many of which use little or no non-renewable resources, a great many industrial sectors

will still be needed in an equilibrium economy, to produce food, provide mobility and manufacture equipment, just as today. These will need to operate completely differently however, with more localised agriculture, the use of electric propulsion using renewable energy, generated without the use of many resources, and by making equipment from recycled metals and other materials. All sorts of new business sectors will be required too, to manage the process of sharing what is produced, for example. The price charged for all these goods and services can still change, meaning that the monetary value of the economy can still grow.

Even so, sustainable societies will probably need to learn to be agnostic about economic growth, not make it the goal. What societies measure reflects what they value, and the pursuit of economic growth for its own sake is a pointless objective from the viewpoint of the vast majority of people.

As well as tracking progress in different ways, equilibrium societies will also need to reflect on the medium of exchange used for the purchase and sale of goods and services, and its purpose. They will need to ask whether or not they need money. Much thought will need to be given the role of the finance sector too. Would it be possible, and better, for the societies of the future to function without both?

Similarly complex is the question of governance. Will democracy be the best way to achieve progress in an equilibrium economy? It is easy to think that it would be, to parrot in affirmation because that is the Zeitgeist. It is nonetheless true that the country which has achieved the most in the last 50 years, in terms of improving the well being of its citizens, is China. It is a country that is not democratic, at least in the Western-world sense. It is also true that the monarchies and military empires of the past were often more stable and longer lasting than the current economic system. Much thought will also need to be devoted to the role and purpose of the nation state. Linked to this will be questions about the role of the military. Any long-lived society would need to live without conflict, and also without weapons which require many resources to manufacture and which create, or threaten to create, devastating levels of lasting pollutants. The civilisation of the future will need to banish war, a little like some of those idealised communities from an episode of Star Trek. Stopping war may seem an impossible task, given human history, but it is nonetheless a condition for stability.

There are three further conditions which will need to be met if humanity is to flourish sustainably. First, an enduring economy must meet everyone's requirements for food, education, safety, purpose, mobility, communications and shelter, and it must achieve all this fairly. This is obviously necessary to sustain life but it is also needed to eradicate injustice, which will greatly reduce the chance of conflict, and so war. A vital watchword of the future will need to be dignity. Everyone will also need to be equal before the law.

Second, the right to privacy will need to be reinstated because it is a necessary requirement for individual freedom. Being watched and monitored limits people's ability to think and speak freely. Freedom would need to be tightly restricted in other ways, however. An enduring society would need to focus on the good of everyone and this requires individual activities to be constrained at times. People would not be able to have as many children as they wish, or waste resources or generate pollution. Individuals would need to respect the social limits that are necessary to maintain an equilibrium state.

Third, a sustainable world will require leisure time. Technological improvements which increase output will have to be exchanged for greater leisure, so that a sustainable society can avoid excess production and waste. Surplus production would not be permitted.

An equilibrium society would still need to develop lots of new technology, to continually reduce waste, improve the rate of recycling, increase energy efficiency and in medical science. Societies would want to increase the lifespan of products, collect as much discarded material as possible, find new ways of capturing solar energy and increase harvests without the use of damaging chemicals. Developments would also be needed in medical science, and in the provision of contraception.

A major incentive for people to innovate would be the knowledge that their work had further improved human well-being. How people spent their leisure time would also need to be limited to activities which did not increase consumption, use non-renewable resources or generate pollution. One goal of a sustainable society might be to fulfil John Maynard Keynes' (Keynes, 1930) expectation from the 1930s, where people would only need to work for 15 hours a week.

A steady state economy would not require equality. People are not all equal. Differences should be recognised. More important would be for it to provide equality of opportunity, to ensure that everyone contributed to social development as much as possible, and according to their abilities. Once a sustainable society has met the basic needs of all its citizens, rewards for individual achievement can still be offered, as long as the gap between rich and poor is carefully controlled, and as long as these achievements are justly recognised. As well as a guaranteed minimum living standard, there would need to be a maximum standard too. It would, of course, be possible to maintain a society with very wide levels of inequality as well, as this has happened in the past. This eventually leads to conflict however, and so is unlikely to endure as long.

In summary, to successfully build a sustainable economy, means that the entire system of human development will have to be overhauled. Societies will need something like a new Enlightenment, to redefine just humanity's role and purpose.

On the need to reflect on what words mean

As with the European Enlightenment, societies will also need to put a great deal of effort into thinking about what words mean. They will need to carefully redefine what is meant by freedom and liberty, and perhaps return to something more like John Stuart Mill (1869) and Jean Jacques Rousseau (1762) originally intended. According to Mill, freedom is defined as the right to say and think openly, to have any opinion, no matter how outrageous, as long as others are not injured by what is said. The state's power over the individual is limited, but it is not removed.

Today, freedom has morphed into the right for people to act as they wish, to behave selfishly, almost completely unhindered by the effect their words and actions have on others, the state, or the earth's destiny. It builds on the false idea that the individual is sovereign. To move beyond this, humanity will need to ditch another wrong-headed idea from the 1980s: Margaret Thatcher's notion that there is no society, only individual men and women, as well as families (Margaret Thatcher Foundation, N.D.). A sustainable society will need to accept that there is a human society, a necessary social connection between peoples. As well as fearing the tyranny of the majority, healthy societies of the future will need to find a way to embrace its collective wisdom.

Humanity will also need to rethink its relationship with nature. Modern societies have warped Charles Darwin's ideas on nature. When he talked about the "survival of the fittest"², he did not mean that competition is good and that only the strong survive (see Darwin Correspondence Project, 2016). He meant that those that survive are those that best "fit" their surroundings. They are best adapted to live in harmony with the world around them. Humanity cannot fight with nature and hope to win. A sustainable society will need to learn the humility to live in balance with nature, as part of it.

Humanity will also need to redefine what it considers to be happiness, peace and purpose. It will need to redefine leisure, so that does not equal consumption. It will need to stop wasting huge amounts of energy and time creating products and services of no useful value.

Properly thinking through the implications of an equilibrium economy will take a very long time. There will need to be extensive debate and a coalescence of ideas about what a better world should be like and how societies can construct it. It will require a change in mindset, in human values, not just a change in the economic system and ideas of progress and well-being. Humanity will need to radically rethink almost everything it considers normal if it is to build a society which can endure. As very few people have given these issues much thought for a very long time, societies will also need to develop the capacity to do that too. One of the biggest barriers to progress in recent decades has been humanity's inability to imagine its future.

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2. While the concept is attributed to Darwin, the actual phrase "survival of the fittest" belongs to Herbert Spencer.

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Agrowth Instead of Anti- and Pro-Growth: Less Polarization, More Support for Sustainability/climate Policies¹

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Abstract

An agrowth strategy, defined as being agnostic and indifferent about GDP growth, is proposed as an alternative to unconditional anti- and pro-growth strategies. It is argued that such a strategy can contribute to reducing scientific and political polarization in the long-standing debate on growth versus the environment. Hence, it can broaden urgently needed support for serious sustainability and climate policies. The exposition includes a novel graphical illustration, a summary of recent surveys of citizens and scientists regarding support for an agrowth position, and a discussion of implications for population growth and policies.

1. I am grateful to the editor, David Samways, for careful reading and insightful comments.

1. Growth fixation as a barrier to sustainability policies

Humanity faces serious sustainability challenges but has been incapable so far of implementing sufficiently strict policies that guarantee a sustainable course of the economy. One important reason is that voters and politicians – fueled by pessimistic environmental science studies – fear that serious policies will hamper economic growth. Whether this will be the case or not is of no relevance. What matters is the psychology behind it. If people cannot be convinced that policies will not harm growth then such policies will not receive majority support. Of course, one could respond by claiming that green growth is possible, even though the evidence for this is weak. In fact, the uncertainty surrounding this issue is immense and it is impossible to provide definite proof of whether or not green growth is feasible. What we know for sure is that current growth is not sustainable and that for a while, during a transition phase, it will remain unsustainable. One way out of this dilemma is to refrain from trying to convince voters and politicians that green growth is possible. In fact, economists have been unsuccessful in persuading both groups, otherwise good sustainability policies would have already been implemented. I will propose here that we should become agnostic and indifferent about GDP growth, i.e. adopt an *agrowth* position (van den Bergh, 2011). One reason is that the GDP is not a good indicator of happiness or social welfare. Another reason applies specifically to rich countries where for some time increases in average income growth have not contributed to significant increases in social welfare.

Climate change illustrates the need for an ideological shift to *agrowth* (van den Bergh, 2017a). The challenges posed by climate change and policies to tackle it have revived the growth debate. Modern economies and lifestyles are highly dependent on burning fossil fuels, generating CO₂ emissions responsible for global warming. If per capita GDP increases by 1.5% annually, to realize the 2°C goal (supported by IPCC and the Paris Climate Agreement), carbon intensity or emissions per unit of GDP should decrease by some 80% by 2050, which comes down to a 4.4% average annual improvement (Antal and van den Bergh, 2016). Even if economic growth would come to a halt – i.e. in the case of zero growth – still an impressive 67% intensity reduction, or 2.9% on average per year, will be required. Since these reduction rates should be net of all energy rebound (Sorrell, 2007) and carbon leakage effects (Felder and Rutherford, 1993), they are merely lower bounds. Under serious climate policy the rate of economic growth

is thus likely to drop for some time, possibly until we have reached a zero-carbon economy. Such a consequence will induce fear for and opposition to associated climate policies in many advocates of green growth. An agrowth strategy, on the other hand, will facilitate the acceptance of these policies as it will free us from the unnecessary, welfare-obstructing growth paradigm. This will result in removing false trade-offs between GDP growth and other goals arising from the constraint of always, at any time and under any conditions, having to achieve GDP growth.

2. We should abandon GDP but are unable

A large majority of economists, journalists and politicians, irrespective of their political affiliation, express themselves uncritically about GDP and fail to distinguish it clearly from (social) welfare. Nevertheless, a growing group of economists, including many Nobel laureates, have explicitly accepted the shortcomings of GDP (summarized in Table 1). Early critics included eminent economists such as Kuznets (1941), Galbraith (1958) and Samuelson (1961). Later influential voices are Mishan (1967), Nordhaus and Tobin (1972), Hueting (1974), Hirsch (1976), Sen (1976), Scitovsky (1976), Daly (1977), Tinbergen and Hueting (1992), and Arrow et al. (1995); more recent contributions come from Frank (2004), Kahneman et al. (2004), Victor (2008) and Jackson (2009).

In line with this, empirical research on happiness suggests that in most Western (OECD) countries the increase in prosperity or happiness stagnated somewhere in the period between 1950 and 1970 or even reversed to negative trend, despite the steady growth in GDP per capita (Layard, 2005). This is supported by empirical studies of alternative indicators of social welfare, such as the ISEW (Index of Sustainable Economic Welfare) (Daly and Cobb, 1989). Moreover, psychological research has found that individuals quickly become accustomed or adapt to new conditions, including income increases, and as a result welfare increases fall short of ex ante expectations (Easterlin, 1974).

Unfortunately, the majority of economists are less critical and accept or even overtly support the false idea that that GDP growth always means progress. They should realize that both microeconomic and macroeconomic theories tend to formulate societal goals in terms of social welfare not GDP or its change. In the standard utility-maximizing behavioral model of microeconomics, income co-determines, with prices, the budget constraint, rather than being a proxy for

utility. Likewise, in macroeconomics, growth theory is dominated by models of optimal economic growth in which the guiding criterion is (intertemporal) social welfare rather than an aggregate GDP type of income measure.

Table 1. Main shortcomings of GDP as a proxy of social welfare

General	Specific
<p>GDP use does not satisfy basic principles of good bookkeeping.</p>	<ul style="list-style-type: none"> – GDP does not distinguish clearly between costs and benefits. – It does not correct for changes in (economic and environment) stocks. – It does not account for external (or social=private+ external) costs. – It is an estimate of the costs rather than benefits of market activities in a country.
<p>Using GDP (growth) as a proxy of social welfare (progress) is inconsistent with the general welfare focus in microeconomics and macroeconomics.</p>	<ul style="list-style-type: none"> – Optimal growth theory employs social welfare rather than GDP/income type of criteria. – In microeconomics, income is part of the budget constraint, not a proxy of utility. – If income is not a robust measure of welfare at the individual or micro-level, then aggregation of individual incomes into GDP cannot result in a robust indicator of social welfare.
<p>GDP does not capture stylized facts of empirical research on subjective well-being (happiness).</p>	<ul style="list-style-type: none"> – Modern income growth increases material consumption at the cost of basic needs like serenity, clean air, and direct access to nature; the latter are, however, not captured by GDP. – Somewhere between 1960 and the present, the increase in welfare stagnated or even reversed into a negative trend in most Western countries, despite the steady pace of GDP growth. – Individuals may adapt or get used to changed circumstances, including a higher income; thus well-being may temporarily change in response but then return to its baseline level.
<p>GDP does not capture income inequality, relative income, and status-seeking in consumption.</p>	<ul style="list-style-type: none"> – GDP per capita emphasizes average income, and neglects the income distribution, even though this affects opportunities for personal development and well-being. – GDP does not capture that individuals or families with low incomes benefit relatively more from an

	<p>income rise, because of the diminishing marginal utility of income.</p> <ul style="list-style-type: none"> – Welfare is relative or context-dependent, characterized by comparing oneself with others, rivalry via “positional or status goods”. – As GDP omits relative income aspects of welfare, it tends to overestimate social welfare and progress. – Rises in relative income and welfare come down to a zero-sum game: one individual loses what another one gains; GDP cannot account for this.
<p>GDP neglects the informal economy, its share in the whole economy, and its change.</p>	<ul style="list-style-type: none"> – In general, GDP just covers activities and transactions that have a market price and neglects informal transactions between people that occur outside formal markets. – Actual GDP growth sometimes reflects a transfer of existing informal activities (unpaid labor) to the formal market; so the benefits were already enjoyed but the market costs were not yet part of GDP. – This holds for both developed and developing countries, and for such informal activities as subsistence agriculture, voluntary work, household work, and child care. – The GDP can, therefore, not serve as a measure to judge the welfare impact of fundamental changes that involve a transition from informal to a formal activities.
<p>GDP does not capture environmental externalities, damage to ecosystems, and depletion of renewable and non-renewable natural resources.</p>	<ul style="list-style-type: none"> – The presence of externalities means that market prices do not reflect total social (=private+ external) costs, making them unreliable signals. GDP is, however, calculated using these prices. – If air, water, or a natural area are being polluted, any damage does not enter GDP, but when pollution is being cleaned up this contributes to GDP. – Capital depreciation associated with environmental changes (fish stocks, forests, biodiversity) and depletion of resource supplies (fossil energy, metal ores) is missing from the GDP calculation. As a result, GDP suggests we are richer than we really are.

NOTE: THIS TABLE IS REPRODUCED FROM VAN DEN BERGH (2017) AND SUMMARIZES THE SURVEY IN VAN DEN BERGH (2009).

So if this is all true, why do so many influential people get nervous when there is little GDP growth? This paradox (van den Bergh, 2009) can be explained by all of us constantly receiving the message, through news media and in education, that economic growth is imperative. Moreover, the response to low GDP growth from politicians, economists, financial markets and international organizations like the OECD (e.g., 2011), the World Bank (e.g., 2012), and the IMF is consistently negative. They all signal that GDP growth is a *sine qua non* for our society. An important additional reason is the widespread belief that GDP growth is a necessary condition for economic stability and full employment. Empirical evidence for this view is weak though, indicating that the relationship between GDP and employment is not constant (Saget, 2000). Broadly accepted insights about long-run equilibrium employment suggest that it depends more on search time (jobs and employees); structural mismatches between education and work; the difference between gross and net income; and the gap between income and unemployment benefits (Pissarides, 2000). Moreover, the causality of growth and employment is easily confused as more employment can increase GDP rather than the reverse. In this respect, the “productivity trap”, coined by Jackson and Victor (2011), is relevant. It denotes that growth compensates for potential unemployment resulting from technological innovation driving labor productivity improvements. This is possible as a higher labor productivity translates into higher incomes, allowing for additional purchasing power to balance the larger production capacity associated with productivity increases. This is, in a nutshell, the fundamental mechanism driving economic growth. Incidentally, by shifting taxes from income to environmental externalities one could redirect technological change from improving the productivity of labor to that of energy and material inputs to production. As a result, it would be easier to realize full employment and environmental goals simultaneously.

3. *Agrowth* elaborated

An *agrowth* position or strategy comes down to being agnostic about, i.e. ignoring, the GDP (per capita) indicator in public debates and policymaking. It means we will be indifferent, neutral or “agnostic” about the desirability of GDP growth, an idea first proposed in van den Bergh (2011). The motivation is the insight that unconditional growth implies an unnecessary and avoidable constraint on the search for human welfare and progress. By definition, such a constraint hampers the achievement of good public policies and decisions in any

area, whether social, health, labor, equity, education, environment or climate. This is graphically illustrated by Figure 1 in van den Bergh (2017a). One should note that an agrowth position opposes unconditional GDP growth, also known as the growth paradigm, but not growth per se.

Under an agrowth strategy, periods of high, low, zero and even negative growth could alternate with one another, as long as environmental sustainability and progress in terms of welfare were guaranteed. We would no longer give priority to average income over welfare, or assume growth would be necessary or sufficient for progress. While progress might sometimes coincide with growth, nobody would really care. With regard to environmental pressures, an agrowth strategy would allow for selective decline and selective growth of distinct economic and industrial sectors which would not necessarily translate into aggregate GDP growth.

By ignoring GDP information, we would in some periods be capable to give up potential GDP growth for a better environment, less unemployment, more income equality, more leisure or better health care. As a result, welfare-enhancing policy would be given priority over GDP growth-enhancing policy. This would contribute to social-political acceptability of public policies focusing on solving urgent and socially important problems that are likely to reduce social welfare. Such an approach is consistent with the advice by Nobel laureate Daniel Kahneman et al. (2004) to focus the attention of public policy on minimizing unhappiness. Clear examples are avoiding dangerous climate change, minimizing structurally high unemployment, and reducing extreme inequality and poverty. Whether these policies would work out well in terms of growth of GDP (per capita) would no longer be an issue.

Another advantage of an agrowth strategy is that it increases economic stability and reduces the likelihood of economic crises. The reason is that it weakens positive feedback in the economy which contributes to business cycles and crises. As argued in Antal and van den Bergh (2013), the current economic system is self-amplifying because a majority of the connections between important economic system variables take the form of positive feedbacks, while a minority of such connections takes the form of negative feedbacks. A positive feedback denotes that an output of a system enters the same system as an input, which then reinforces

the actual trend in the output. This is irrespective of whether the trend is a decline or a growth pattern. In other words, positive feedback can generate negative and positive spirals. Expectation about, and predictions of, GDP growth can be characterized as being pro-cyclical, in the sense that if it is widely believed that such information has a significant influence on reality, then, through pessimistic (or optimistic) reactions to negative (positive) growth expectations, these beliefs become self-fulfilling. This sets in motion positive feedback affecting, among others, consumer expenditures and savings, firm expenditures and investments, which result in economic instability.

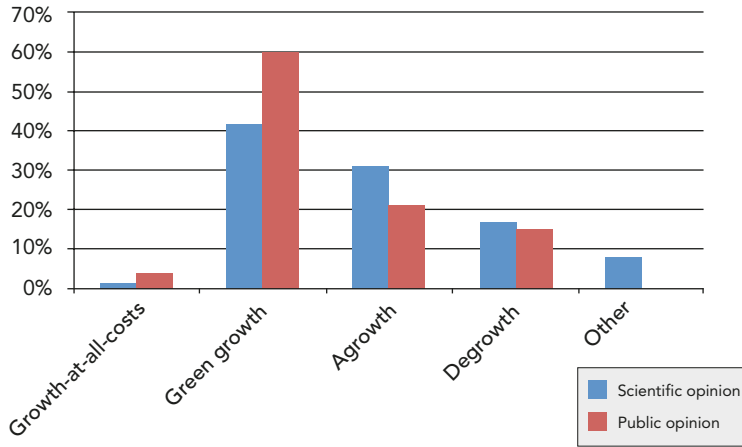
Positive feedback assures that, as long as we are on the upward trend, there is optimism about the economy. If, though, growth weakens and expectations are not met, pessimism about future GDP growth starts to set in, potentially leading to a recession. Two common solutions are offered by Keynesian and monetarist or new classical² schools of macroeconomics. The first recommends stimulating aggregate demand by increasing public spending or lowering taxes. The second proposes austerity and debt reduction to restore confidence. These strategies, although polar opposites, share the goal of restoring the upward economic spiral driven by positive feedback. And in environmental terms, both put their full confidence in green growth. Instead, an agrowth strategy tackles a fundamental positive feedback mechanism underlying economic instability, namely the role of GDP information. By suggesting to ignore the GDP indicator, it weakens positive feedback in the economy, resulting in a more stable economy. This will discourage extremely high growth rates but also lower the probability of recessions.

Antal and van den Bergh (2013) discuss a long list of options to weaken other positive feedbacks and strengthen or create negative feedbacks, with the aim to improve economic stability. One recommendation is to replace the GDP by another indicator, such as the Human Development Index, an income inequality measure (Gini index or median income), or an ISEW-type of proxy of social welfare (Daly and Cobb, 1989). Another idea is to construct an index that is an average of a minimum, medium and mean income, as it results in a monetary indicator that captures income inequality well (van den Bergh, 2017a).

2. Aimed at establishing neoclassical microeconomic foundations for macroeconomic analysis.

Empirical evidence suggests that agrowth may count on reasonable support, which means it could depolarize the debate on growth-versus-environment. Figure 1 depicts results from two questionnaire surveys, among scientists and citizens. While green growth is the most popular position, scientists express relatively more support for agrowth and less for green growth than citizens. With more discussion of a recent and new idea like agrowth one might expect support for it to increase.

Figure 1. Scientists’ versus citizens’ preferences for a public policy strategy regarding growth and the environment



SOURCE: VAN DEN BERGH AND DREWS (2019). DATA FROM DREWS AND VAN DEN BERGH (2016 AND 2017).

4. Riskiness of pro- and anti-growth strategies

The historical debate on growth versus the environment is often summarized as between optimists believing in limitless growth and pessimists seeing environmental and natural resource limits to growth. This opposition best defines the main policies and strategies found: namely, striving for green growth by decoupling income and production from environmental pressure versus an anti-growth approach taking the form of stopping growth (zero-growth) for the sake of the environment. However, a more subtle classification of viewpoints in the growth debate is possible, such as the five perspectives identified by van den Bergh and de Mooij (1999): a moralist, denying the relevance of further growth for individual and social welfare, notably in rich countries; a pessimist, stressing

environmental and resource limits to growth; a technocrat, seeing markets and technological progress as powerful mechanisms to relieve any existing limits; a sceptic, assessing economic growth and environmental ruin as both unavoidable; and an optimist, considering growth as a requirement for solving environmental problems since it makes citizens more concerned about the environment.

Even though many economists and international organizations express a strong belief in green growth, few politicians demonstrate that they share this belief through their actual decisions. Instead, they signal fear that serious climate policies will reduce the rate of economic growth. This suggests that economists have not provided sufficiently convincing evidence for the feasibility of green growth. This is no surprise, as the future is uncertain, and we have not yet succeeded in applying all the policy conditions that guarantee a sustainable economy, hence we do not know if such an economy could steadily grow in GDP terms. Theory says both outcomes are possible (Acemoglu et al., 2012). If green growth is not feasible, however, any strong messages about its realization will create false hopes. As a result, one will harm either the environment or economic stability.

Recently, a particular expression of anti-growth has appeared: so-called “degrowth” has the explicit aim of downscaling the economy to meet environmental goals (Schneider et al., 2010; Kallis, 2011). It can be interpreted as complicating climate policy with a quest for radical change. Degrowth is unlikely to be an effective strategy for creating broad political support given that it focuses on variables with an indirect link to emissions, instead of on the carbon content of growth, in addition to its basic message that we need income and other sacrifices to save the environment (Drewno and Antal, 2016). Furthermore, as degrowth does not follow a clear welfare approach and is not focused on sharply distinguishing between low-carbon and high-carbon consumption, it runs the risk of destroying too much welfare for the purpose of sustainability, without even guaranteeing an effective, let alone a cost-effective, way of solving sustainability problems. For instance, the degrowth proposal does not offer a clear framework for satisfactorily balancing – from a welfare perspective – changes in inputs (e.g., fuels), energy efficiency of technologies, composition of production and consumption, and volume or scale of activities. Any physical or GDP degrowth goal will then be arbitrary and debatable. Another shortcoming is that the term “degrowth” is defined and used differently by distinct authors. One can identify

at least five interpretations (van den Bergh, 2011), namely as GDP decline, less consumption (unclear how measured), a work-time reduction, a smaller physical size of the economy, and a radical move away from “capitalism” and markets. Such ambiguity does not contribute to productive societal or scientific exchange. The proposal for degrowth is likely to contribute to polarization, creating sharp differences between supporters and opponents of degrowth. If we sell climate solutions as degrowth, then support for these is likely to diminish rather than rise over time.

Instead, an agrowth strategy can, because of its neutrality and indifference regarding GDP growth, bridge pro-growth and anti-growth views and so reduce polarization. In fact, I have many personal experiences with degrowth and green growth believers expressing support for the agrowth position. To see why it can bridge the divide, one should recognize that agrowth does not preclude GDP growth when it is feasible and improves human welfare, and neither rejects GDP decline when an outcome of good social or environmental policies. In view of this, an agrowth strategy has the potential to create and amplify the political space for balancing distinct components of social welfare, such as consumption, employment, environment, leisure, health, and inequality. In particular, agrowth will make it easier to sell serious climate policy to the public and politicians, much easier than selling degrowth. In addition, by tempering preoccupation with continued GDP growth, it will moderate panic that is common among economists, journalists and politicians when GDP growth slows down. In other words, an agrowth strategy contributes to economic stability.

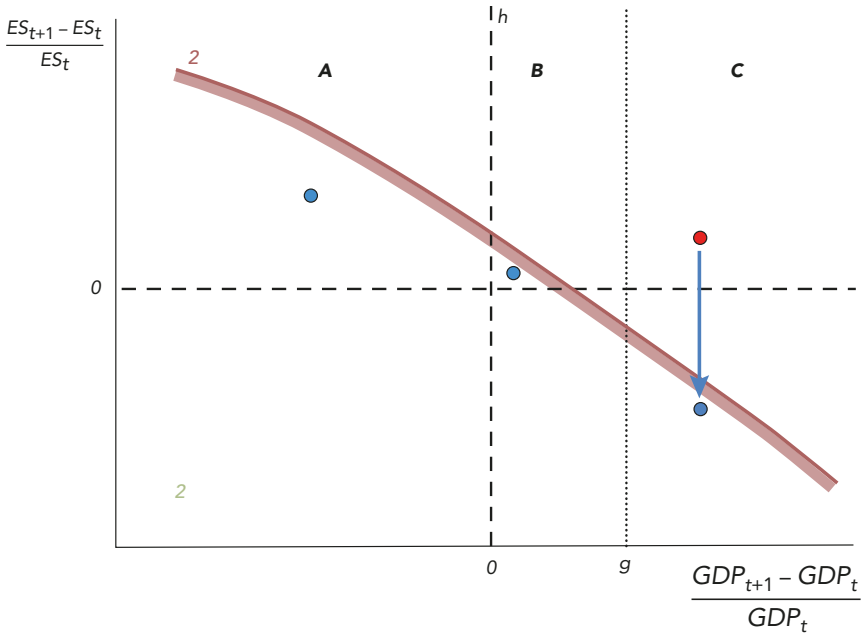
Figures 2 and 3 graphically illustrate that an agrowth strategy, i.e. indifference about where on the horizontal axis (indicating the rate of GDP growth) the economy is positioned, is robust against uncertainty about the relationship (curve 1 versus 2) between the GDP growth rate (horizontal axis) and the change in other components of human welfare including environmental sustainability (ES) (vertical axis). It is assumed here that environmentally desirable outcomes require being positioned above the horizontal 0 (zero) line, meaning that no reductions in environmental performance are accepted. Hence, a degrowth strategy strives to be in (rectangular) area A, a zero-growth strategy on the top (positive) part of vertical line h , a low growth strategy in (rectangular) area B, and a high-growth strategy in (rectangular) area C (where growth is higher than rate g , such as the

often expressed desire of at least 2% growth). However, an agrowth strategy does not exclude any of these areas.

Now, a pessimistic perspective on the growth-vs-environment relationship is shown in Figure 2 through a downward-sloped curve 1 that represents the upper bound to feasible combinations of changes in *GDP* and *ES*, while Figure 3 displays an optimistic perspective through an upward-sloped curve 2. Consider first Figure 2, where a green growth strategy aiming for growth beyond the rate g is not wise as it will not achieve its aim of ending up in area C. The reason is illustrated by the red position above the constraint 1 which represents an infeasible goal. If one strives for high growth associated with it, the economy will end up in the blue point below the constraint (following the arrow). In this case degrowth (area A) and low growth (area B) strategies are feasible. On the other hand, in the case depicted in Figure 3, a high growth strategy is feasible but a degrowth strategy not because while environmental impacts get lower, it becomes increasingly difficult to sustain human welfare. Indeed, trying to be in area A fails here as one will be forced to be below constraint 2, indicated by an arrow from the red goal to the blue realization. Hence, unlike an agrowth strategy that is tolerant to any outcome (positive, zero or negative GDP growth, or areas A, B and C), neither growth and degrowth strategies are robust or precautionary in the face of uncertainty about the conflict between growth and environmental sustainability (represented by uncertainty about whether curve 1 or 2 holds true). For further discussion, see van den Bergh (2017a).

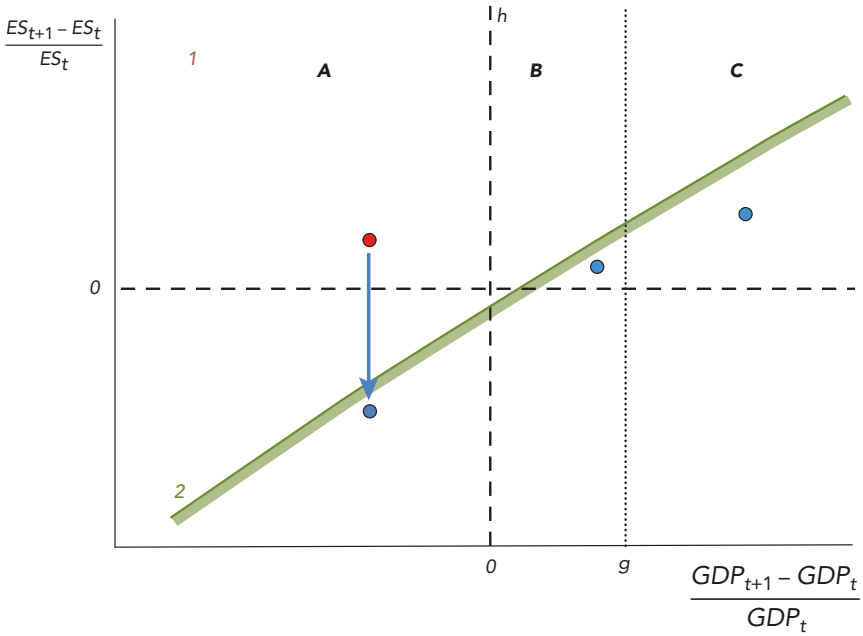
In conclusion, both green growth and degrowth lack credible empirical support and make debatable assumptions. These limitations make either of them risky strategies in solving environmental and climate change problems, as well as more generally in realizing progress in terms of social welfare. We do not need to assume that growth and environment are conflictive or compatible. Recognizing uncertainty about the future and complexity of the economy warrants being precautionary – making an agrowth strategy the better response.

Figure 2. Growth strategy fails in case of conflict between growth and environmental sustainability, while degrowth and agrowth strategies remain within feasibility area indicated by area below brown curve 1.



Note: Search space for human progress spanned by relative changes in GDP & ES in interval $[t, t+1]$; bold letters denote the rectangles separated by the vertical and horizontal broken lines.

Figure 3. Degrowth strategy fails in case of no conflict between growth and environmental sustainability, while agrowth and growth strategies remain within feasibility area indicated by area below green curve 2.



5. Climate change and population growth

Climate change is also affected by population growth, while income GDP growth affects both of them in different directions with an uncertain net outcome, depending on the country and other factors. On the one hand, before we have made a transition to low-carbon technologies, economic growth will increase emissions directly. On the other hand, increasing income goes along with a demographic transition in certain parts of the developing world, leading birth rates to go down due to, among other factors, a fall in infant mortality leading parents to recognise that fewer births will meet their needs in old age, urbanization, improved education of women and access to contraception (Chesnaï, 1992). An agrowth position does not deny the need for economic growth so a scenario where growth contributes to demographic transitions in some countries (notably in sub-Saharan Africa) may be an outcome. In rich countries with low or no

population growth, however, low economic growth is more likely as a transition scenario before a low-carbon economy is achieved. For some middle-income countries with high birth rates the trade-off is less clear beforehand and the net effect of economic growth on emissions, taking population effects into account, may be either positive or negative. An agrowth strategy is consistent with such a diversity of growth strategies in different countries, notably poor and rich ones, unlike a green growth position which requires high growth in all countries, denying national diversity of potential and need for growth. Note that agrowth as a strategy does not apply to population directly. Instead, population growth worldwide needs to be stopped as soon as possible to avoid further overshooting of the human economy, including with regard to global warming.

A recent account of the link between climate and population and adequate policies is provided by Bongaarts and O'Neill (2018). They argue against various misperceptions, such as that population growth is under control and does not matter much for climate change, and that population policies are ineffective and too controversial to succeed. Possibly, the worst decision one can make in terms of climate-change externalities is not to buy a product or service but to have a child (Harford, 1998; Wynes and Nicholas, 2017), unless during its life-time it will invent some cheap zero-emission technology that will change the world. It implies additional emissions over the entire lifetime of a child, decades into the future. With a growing number of people on Earth, the carbon budget associated with a safe climate is quickly exhausted. In view of this, some have proposed, in addition to a tax on the carbon content of energy, goods and services, so-called birth taxes (Kennedy, 1995). One argument why the decision of having a child should be regulated or priced separately is that parents make this decision while arguably only accounting for their own welfare effects and neglecting any social or environmental costs generated by the child in the future. Moreover parents may be insufficiently rational to perceive all private costs of raising children until adulthood. In addition, the desired number of children will be influenced by the culture and religion to which parents belong. Parents will thus be unable to respond rationally or optimally to the sum of private and social costs (as captured by the carbon tax), suggesting that birth regulation is required as well to assure that climate goals are reached. The magnitude of this is not insignificant: Bohn and Stuart (2015) calculate that an optimal child tax equals 21.1% of a corrected per capita income during the time span of a generation. They illustrate this for the

USA, noting that the relevant income measure was on average \pm \$48,000 per adult per year during the study period, which translates into a child tax of about \$10,000 per year during a period of 30 years from birth on. Hence, over the 30 year period the undiscounted sum of annual taxes would amount to \$300,000. Implementation of such a policy would arguably also contribute to reducing poverty in the next generation as a larger share of people would be the offspring of relatively rich families who could more easily afford a child tax (even though it would be higher in absolute terms), offering a better start in life in terms of wealth and education. Although such a child tax is sure to meet ethical and political resistance, one should recognize its unique capacity to simultaneously address climate, overpopulation and long-term poverty challenges. Moreover, the associated tax revenues could be used to reduce existing income taxes so as to limit the overall tax burden for households which might simultaneously increase employment (Freire-González, 2018). Incidentally, an alternative for a child tax with similar consequences would be a system of tradable birth permits (a combination of regulation and market mechanism), as proposed by Boulding (1964) and elaborated by Daly (1977) and others (see references in De La Croix and Gosseries, 2009).

6. A transition to an *agrowth* paradigm

One cannot be optimistic about changing the current growth paradigm, but it is worth trying as the permanent focus of our society and politicians on GDP growth forms a barrier to urgently needed sustainability policies. The fear that stringent climate policies will frustrate future economic growth is an important reason for many voters and politicians to be reluctant to genuinely support such policies. This partly explains why the Copenhagen climate summit failed and the recent Paris agreement was designed around voluntary national climate targets rather than globally harmonized policies. The discussion about climate versus growth will probably intensify in the coming years now that the time available to limit global warming is shrinking and serious emissions reductions are still awaited.

The literature on growth-versus-climate shows that theoretical and empirical support for both green growth and anti-growth is weak. Both strategies are risky and do not provide sufficient guarantee for managing climate change or other sustainability challenges. These strategies are also incompatible with a focus on social welfare in normative micro and macroeconomic theories. A third, neutral or indifferent vision called *agrowth* is more reasonable. It will create a broader basis

of support for stringent climate policies as it will de-polarize the growth debate by bridging the opposition between green growth and anti-growth positions. In contrast to pro-growth, the agrowth strategy does not give priority to income growth over the climate, but is aimed at finding a genuine balance between all aspects of social welfare. That is why it will provide more political scope for effective climate policy, as well as for a fair income distribution. In response to uncertainty about whether to be optimistic or pessimistic about sustainable growth, one can follow a precautionary strategy by being agnostic and being resilient to all possible options.

Since the unconditional pro-growth strategy is dogmatic in nature, change to a new agrowth paradigm will be difficult. Current politics is characterized by nervous reactions to low GDP growth. The preoccupation with GDP growth is invigorated by repetition, in both education and the media, of the erroneous idea that growth is necessary or even sufficient to solve important social problems. Higher economic growth has also been shown to increase the likelihood that government leaders will stay on longer (Burke, 2012). Hence, the pressure on politicians to be guided by unconditional economic growth is unfortunately still great. If change does occur, it is likely to come in stages, such as: first social sciences, then economics, then politics and then voters.

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Steady State Economy at Optimal Population Size

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Abstract

This paper reviews briefly the idea of a steady state economy from the ancient times to the present. It discusses some of the suggestions made by H. Daly in his model of a steady state economy and particularly the idea of a stable population. It suggests that population must be stable at a level that is compatible with ecological equilibrium. That level is about three billion people and therefore the world population must be reduced drastically. This can be achieved if each family is allowed to have less than two children. To achieve this reduction of population this paper proposes the creation of an international market for human reproduction rights.

Introduction

In his *General Theory of Employment, Interest and Money* Keynes (1960) writes in the final concluding note at the end of his book:

Practical men, who believe themselves to be quite exempt from any intellectual influences, are usually the slaves of some defunct economist. Madmen in authority, who hear voices in the air, are distilling their

frenzy from some academic scribbler of a few years back. I am sure that the power of vested interests is vastly exaggerated compared with the gradual encroachment of ideas. Not, indeed, immediately, but after a certain interval; for in the field of economic and political philosophy there are not many who are influenced by new theories after they are twenty-five or thirty years of age, so that the ideas which civil servants and politicians and even agitators apply to current events are not likely to be the newest. But, soon or late, it is ideas, not vested interests, which are dangerous for good or evil (p.383).

If Keynes was right, then, those in authority during the last fifty years (presidents, prime ministers, religious leaders, heads of international organizations etc.) should have been totally unfamiliar with the ideas of Plato, Aristotle, Malthus, Huxley, Paul Ehrlich, and the report of the Club of Rome. Indeed, this conclusion appears to follow from the fact that few of such people have shown any interest in the unprecedented growth of world population in the last half century in spite of the warnings of the writers mentioned above and many other modern scientists regarding the dangers of overpopulation either for some countries or for the entire planet.

More relevant to the problem of overpopulation, another quotation from Keynes (1963) is interesting. He says:

I draw the conclusion that, assuming no important wars and no important increase in population, the economic problem may be solved, or be at least within sight of solution, within a 100 years. This means that the economic problem is not -if we look into the future- the permanent problem of the human race.

Unfortunately, neither of the two conditions was met and the economic problem seems to be permanent. In addition, the increase in wasteful consumption after World War II and the growing income disparities worldwide make the solution of the economic problem a "mission impossible". In fact, the alarming growing gap between our ecological footprint and the globe's biocapacity means that our prime concern now is not just to solve the economic problem but to save our planet and its population from tragic prospects.

What does it mean “To Solve the Economic Problem”?

The economic problem exists because an economy's resources are limited while human wants are unlimited. Utopias like the Garden of Eden have no economic problem. But, in modern human societies, the attempts to solve the economic problem are based on efficiency: efficient production, efficient allocation of resources and efficient technologies. People are free to satisfy their wants as best they can. No one in modern times has ever suggested imposing a limit on the level of wants satisfaction because that would be against the freedom of choice. Thus, for the modern economist and also for the modern individual, the economic problem can be solved by maximizing production to satisfy wants as much and as many as possible.

Human wants are unlimited for two reasons. First, wants have the property of being insatiable in the sense that the typical individual would like to have more of everything if they could afford it. Under normal circumstances, the marginal utility of an additional unit of an item would always be positive. Second, human wants are multiplied by the rate at which population increases. Prior to the emergence of contemporary environmental concern, during the modern economic era no one except Malthus and John Stuart Mill, (indirectly and a little later) considered the possibility of population growth to the point that it would become a major problem.

In ancient times, it was suggested by philosophers that the solution of the economic problem should be looked for not on the side of supply, i.e. not in increasing the available resources or in using them more efficiently in order to maximize production, but rather on the demand side, i.e. in constraining consumption and population size within limits. These limits were determined by reference to human wants. The cynic philosophers introduced the idea of suppressing wants to needs. We should consume not what we want but what we need for simple life. Diogenes, a leading figure of this school of philosophy, once saw a boy drinking water from a fountain using his hands, and then he threw away his cup because he understood that he did not really need a cup - he said: “A child surpassed me in plain living” (Diogenes Laertius, p. 131). Of course, Diogenes had no intention to solve the economic problem as we understand it today but rather to give an answer to the question put by Socrates, namely “How to live”.

Between the typical modern economist, who sees the solution of the economic problem in maximum utility, and Diogenes who is the champion of the simple life by minimizing utility to a level corresponding to the satisfaction of real needs, stands Aristotle whose ideas are as timely as ever. The fundamental idea in Aristotle's economics (and ethics) is that of the "best life" (Politics, book VII). This is a life in which the individual has enough material wealth by which he/she can live with comfort and generosity but not luxuriously and wastefully. Happiness (*eudemonia*) means acting with virtue and this requires external goods, i.e. material wealth. Thus, according to Aristotle, to solve the economic problem means to produce enough so that everyone can live comfortably but not waste resources through luxurious consumption.

How is the Economic Problem Actually Solved?

An unbiased observer would certainly agree that, historically, human societies have been successful in partly solving the economic problem by increasing production and thus allowing higher consumption levels. Thus, today in perhaps all countries of the world, most people enjoy a higher standard of living than in any other period in the history of humankind. The sciences, technological changes (embodied and disembodied), and institutional changes are the prime powers that have led to an amazing growth of world production.

However, the unbiased observer should also agree that people act under a veil of myopia or indifference, in the sense that they do not see all of the real consequences of their actions or they do not care about them. This is evident from the effect that the last half century's economic growth has had on the ecosystem: during this period humanity's ecological footprint has exceeded the biocapacity of the Earth. In 2014, the planet's biocapacity was estimated at 12,221 million hectares and the ecological footprint 20,602 million hectares (Global Footprint Network). Thus, the solution of the economic problem worldwide has resulted in a huge ecological deficit. According to the Global Footprint Network, in 2018 the "ecological year" ended on August 1st. To sustain current levels of consumption would require 1.7 Earths.

Thus, the world economy has "solved" the economic problem in the same way as many countries do when they create huge external public debts that future generations are expected to pay. Or like the lumberjack who cuts down trees at a

rate faster than the forest can reproduce itself. In such cases, a deficit is created that future generations will be forced to cover in ways that may be painful. In this sense, so far, the economic problem is being solved in a myopic way.

Why is it so Difficult to Solve the Economic Problem?

In one of the quotations given in the introduction, Keynes mentioned two factors that make the solution of the economic problem extremely difficult, namely wars and population growth. Wars absorb huge amounts of resources that could be used for the production of consumption goods. Natural catastrophes and other human activities that do not result in production of consumer goods would have the same negative economic effects as wars.

During the period after World War II, a third factor has appeared that absorbs very considerable amounts of the available resources: namely overconsumption by the general population in the wealthy nations, but also of the rich in less developed countries. Of course, orthodox economic theory does not recognize the term "overconsumption" because each individual is free to choose the type of commodities they like and buy as many as they wish and can afford. However, it is hard to shake the feeling that there is something wrong in a society where a small family has a huge house and a swimming pool next to a sandy beach, where people travel with private jets and private yachts, where wealthy women buy luxury dresses that they will wear only once, where simple people have five watches when they need only one, etc. I do not wish (and I do not have the knowledge) to enter into a discussion about the ethics of consumption, but simply to point out that the misuse of scarce resources is so great that one cannot be criticized for speaking about overconsumption as a factor contributing to the ecological deficit.

Is the Earth Overpopulated?

A region, a country, or the entire Earth can be said to be overpopulated if it can be shown that its population exceeds a certain level determined by a relevant criterion. With respect to our planet, there are several different and independent studies that show that Earth is heavily overpopulated.

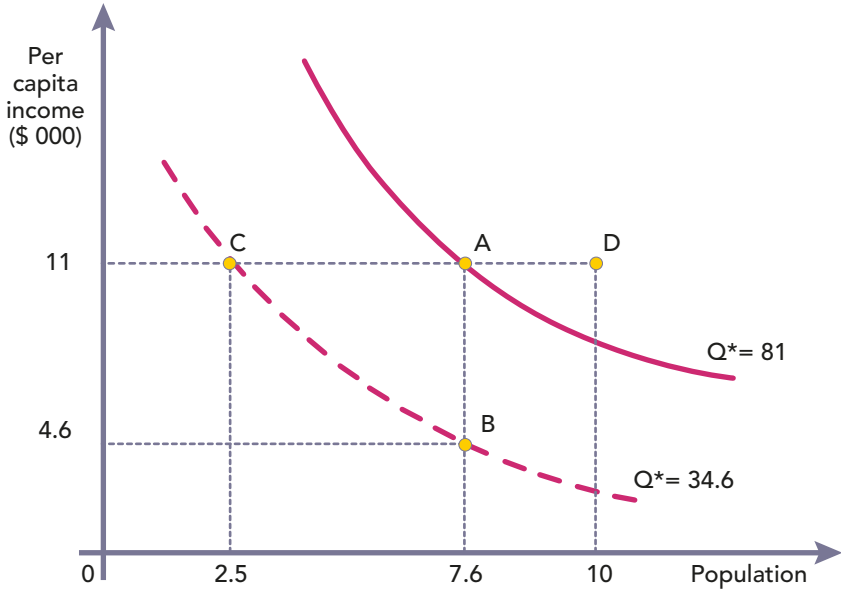
In 1994, Daily, Ehrlich, and Ehrlich (1994) conducted a thought experiment to calculate the optimum population size based on an estimate of the maximum

total world energy production “at which ecosystems and resources seemed to be holding their own”. Assuming a 50% margin of error, the authors postulated that at 6 TW total energy production (6,000,000,000,000 watts) and a level of consumption of just 3 kW per person would lead to an optimum population of 2 billion. The same year, Pimentel et al. (1994), based on the estimate that 0.5 ha per capita is needed to supply food and assuming a program of soil conservation, estimated that a world population of 3 billion people could be sustained. More recently, Pimentel et al. (2010) estimated that under certain reasonable assumptions regarding land inputs, a European standard of living for everyone with sustainable use of natural resources results in a carrying capacity of the Earth of 2 billion people. In a more recent study, Lianos (2013) estimated that, assuming a per capita income of \$11,000, ecological equilibrium (defined as equality of ecological footprint with biocapacity) can be maintained if the world population is 2.5 billion or less. If the population size is bigger, ecological equilibrium requires lower standards of living.

Clearly, even allowing for a margin of error of 100%, the above estimates show that the present (October 2018) population size of 7,659 million people exceeds by far the carrying capacity of our planet. The fact that all of the above estimates result from different methods of estimation and do not differ substantially is a strong indication that our planet is heavily overpopulated.

The exact meaning of overpopulation can be shown with the help of Figure 1. It is estimated (Lianos and Pseiridis, 2015) that the maximum value of world GDP that corresponds to ecological equilibrium is $Q^* = 34.6$ trillion dollars. According to the World Bank, the world GDP in 2017 was approximately 81 trillion dollars and with 7.6 billion people the per capita GDP is about 11 thousand dollars. This pair of values is shown as point A in Figure 1. However, with $Q^* = 34.6$ and 7.6 billion people per capita GDP should be 4.6 thousand dollars as shown at point B. If we wish to have a per capita income of 11 thousand ecological equilibrium requires a reduction of population to 2.5 as shown at point C.

Figure 1. The trade-off between standard of living and population at ecological equilibrium.



Thus, it becomes clear that the meaning of overpopulation is relative to the desired standard of living given the availability of resources with ecological equilibrium. In terms of Figure 1, all pairs of population and GDP per capita that can be shown by points to the right of the dotted curve Q^* , such as point A, reveal overpopulation. Therefore, those who argue that the world population can increase to 10 or more billion should also specify the standard of living to be enjoyed by those billions of people.

The curve Q^* in Figure 1 has been drawn to correspond to the maximum world GDP of 34.6 trillion on the condition of ecological balance. Technological innovations, institutional changes, and better management of resources may shift the Q^* curve to the right thus allowing for higher per capita incomes at given levels of population. It seems unlikely that Q^* can be 81 trillion with ecological balance in the foreseeable future; but even if it does, population would have also increased in the same time period so that a point like D is likely to occur. Thus,

arguing that technology can solve the problem of ecological disequilibrium is the same thing as arguing that one can step out of their shadow.

Why is Overpopulation a Problem?

There are people who argue that overpopulation, or rather increases in population, do not create a problem. The basis of this argument is that increases in population mean an increase in total utility as long as every individual has a positive level of utility. Thus, adding one individual with a positive level of utility to the population, other things remaining equal, will result in an increase in total utility. Therefore, a large increase in population instead of being a problem is actually a positive development. However, such a conclusion is clearly false and unacceptable. It is false because the mere addition of people violates the "other things remaining equal" condition. New people need resources and, since resources are limited, the satisfaction of their needs will reduce the resources available to those who were born before. The argument is unacceptable because it leads to Parfit's (1984) "repugnant conclusion" that a huge population with each individual having a utility level just above zero is better than a small population with each individual enjoying a high standard of living.

That overpopulation is a problem is clearly indicated by the existence of ecological deficit and the estimates of the population size that can be sustained assuming ecological balance. Resource depletion, water shortages, climate change, loss of biodiversity, soil depletion, overcrowding, lack of space for various uses, sordid slums and poverty are some of the issues associated with overpopulation. Some researchers are very pessimistic and speak of "painful population crash" (Schade and Pimentel, 2010), "increased social and political instability in many parts of the world" (Pimentel, 2012) and even suggest that the human race will be extinct within a hundred years because of population explosion and "unbridled consumption" (Frank Fenner, reported by Firth, 2010).

The above discussion is suggestive of only one solution to the economic problem, namely that of reducing the size of world population to a level that would be in congruence with ecological balance. This is a defining property of a steady state economy.

STEADY STATE ECONOMY

1. The ancient philosophers

The idea of a steady state economy is very old. In the 4th century BC, Plato and Aristotle both developed the idea of a steady state by specifying the proper relationship between land and population that is necessary for a just and happy state.

Plato's treatment in the *Laws* (book V) is very brief but Aristotle's analysis is more thorough. In his *Politics* (book VII), Aristotle constructs a comprehensive model of a steady state economy based on his idea of the "best life" or a life of happiness, namely "life conjoined with virtue furnished with sufficient means for taking part in virtuous action" (1323b40 – 1324a2). In Aristotle, this means a comfortable but not a luxurious and wasteful lifestyle. The elements of his model are private land (property), public land, and population. These elements can be properly combined to produce enough wealth for all individuals that possess land, and sufficient proceeds from public land to take care of the poor and cover the costs of administration.

Aristotle believes that there is no limit to the growth of population if it is left uncontrolled. Therefore, the optimum land-population combination cannot be sustained unless population controls are introduced (for a detailed analysis see Lianos, 2016).

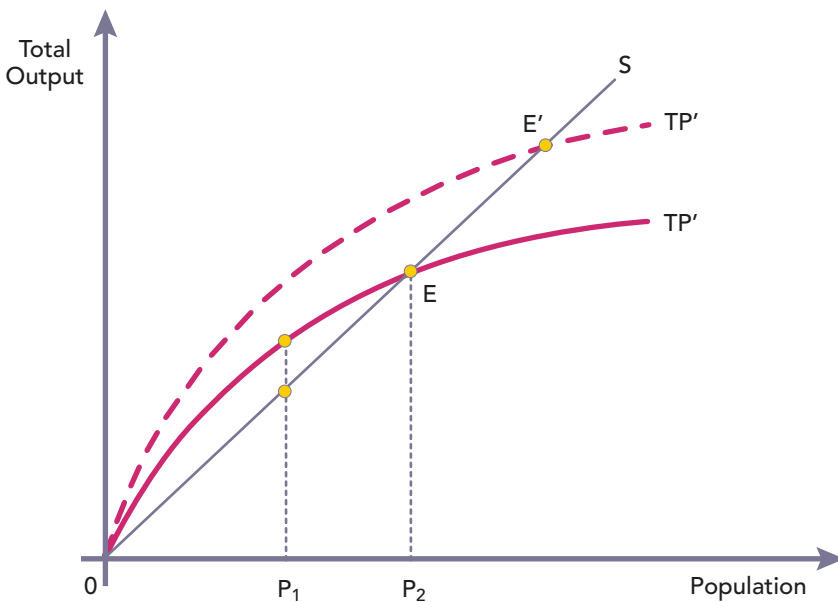
2. The Classical view

During the 18th and 19th centuries many of the classical economists, including Smith and Ricardo, thought it inevitable that the economy would tend toward a steady state. However, John Stuart Mill was possibly the first to argue that a steady state "would be, on the whole, a very considerable improvement on our present condition" (Mill, 1970, p. 113). For Mill, a steady state is a stationary state of capital and wealth.

The view of steady state economy held by the classical economists, including Mill, is epitomized by Baumol's (1951) "magnificent dynamics" presented in Figure 2. Curve TP shows total product (or output) for each level of population (or labor force). This is the aggregate production function and displays diminishing

returns to labor. Line S shows the amount of product that is necessary for the subsistence of the labor force. The real wage rate is shown by the slope of line S. At population level P_1 the difference between TP and S represents profits which motivate investment, increase in employment, higher wages, and improvement of the condition of the labor force and thus increase of population. This process will be terminated at point E when population increases to P_2 . At point E the stationary state is reached with zero profits. Improvements in the production process that raise the total product curve to TP' will motivate investment again and the new process will bring the economy to a new stationary state at point E'.

Figure 2. The magnificent dynamics.



The question often raised by several writers, e.g. Blauwhof (2012), Binswanger (2009), Gordon and Rosenthal (2003), is if a capitalist economy can really stay at a steady state position with zero profits? The answer given by the classical economists is in the affirmative.

3. The Marxist View

A steady state economy in the Marxian sense is supposedly described in his theory of simple reproduction outlined in chapter XXIII of Volume One of *Capital* (ch.23). The case of simple reproduction can be a steady state economy only if at every period capitalists consume the surplus value acquired as revenue that year. For some (e.g. Blauwhof, 2012) this is in fact a steady-state economy. However, this equilibrium position will not be sustained because in capitalism only a small part of surplus is consumed and the rest is invested. Thus, the economy always follows the expanded reproduction path, although crises will not be avoided.

The Marxian steady-state is not the simple reproduction scheme. It is, rather, the higher phase of communist society, very briefly mentioned in the Critique of the Gotha Program (part I). As is well known from Marx's brief description, at that higher phase the economy will have greatly developed its productive powers, work will have become an integral part of living, not just a means to live, and each member of society would offer to production what they can and take what they need. This situation can be said to be a steady state in the sense that further economic growth is meaningless. According to Marx, human history ends at that phase of the truly communist society where the word "scarcity" is removed from society's vocabulary.

Given the circumstances prevailing today, namely a world population of 7.6 billion and a huge ecological deficit, Marx's vision of a communist affluent society is purely utopian. Therefore, it is inaccurate to talk about steady-state in Marx's economics in the same sense as in the classical tradition or in contemporary accounts such as Herman Daly's.

4. Daly's Steady-State Economy and De-growth

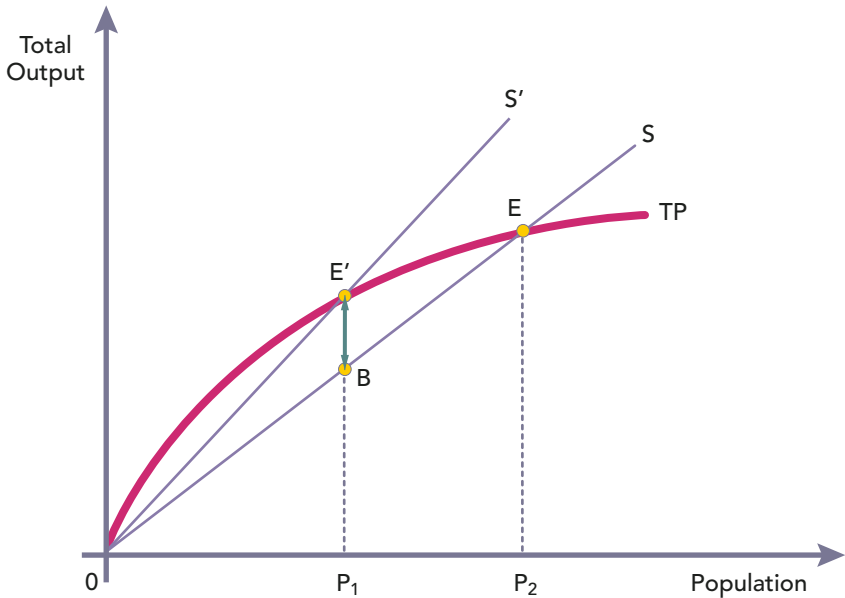
Daly's steady-state economy (SSE) is sometimes discussed together with economic de-growth (e.g. Kerschner, 2010). This is probably because of Georgescu-Roegen's rejection of the steady-state economy proposed by Daly and also because of Daly's (1997) criticism of Solow and Stiglitz on the basis of Georgescu-Roegen's arguments. However, Daly's steady-state economy and de-growth are two different concepts at least for economic policy purposes.

According to Latouche (2009), de-growth is a political slogan primarily designed to make clear that exponential growth must be abandoned. Growth serves the

interests of capitalists and has disastrous implications for the environment, and consequently for the world as a whole. Although Daly and Latouche share some common concerns, they should not be discussed together as they have very different agendas. Daly's steady-state economy and his policies for achieving a satisfactory state are of immediate practical importance. In his many writings, Daly defines the steady-state economy as:

... an economy with constant population and constant stock of capital, maintained by a low rate of throughput that is within the regenerative and assimilative capacities of the ecosystem. This means low birth equal to low death rates, and low production equal to low depreciation rates. [...] Alternatively, and more operationally, we might define the SSE in terms of a constant flow of throughput at a sustainable (low) level, with population and capital stock free to adjust to whatever size can be maintained by the constant throughput that begins with depletion of low-entropy resources and ends with pollution by high-entropy wastes. (Daly, 2008, p. 4)

The long run equilibrium position of Daly's steady-state economy can be presented in a diagram like that of the classical model. The equilibrium position of the latter is based on the stability of the subsistence wage and on the Ricardian mechanism of the labor market. If the real money wage determined in the labor market exceeds the subsistence wage, population will increase. In the opposite case population will decline. Thus, deviations from point E of Figure 3 will be temporary. Now, suppose that the economy is at point E' with population at P_1 . Since by definition population is stable, point E cannot be reached. The equilibrium position will now be at point E' with higher wages indicated by the higher slope of the S' line. The gap of BE' will be closed not by a movement to E but by an increase of the wage rate. The horizontal supply of labor curve implied in the Ricardian model is now replaced by a vertical labor supply curve because of constant population.

Figure 3. Equilibrium with stable population.

In the same paper, Daly gives a ten point policy summary. Daly's definition and his suggested policies raise a number of issues, one of which is a vague reference to the stability of population. Economic policy requires setting quantitative targets. It is not sufficient to say that population should be stabilized by equating birth rates with death rates. This leaves the SSE undetermined. It is necessary to specify the size at which population should be stabilized. This target should be, according to Daly and other writers, at the level where there is a sustainable constant flow of throughput. Since a given level of throughput corresponds to a given level of total output (assuming constant technology), the size of population should be stabilized at a level dictated by the sustainable level of total product. The studies we have already referred to have found that level to be between two and three billion people.

Although the burden of overpopulation on the resources of the planet is obvious and recognized by the majority of researchers, it seems that Daly is not willing

to specify the optimal size of population and, like many others, he avoids the challenge of raising the issue of population control. Population control is still a taboo.

Also, Daly seems to believe that a SSE will necessarily suffer from unemployment. This follows from his question "If we must stop aggregate growth because it is uneconomic, then how do we deal with poverty in the SSE?" (Daly, 2008, p. 4). His answer is redistribution by setting limits to minimum and maximum incomes. However, as we have indicated earlier, if population is constant there is no need for growth for the purpose of absorbing the increasing labor force. There is no economic argument on the basis of which a SSE will suffer from unemployment just because it is a steady-state. However, unemployment may result from changes in technology or in consumers' tastes that change the structure of demand and require transfers of labor and resources from one industry to the other. Also, the type of redistribution suggested by Daly is questionable. A limit on maximum income would create problems of economic motivation and of bureaucracy. It would also keep the minimum limit low. Redistribution of income can take place through a system of taxes and subsidies and other means depending on the inventiveness of the government.

One major item in Daly's ten point policy summary is that "the SSE could benefit from a move away from our fractional reserve banking system toward 100% reserve requirements." His slogan is "Nationalize money, not banks" (2017). This can be achieved by treating demand deposits differently from time deposits. For demand deposits the reserve requirements would be 100%. In this case, however, consumers and business would deposit money only for security and for their transactions. Also, banks would need to charge a fee as this would be their only source of revenue from accepting and handling demand deposits and this may discourage people from depositing. In the case of time deposits (savings accounts), according to Daly, there would be no required reserve and all savings can be loaned to potential borrowers. The banks will profit from the difference between the interest rate paid by borrowers and that received by savers. Now, banks would bring together savers and borrowers but they cannot change the money supply and the risk of financial crisis disappears. This suggestion is not without problems. There are two important cases where Daly's suggestion appears to be too restrictive. One case has to do with the time structure of time deposits

that may not coincide with that of the demand from borrowers. In this case, the banking system will leave borrowers unsatisfied while time deposits are resting within the banks. The other important case is the inability of the system to finance new firms. In a capitalist steady-state economy there will certainly be changes in consumer tastes, new products will be introduced, and new technologies will be applied to production. Therefore, new firms will be created and old ones will disappear. A banking system with 100% reserve requirement will make difficult the financing of new firms. The stability of the financial system can be protected by other means without sacrificing the advantages of fractional reserves.

Daly offers a few other policy suggestions that might improve the existing situation in many countries. However, they do not define a steady-state economy. The heart of the matter is the size of population which needs to be determined at a level that would be in harmony with ecological balance.

5. Population and Steady State Economy

As was pointed out earlier, it is not enough to say that in a steady-state economy population should be stabilized. The actual size of population should also be known. For example, with the present population of 7.6 billion the economy cannot be sustained at its present level because of the ecological deficit that we experience at the present time. The choices we have were presented on Figure 1. The curve Q^* shows the combinations between population and per capita income compatible with ecological balance. This means that there are many positions that a steady-state economy can occupy along the Q^* curve. The decisive factor that will determine the size of population is our choice of the standard of living that we wish to enjoy.

The sad truth is that in the not very distant future a steady-state economy with a population much smaller than the one we have today will become necessary. It will occur either by voluntary birth rate reduction or by imposed population controls (as for example in China) or the hard ways to which the present unsustainable situation leads, namely poverty if not starvation, conflicts, and wars.

At the theoretical level, a steady-state economy requires three fundamental elements. First, population must be stable at a size that would be compatible with ecological equilibrium, or less. If technological advances make possible more

efficient use of resources and total product can increase, population and/or per capita consumption may also increase. Second, as has been repeatedly said by Daly and others, externalities must be internalized so that prices reflect real costs in terms of resource use. Third, the prices of products and of factors of production should be flexible so that changes in technology and/or in tastes would not result in permanent market deficits or surpluses.

Price flexibility is very important because of its implications. For example, it implies that labor unions should not have the power to determine wages and thus give rise to the insiders-outsiders phenomenon that has resulted in higher unemployment in many European countries. However, labor unions would have a role in a steady-state economy as for example in representing workers in a bargaining process. Also, there should not be subsidized products (like bread, for instance). Problems of poverty should be solved by other means of income redistribution. Monopolies and other privileges should be abolished. Natural monopolies should be under the control of the community or of the government. Commodities and factors of production should be allowed to move freely.

There may be differences of opinion regarding the institutional arrangements in a steady-state economy. But it is undeniable that the size of population should be determined by the scarcity of resources and the need for ecological balance. If population is fixed at a certain level, everything else will be adjusted relative to that level.

Economists and policy makers in modern economies have been unjustly accused for "growthmania" since the end of World War II. Growth was necessary not only for improving the standard of living but also for accommodating the exploding population. The driving force for economic growth has been the explosion of population. Stability of population will make growth unnecessary although it could take place when technological and other production improvements raise the biocapacity of the Earth.

6. The Role of the State in a Steady-State Economy

It should be emphasized that "a steady-state economy is not a failed growth economy" (Daly, 2008, p. 4). It is not an economy in stagnation. All the things that happen in a free economy would also happen in a steady-state economy.

In the words of Mill “There would be as much scope as ever for all kinds of mental culture, and moral and social progress” (1970, p. 116). However, such an economy would not be free of the problems that constantly appear in a free economy.

Scientific discoveries, new technological applications, changing consumer preferences, new products, and new methods of production and management would constantly change the structure of demand and therefore adjustments in production would be necessary. Unless prices are perfectly flexible and adjust automatically, which is rather unrealistic to expect, it would be necessary for the state to intervene. Also, public schools and public health systems would require the intervention of the state. Finally, natural disasters, such as earthquakes and floods, would make intervention necessary. Generally speaking, the frictions of the capitalist system and the myopia of many individuals in providing for the future would make it necessary for the state to play a corrective role.

It is certainly premature to discuss what the role of the state should be in a steady-state economy and what concrete measures it should take as this depends on the nature of the problems that are likely to appear. What is urgent today is to discuss and think of ways to reduce the size of world population.

REDUCING POPULATION

The current world population is close to 7.7 billion people and it is projected to increase in the decades to come. Every day a new city of approximately 250 thousand people is born.

According to a recent study from the International Institute for Applied Systems Analysis (Lutz et al., 2014a, 2014b) world population is likely to peak at 9.4 billion around 2070 and then decline to about 9 billion by the end of the century. According to a United Nations study (Gerland et al., 2014), the world population can be expected to grow to 9.6 billion in 2050 and to 10.9 billion in 2100. Despite their differences, both studies predict a 30% increase in world population in the next forty to fifty years.

If we accept that the Earth is overpopulated then the population must be reduced to preserve the natural powers of the planet in a condition conducive to human

life. At various times several ways have been suggested for population control including moral abstinence, guidance to the young, delaying marriages, availability of contraceptives, abortions by consent, voluntary sterilization, coercion, and economic incentives and disincentives. The fact is, however, that these methods, to the extent they were applied, have not given the expected results. Actually, in some countries incentives have been given for population growth rather than reduction. It is often suggested (e.g. Conly, 2016) that education and economic incentives may be effective. Thus, it is interesting to discuss briefly the likely effects of economic incentives.

1. Economic incentives and disincentives

Given that stability of population requires 2.1 children per family on average, incentives in the form of money or other equivalent rewards should be given to families that agree to have no more than one child so that the average number becomes less than 2.1. Such a policy is not without problems. First, families that have no intention or desire for more than one child would also be rewarded and will raise the cost of the program. Second, it is unknown what size of monetary reward (in cash or kind) would be sufficient to convince the family to have only one child. For example, would covering all the educational expenses of the only child up to university be sufficient or would subsidies be required equal to the total income that the second child is expected to bring to the family? One can think of other types of financial incentives as, for example, free social security benefits when the parents reach a certain age. Third, those families that would be willing to participate in such a program would certainly be among the poorest and thus in effect such a program would be discriminatory.

A policy of economic disincentives should involve economic punishment for those families that decide to have two or more children. The punishment can be something like a progressive tax for each child after the first, high enough to make the marginal utility of the money paid higher than the utility of the additional child. To the extent that such policy is successful it is also discriminatory against the poor and it is certain that it will meet strong opposition.

In general, although economic incentives and disincentives seem to be, at least in theory, a good idea, in practice they will be very costly and very unpopular.

2. Creating a Market for Human Reproduction Rights

Another way for reducing world population is by monetizing the problem and creating a market for human reproduction rights¹. One model for implementing such a program can be described as follows.

- (i) Every couple is given three shares by the government, with each share giving the right to give birth to half a child. Each share represents the right of the couple to participate in the creation of the next generation and all couples have the same rights.

- (ii) These rights are tradable in the world market. Thus, a couple in Canada that wishes to have two children can buy one share from a couple in China. Similarly, a couple that wishes to have three children would have to buy three shares etc. If all couples wish to have two children, no trade will take place and therefore the one-and-a-half policy becomes in practice a one-child policy. However, it is certain that there will be people in all countries that would be willing to buy and others than would willing to sell shares. Thus, the one-and-a-half child program will at the same time become a program of income transfers, probably from relatively rich people to relatively poor, within each country and between countries.

- (iii) This policy can be applied to each individual country that suffers from overpopulation, e.g. China, India, Indonesia, etc. However, since the population problem is universal, the full impact will be seen if its application is global. Thus, it is desirable that it has the support of all governments and also of various institutions, e.g. the Church and other social organizations. It is very likely that some governments that favour the large family model would prefer not to adopt the one-and-a-half children policy. However, if the international demand for shares is high and a substantial sum of money is received by those who sell one or more of their shares, the popular demand for the adoption of the plan in those countries would be strong.

1. A reviewer's comment led me to a search in the relevant literature where I found that a similar plan with transferable birth licence was proposed by Boulding (1964) and presented later by Daly (1990). The plan presented in this paper was developed independently.

(iv) In addition to reducing world population, some other positive side effects are also possible. For example, the black markets for adoption of children that exist in some (perhaps many) countries would practically disappear since there would be not many children for sale. Also, the adoption of orphans will be much easier. In addition, very substantial money flows would be directed from rich families and countries to poor ones. Of course, negative side effects are certain to appear as in the case of unintended pregnancies of married women who have sold their shares.

Variations of the basic idea are possible. For example, some people may argue that the right to give birth to children should be given to individuals and not to couples since there are many people who wish to have children but not get married. In other words, the right to give birth to a child is an individual right, separate from the way couples decide to live. Also, instead of each share corresponding to half-a-child, different values may be given, e.g. 0.6 or 0.4, depending on the desired rate of decline of population.

To facilitate exchanges of reproduction rights an international stock exchange can be established where reproductive rights would easily, and with a minimum cost, be sold and bought. Thus, a couple in one geographical region can very easily buy (or sell) a reproduction share from (or to) another couple living in a very distant place.

Needless to say, such a scheme of population reduction will often be violated, at least at the beginning. Problems of non-compliance will certainly arise and no easy treatment is available. However, fines and other measures of an administrative nature can be used so that compliance is encouraged and non-compliance discouraged. Information about the problem of overpopulation and moral suasion can contribute to the acceptance by the public of the proposed solution.

This plan has two advantages and one important disadvantage. The advantages are that essentially it would be cost-free and it treats everybody equally². The disadvantage is that it is coercive. Of course, controlling the family size in this

2. Of course, it would be easier for wealthy couples to buy shares, but this is true for all items for which a market exists.

way violates a basic human right. Many people would be very skeptical about introducing laws that force families to reduce the number of our offspring. For example, Conly (2016) rejects the claim that people have a fundamental right to have as many children as they want but refuses to accept enforcements on the number of people that a family may have. However, the offence of this violation should be weighed against the alternatives. There is, also, an intergenerational social justice issue involved in this discussion. Forcing people to have fewer children than they might want to have will certainly reduce the level of utility (happiness) they enjoy. However, if they are allowed to have as many children as they want, the level of utility of the future generations will be much lower given the limited resources that would be available to them just because the present generation contributes to overpopulation. In a real sense, the present generation by its numbers and its consumption habits is using resources that will be lost for the future generations. This is no different from the act of a thief who steals corn from the barn of a neighbor. Although freedom is a fundamental right the thief is imprisoned. One might say that the comparison is not valid because the present generation has no intention of stealing resources from the future generations and therefore there is no deceit involved. This defense is not convincing because it is difficult to find people that are not aware of the critical situation to which the Earth has been brought because of overpopulation. Finally, it should be pointed out that a policy or a rule, if applied generally, is not conceived by the public as a coercive restriction. We do not feel that our freedom of choice is violated when we are required by law to enroll our children in school or to drive on one side of the road or even fight in a war.

In defense of this plan I would like to quote J. S. Mill's "very simple principle" that "the sole end for which mankind are warranted individually or collectively in interfering with the liberty of action of any other member is self-protection. That the only purpose for which power can be rightfully exercised over any member of a civilized community, against his will, is to prevent harm to others" (Mill, 1961, p. 263).

It is clear from the analysis presented in this paper that the primary purpose of the one-and-a-half child policy is to prevent the present generation from harming the next ones.

In the history of the world, social problems have been solved or were limited to manageable proportions by command rules, by economic incentives, and by a combination of both. Of course, monetizing a problem will not necessarily lead to the best solution, but a second best solution is often better than letting things run their own course. My suggestion of the one-and-a-half child policy is a combination of command and economics that also allows some choice.

Reducing population is not without problems, at least in the short run. A reduction in population worldwide will be followed by a general fall in demand for goods and services and a period of deflation and unemployment at least at the first stages. It is unlikely that price flexibility would be an adequate remedy for the waves of demand reduction. Some rigidities will always exist. Thus, very active government policies of demand and of income redistribution will be necessary. However, the problem may not be very serious because incomes previously spent for the needs of children will now be spent on other items and therefore the decline of aggregate demand need not be so great.

3. Ecological Renaissance

If such a plan is generally adopted, the world population would be halved in three to four generations, i.e. in about one century. At the same time and despite initial passive or active resistance to such a plan, it is very likely that important changes for the better will take place in the ways people see themselves in relation to the environment and to each other. During the transition period towards the steady state something like a modern ecological renaissance may occur and free humankind from the narrow anthropocentrism that may be a factor in preventing environmental sustainability and more socially fulfilling lives (Samways 2016).

Comments

It was pointed out that a steady-state economy is not a stationary economy in the sense of "a failed growth economy". It should also be said that it is not necessarily an affluent economy as long as population remains above the optimal size. Population must be stabilized at a level much lower than the present level of 7.7 billion. If population fails to be stabilized at a level at which the ecological deficit is maintained, society will, in the long run, suffer from problems of inadequate resources to support that population size. Consequently, in addition to the serious ecological problem that we are already facing, poverty will result. Thus, it

is important that the steady-state economy be defined as one with population at a level compatible with ecological equilibrium as well as comfortable lifestyles.

Also, the steady-state economy will suffer from some of the problems that capitalist societies presently have, e.g. problems related to changing tastes, new technologies, risks, natural disasters, etc. Therefore, state policies that facilitate economic and social adjustments would be necessary.

Finally, I have emphasized the need for birth controls even if that means some violation of human reproduction rights to some extent. The justification for such violations is that they are less onerous than poverty, starvation, social unrest, and wars that result from overpopulation. In analyzing population issues it is useful to keep in mind that "The real crux of the population question is the quality of people's lives: the ability of people to participate in what it means to be human; to work, to play, and die with dignity; and to have some sense that one's life has meaning and is connected with other people's lives" (Cohen, 2017 p. 42).

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