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World population: the elephant in the living room

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Introduction

There is no doubt that the climate change and the unequal distribution of income (and wealth) are the two major problems of our time with tragic consequences if we fail to deal with them in time and in the right way. However, the general public is either not interested or not informed or feels powerless and therefore indifferent and inactive. In recent worldwide demonstrations it is estimated that four million people participated which is only one in two thousand and, among the young generation, two in a thousand.

Scientists, and among them economists and ecologists, predict that in the next decades, if we remain inactive, dramatic changes with tragic consequences, such as natural catastrophes, famines, wars, local conflicts, social unrest and even extinction of the human race within the next one hundred years (Fenner, reported by Firth, 2010) will take place. The ideas suggested by economists and ecologists to cope with the two problems mentioned above have usually been grouped in four action plans, namely New Economics, Green Growth, Degrowth and Steady State Economy. Sometimes they are referred to as theories or hypotheses but these are misnomers because they refer to the future and they cannot be tested empirically.

The purpose of this paper is to comment on the above policy plans, to defend the steady state economy (SSE) proposal and suggest a variation of it that will make the implied policy plan more viable. It is intended as a constructive contribution to Herman Daly's perspective by introducing in the steady state economy the condition of population stability at the optimal size.

Causes and cures of the environmental problem

The obvious cause of environmental degradation and of climate change, specifically, is the growth of GDP. The root cause behind GDP growth is, according to some writers, a fixation with economic growth and a generalized culture of greed for higher profits and higher consumption levels. Other writers repeat the Marxian thesis that growth is the essence of the capitalist system and growth is simply unavoidable as long as the capitalist organization of society remains dominant. Another "cause" of the problem is, by implication, the inability of technological innovations or of their application to production to proceed fast enough and to make possible a relative or absolute decoupling of production and resource use.

A summary index of the environmental condition of our planet is the difference between biocapacity (BC) and the ecological footprint (EF). Table 1 presents these differences for every fifth year for the 1961-2015 period. The last year of ecological equilibrium, i.e. BC=EF, was 1969 (not shown). From 1970 on the difference is increasing and in 2015 the ecological footprint exceeds biocapacity by 68%. Also presented on Table 1 are the world population (Pop), the gross world product (GWP) and gross world product per capita. Population and

gross world product both increase monotonically and so does GWP per capita. Comparison of GWP with (BC-EF) shows that the two variables are very closely connected. As GWP grows the gap between biocapacity and ecological footprint increases. Also the increase of per capita GWP is closely related to the increasing ecological deficit.[1]

Table 1 Population, Gross world product, Ecological footprint, and Biocapacity, 1961-2015.

Year	Population (mil)	GWP (bn USD)	GWP/Population (000 USD)	Ecological footprint (mil ha)	Biocapacity (mil ha)	Biocapacity – Ecological Footprint
1961	3075	11683	3800	7035	9611	2576
1965	3325	14609	4394	8155	9736	1581
1970	3685	19040	5167	10052	9992	–60
1975	4066	23004	5657	11098	10117	–981
1980	4437	27840	6274	12284	10336	–1948
1985	4843	31662	6538	12778	10752	–2026
1990	5285	37887	7169	14221	11056	–3165
1995	5710	42198	7390	14716	11173	–3543
2000	6198	49999	8172	15749	11484	–4265
2005	6517	58108	8196	18001	11691	–6310
2010	6956	65955	9516	19862	11938	–7924
2015	7380	73590	9972	20504	12148	–8356

Sources: (a) World Bank, GDP in 2010 US$. (b) Global Footprint Network.

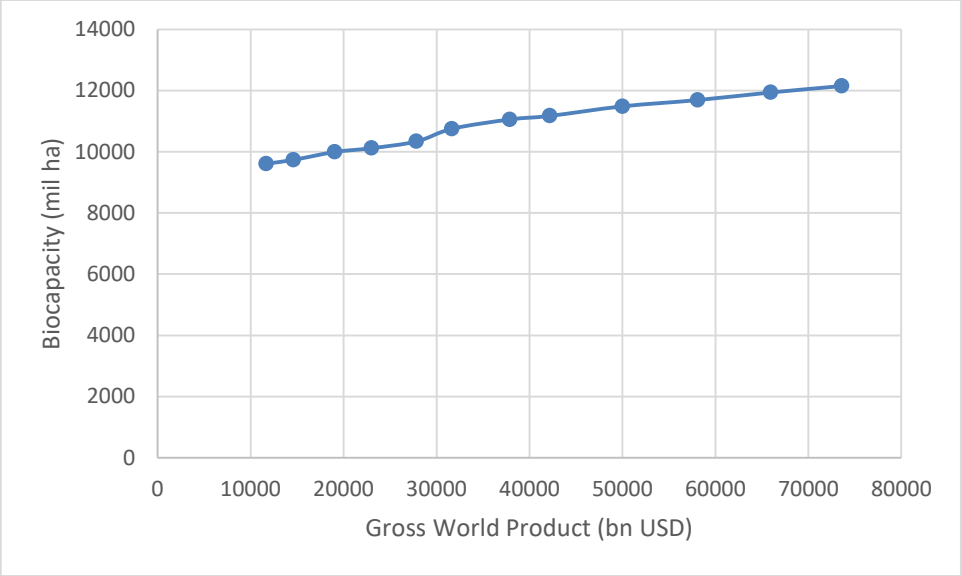
The negative relationship between the ecological surplus, i.e. the difference between biocapacity and ecological footprint, is shown in Figure 1. It shows very clearly that every increase in gross world product as a result of population growth or of per capita consumption or both increases the ecological deficit. It also indicates how difficult it is to decouple production from the use of resources.

Figure 2 shows the relationship between gross world product and bicapacity. Large increases in production are associated with very small increases in biocapacity and this implies that modern technologies are much more efficient in the production of commodities than in raising the productivity of resources. It can be interpreted as a practical refutation of the idea that resources are made, not given.

[1] Various publications, such as those of the Intergovernmental Panel on Climate Change (IPCC) and the World Meteorological Organization (WMO), contain very frightening detailed reports about the present condition of the Earth.

Figure 1

Figure 2



Depending on their interpretation of the cause of the problem various schools of thought have been developed that come under various names, such as Green New Deal, Green Growth, New Economics, Degrowrh, Ecomodernists, new Socialism, the Simpler Way, and various action plans or policies have been proposed to minimize the negative impact of producing GDP with or without growth. These proposals include the following:[2] reduction of fossil fuels, limits on carbon emissions, downscaling affluent economies and material flows, home and commercial insulation, renewable heating, private and public investment to secure a clean economy, decoupling GDP from resource use relative or absolutely, reducing work

[2] There is a voluminous literature on these issues but a feeling of what is involved can be obtained by consulting the following: NEF(2019), Jackson (2009), Kallis (2011), Kallis, Kerschner and Martinez-Alier (2012), Latouche (2009), Trainer and Alexander (2019) , Foster, Clark and York (2011)

hours and sharing available jobs, changing the monetary system, zero interest rates, communal management of resources, a "simpler way" society involving renewal energy and localized production, getting rid of market forces and finally transforming the capitalist system to a socialist one.

Some of these policy suggestions are consistent with others, some are contradictory, some are very imaginative but unrealistic and some imply very drastic changes that are unlikely to be adopted within a reasonable time period. Some of these policies are obviously promising, e.g. house insulation, but others do not seem to make sense within the existing institutional framework, e.g. zero interest rates. One of them, the green growth suggestion, is not supported by the available empirical evidence (Hickel and Kallis, 2019).

It is recognized that some policies, particularly those associated with the degrowth agenda, will cause fierce opposition by powerful interests which will use their political power to repeal serious reforms. But according to Kallis (2011, 2015) degrowth is not just a policy, it is rather a political alternative that seeks popular support for radical changes. Thus, the advocates of degrowth see the solution of the environmental problems in a major restructuring of the socioeconomic system and in that respect degrowth resembles the socialist point of view that the cure of all problems is to be found in a socialist transformation of society.

The elephant in the living room

What is really surprising with the studies mentioned above (and of course with many others) is that they fail to see the protagonist of the environmental drama of our time, i.e. they fail to see or refuse to admit the effect of the world population growth. They do not see the elephant in the room or, for some reason, they do not want to talk about it.[3]

There are at least three studies using different methods that have come to a similar conclusion, namely that if everyone on the Earth is to have a decent living standard the world population should be reduced to around three billion, i.e. to forty percent of its present size (Daily et al., 1994; Pimentel et al., 1994; Lianos, 2013; Lianos and Pseiridis, 2015). Independently of the exact size of optimal population most scientists would agree that humanity has in its hands, to use Ehrlich's title, a population bomb. However, politicians and governments never refer to overpopulation and instead of promoting the idea for population reduction they encourage its growth by providing moral support and material subsidies for the third and fourth child. The same is true for religious leaders. Also, there is an unjustified feeling among the general public that population control and reduction is something wicked, and therefore whoever suggest measures in favor of small family size becomes immediately unpopular. Even some academic circles that should not be uninformed show a blatant prejudice against arguments for population reduction.[4]

[3] Of course, there are many studies, particularly those who examine environmental problems in relation to ecological Kuznets curve, where population is the central factor. See, for example, Galeotti et al. (2011), Casey and Galor (2017).

[4] On a personal note, three academic journals that have "population" on their titles turned down a paper of mine in which I was arguing for population reduction without bothering to send it out for peer review because, as the editors said, the subject of my paper, i.e. population, was outside the scope of their journals!.

The steady state economy

In the steady state economy (SSE) model population becomes a central factor by been required to remain constant. The best known advocate of SSE is Herman Daly who 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).

Before Daly, Kenneth Boulding (1964) introduced the Green Stamp Plan in order to control population growth. According to this plan every boy and girl is given 110 stamps which can be sold and bought in the market and thus demand and supply will check population and bring equilibrium. This plan is devised to keep population constant at a time when the world population was approximate 3.3 billion, that is, 56% less than its present size. Of course, the idea of the SSE is much older and can found in the works of Plato (*Laws*) and Aristotle (*Politics*). Both philosophers present well defined models of a sustainable city given the available territory (that is, the equivalent of resources for that time) and adjustment of population so that citizens can enjoy an acceptable standard of living that can be sustained (Lianos, 2016). Also, J. S. Mill (1970) devoted a chapter on the stationary economy.

It should be noted that in the above quotation, Daly actually gives two definitions of the SSE. In the first, population and capital are constant. In the second, it is the flow of throughput which is constant at a sustainable level and population and capital are free to change. The two definitions imply different consequences for the standard of living people can enjoy. If population is kept constant, improvements in productivity will allow higher per capita income whereas the constant flow of throughput may allow bigger population size with a constant per capita income. However, in both cases population controls will be necessary.

The above definitions are not without problems. In the first definition population and capital are required to be constant. However, in a market economy investment (and therefore capital) is determined by market forces and population change is mainly the result of private decisions within families. How can they be kept constant and in the proper proportion except in a command economy? In the second definition, how will it be decided what is the sustainable throughput and if that can be estimated, how is it to be realized in a market economy? Also, what is the proper population size for that level of throughput? It seems to me that Daly's model of a SSE is not realistic except in a command economy (see also Smith, 2010 and Trainer, 2016). In the context of a market economy, the problem of Daly's model of SSE is that it does not have enough constant parameters and thus it remains undefined. Regardless of the way Daly defines it, the SSE does have a realistic version, as shown in the next section.

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 putting limits to minimum and maximum incomes. 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 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 point in Daly's list of 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 differently demand deposits 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, the banks would have to charge a fee and this would be their only source of revenues from accepting and handling demand deposits and this may discourage people to deposit. 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 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 consumers' 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 that needs to be determined at a level that would be in harmony with ecological balance. This raises the question of what is the optimal population size and, if it can be determined, how can it be achieved.

Steady state economy with optimal population size

The steady state economy with optimal population (SSEOP) can be presented by splitting the analysis in two sections and examining first the transition period and then the final state.

The transition period

In the transition period two constant parameters are involved, the maximum GDP (Y*) compatible with ecological equilibrium and a socially accepted standard of living (SL*). In reality these two quantities are variables but for a given point in time they can be assumed constant, and for the purpose of analysis constant at their present values.

The maximum GDP can be estimated using the data for the ecological footprint and the biocapacity of the planet. The acceptable standard of living requires a consensus that may be difficult to be universally accepted. But reasonable and informed people can easily agree on a level of income that allows a comfortable living, as for example the level of income enjoyed by the average citizen of the less developed European countries. On the basis of 2015 data, if the ecological footprint were to be equal to biocapacity the gross world product (Y*) should be 43.4 trillion US$ instead of 73,6 trillion. Accepting an average GDP per capita of 15 thousand which is approximately that of the less wealthy countries of Europe gives an optimal population of 2.89 bl. The reduction of population to sustainable level may take several generations depending on the annual rate of reduction. One cannot escape the conclusion that humanity has come to a very critical stage where tough decisions must be taken.

When the optimal population has been reached and the transition period has ended the size of population should become the constant parameter and all other elements of the model become variables and may be free to change depending on the rate and the type of technological change, and the changes in consumer preferences, on the condition that ecological equilibrium is observed.

The transition period to the SSE will not be a walk in the Athenian Agora or in the gardens of Versailles. It will raise serious problems and it will necessitate inventing proper government policies. The problems related to the reduction of aggregate effective demand and to the viability of pension funds (public and private) because of changing age structure of the population are often cited as the most obvious.[5] But it is better to face difficult problem that can be solved, even in less than perfect ways, than let the present tendencies destroy the ecosystem and undermine the well-being of the now younger and the future generations.

It is worth noting that the transition to SSE does not need to reduce per capita GDP if population reduces faster than GDP. Thus the effects of degrowth in terms of declining GDP may not have the effect of lowering per capita welfare.

The steady state economy in equilibrium

When the transition period comes to an end, the economy can be said to be in equilibrium with optimal population, a satisfactory standard of living and ecological equilibrium. As soon as that situation is reached, the SSE requires only two restrictions, namely the size of population to remain constant and ecological equilibrium to be observed. Technological advances that increase the productivity of inputs, including labor, without harming the environment may lead to higher production and thus to a higher standard of living or in more leisure. Also changes in people's preferences may increase the standard of living if the structure of demand favors commodities and services for the production of which fewer

[5] For a recent review of the problems and benefits of population decline see Gotmark et al., 2018.

resources are needed. In general, as long as population remains constant, all disturbances causing disequilibrium will be self-adjusting.

The brief description of the SSEOP given above raises two difficult questions. First, how population can be reduced so drastically during the transition period? Second, how will the economy function after reaching the equilibrium position, or, as the question is often put, is the steady state economy a socialist or a capitalist economy? This question is often stated in the form: can a SSE be capitalist?

How can population be reduced?

From the ancient times to the present 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, economic incentives and disincentives, and coercion. The fact is, however, that these methods to the extent they were applied they 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. However, as was mentioned before, there are powerful interests (Churches, the military, politicians, etc.) that favor population growth and therefore attempts to reduce the size of population will meet fierce resistance.

Another way for reducing world population (very unlikely to be adopted at the present time but when the disastrous effects of population growth become more apparent may become necessary) is by monetizing the problem and creating a market for human reproduction rights. One model for implementing such a program can be described as follows.[6]

> 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.
>
> 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 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.

This plan has two advantages and one important disadvantage. The advantages are that essentially it would be cost free and it treats everybody equally. The disadvantage is that it is coercive. Of course, controlling the family size in this way violates a basic human right. Many people would be very skeptical about introducing laws that forces families to reduce the

[6] For a more extensive exposition see Lianos (2017; 2018).

number of their offspring. For example, Conly (2016), who rejects the claim that people have a fundamental right to have as many children as they want, 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. By forcing people to have less children that 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 intension of stealing resources from the future generations or harming the natural environment and therefore there is no deceit involved. This defense is not convincing because it is difficult now 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 to school or to drive on one side of the road or even to fight in a war and be forced to kill.

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). It is clear from the analysis presented is this paper that the sole 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. Under the present circumstances, if population growth is left unchecked Parfit's repugnant conclusion will certainly be reached. Our suggestion for the one-and-a-half child policy is a combination of command and economics that also allows some choice.

Can a steady state economy be a capitalist economy?

This question has been asked recently by Richard Smith (2016) in a critique of Daly's version of steady state economy and his answer is in the negative. His answer is based on a brief analysis of three basic characteristics of capitalism. First, the producers are dependent on the market. Second, competition is the motor of economic development. Third, "grow or die" is a law of survival in the marketplace. In short, he concludes that "the growth imperative is virtually a law of nature, built-into any conceivable capitalism. Corporations have no choice but to seek to grow" (p. 31). He ends his paper with a dramatic appeal: "It's time to abandon the fantasy of a steady state economy, go back to the drawing boards and come up with a *real* "new macroeconomic model", a practical, workable post-capitalist ecological economy, an economy by the people, for the people, that is geared to production for need, not for profit.

"Socialism?", "Economic democracy?" Call it what you like. But what other choice do we have? Either we save capitalism or we save ourselves. We can't save both" (p. 42).

It seems to me that Smith and many other authors who argue in a similar way are right in saying that in capitalism firms must grow in order to avoid the danger of being forced out of the market by competitors. The need to grow and survive makes profit maximization an economic law. However, they neglect the factors that make profits possible. In brief, profits are the result of three factors: (1) Technological advances and applications in the production process and/or management that give an advantage over competitors, (2) extension of the market because of exports or changes consumers' taste or increasing population, and (3) abundant labor supply that allows, in Marxian terminology, the extraction of surplus value.

The core of the capitalist system is labor exploitation and the extraction of surplus value. Exploitation and surplus value are uniquely related to abundant labor supplies. Capitalists, more than politicians, religious leaders and the military, want an increasing labor supply that will be exploited to produce surplus value and at the same time extend the market. The huge migration flows from relatively poor European countries to USA, Canada, Australia and the European North during the twentieth century, provide evidence for the need of capitalism for labor supply and hence for increasing population. Jason Hickel's (2019) "scarcity machine" actually provides examples of some instances (as the enclosures in England and the European colonization of Africa) where people were artificially deprived of their means of subsistence and they were forced to supply their labor to capitalist enterprises for low wages.

The argument I am going to present is intended to show that a steady stare economy with constant population can be capitalist. Suppose that the long run equilibrium of the economy is reached, that is, GDP is at the level that guaranties ecological equilibrium and population is constant at a level that, given the technology of production, is just sufficient to produced GDP. In a steady state economy the wage rate and the profit rate are negatively related. A higher (lower) wage rate means a lower (higher) profit rate. If the profit rate is zero and technology and consumer tastes remain constant, capitalists will receive their normal profit, i.e. profits which are just sufficient to induce them to remain in the industry. In this case, wages are at the maximum that can be attained in a capitalist economy. Capital owners will cover their costs, replace depreciated capital and receive their normal profit.

If profits are positive or if there are opportunities for positive profits (because of technological progress or shifts in consumer preferences) capitalists will try to exploit these opportunities, but this at the same time will raise the demand for labor and, given that population (and therefore labor supply) is constant, wages will increase and the expected profits will fall. At the new equilibrium, profits will fall to their normal level and wages will increase to the maximum attainable level. Consequently, an obvious and important byproduct of this process will be a huge improvement in the distribution of income.

The story I am reciting may be seen as a typical textbook perfect competition model. That is true, but holding population as a constant parameter gives drastically different results. This is an important result that partly explains why many economists do not discuss population constancy or reduction even in the face of the threat of environmental catastrophe. Also, it explains the pro-natalist culture that has been promoted throughout the world[7].

[7] It is not implied that this is the only factor that contribute to population growth.

Can a steady state economy be a socialist economy?

In principle, a steady state economy with optimal population can certainly be a socialist economy. However, an exact model of such an economy cannot be specified because it is not always clear how a socialist economy is defined. If a socialist economy is defined as one with private capital ownership but with an extensive public welfare system, the answer is in the positive and in fact a plan for population reduction has more chances to be materialized than in the capitalist economy. If a socialist economy is defined as a command economy, that is an economy whose structure and activities are decided by a central planner, the steady state economy would be much easier to implement but at the expense of individual liberties, depending on the administrative powers of the central planner.

The steady state economy in other socioeconomic systems

The growing ecological problems and the increasing economic inequalities worldwide have led to a search for alternative ways of organizing society. Terms like “Economic Democracy” (Smith, 2010, p. 41), “Direct and Popular Democracy” (Kallis, 2015, p. 4), are often used but their contend is not specified. The same is true for “The Simpler Way” that suggests “a small scale, highly self-sufficient, self- governing and primarily collectivist local economy” (Trainer, 2016, p.62), and also for the “Radical Ecological Democracy” that suggest “collectives and communities at the center of governance and economy” (Kothari, 2014).

It is difficult to see if these suggestions lead to viable and efficient alternative ways of social organization but no foreseeable factor should prevent these alternatives from achieving a steady state economy status.

Conclusion

All the environmental problems created by the human activities are wholly and solely related to the increase of the world GDP. With given technology and consumer preferences, any improvement in the condition of the environment has to come from a reduction of GDP. This is undeniable and is the basis on which the degrowth literature as well as that of the steady state economy are based. The degrowth approach begins with a reduction in GDP ignoring the fact that this will immediately reduce per capita income if population remains constant or if it reduces relatively slowly. Thus, degrowth goes hand in hand with a reduction of welfare. In contrast, the steady state economy suggestion begins with a reduction in the size of world population which will in turn reduce GDP but not per capita income. The criticism that a steady state economy cannot be a capitalist economy does not seem to be valid. In fact, the argument made above is that the steady state economy is compatible with a variety of social systems.

Prospects for the future

Given the size and the urgency of the environmental problems (of which the climate change seems to be the most threatening), it is reasonable for practical men to ask what are the prospects for the future. The evidence from the recent past suggests that policies for GDP reduction or stability in a world scale are very unlikely to be adopted in the near future. Any

government that attempts to follow or simply suggests such policies will fall the next day. Policies for population reduction may be a little less unpopular in some countries but they are also unlikely to be seriously considered. At present, there is no reason to have any ray of hope for a better future, no reason to be optimistic.

The only hope we can have is a *Deus ex machina* or rather a *Deus ex technologia*. If we can have enough solar, wind and nuclear energy within a reasonable time period the disastrous climate change may be avoided. However, although that will be a relief it will not solve the scarcity problem. Growing GDP to allow a growing standard of living of a growing world population will very soon reach the limits of resource availability. In fact, we are already at that stage.

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