STEADY STATE ECONOMY AND POPULATION

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Abstract

The present paper briefly reviews the idea of steady state economy from ancient times to the present. It discusses some of the suggestions made by H. Daly in his model of a steady state economy and, in particular, the idea of stable population. The paper suggests that the population must be stable at a level that is compatible with ecological equilibrium, which is about three billion people and can be achieved if every family is allowed to have fewer than two children. To ensure population is controlled this paper proposes the creation of an international market for human reproduction rights.

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1. Introduction

The idea of a steady state economy is very old. In the 4th century BC, Plato and Aristotle both elaborated on the idea of a steady state by specifying the land/population ratio necessary for a just and happy state.

Plato's treatment is very brief. In the Laws (book V) he says: "The sufficient size of population cannot be properly determined except in relation to the land… And the land should be of such a size that would be enough to feed so many wise men, and no more land is needed….. In other words, men and land form a common factor" (translated by the author).

Aristotle has devoted Book VII of his Politics to establishing the foundations of a state that would be self-sufficient and stable and within which citizens could lead a good life. He develops the idea of best life on the basis of which he constructs a complete model of a steady state economy. The best life, also referred to as life of happiness, "is the life conjoined with virtue furnished with sufficient means for taking part in virtuous action" (1323b40 - 1324a2). In Aristotle, this means a comfortable, but not luxurious and wasteful life style. This should be true for each individual, separately, and for the state, collectively. 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 own land, and enough 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 ratio cannot be sustained unless population controls are introduced. In fact, he suggests various methods for keeping the population constant at the proper size (for a detailed analysis, see Lianos, 2016).

The reader can easily see in the texts of these ancient writers the concern expressed in contemporary literature on limited natural resources and steady state economy.

The structure of the paper is as follows: Section 2 gives a brief presentation of the steady state economy according to the classical view, the Marxian view and H. Daly's view. Section 3 discusses the steady state economy in connection with population size. In section 4 we discuss the role of the State in a steady state economy. Section 5 presents an idea for creating an international market for human reproduction rights for the purpose of controlling the world population. A few comments are given in the last section.
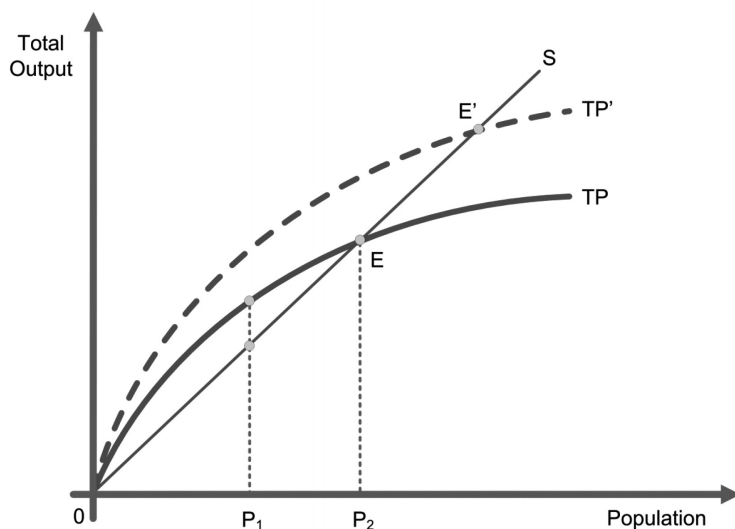
2. Steady State Economy

The Classical view

In the past, many writers examined, in brief or extended versions, the content and

the inevitability of the economic system tending to a steady state position. John Stuart Mill is one the first who confessed 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 classical economists, including Mill, is epitomized by Baumol's (1951) "magnificent dynamics" presented in Figure 1. Line TP shows total product 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 P1 the difference between TP and S represents profits which motivate investment, increase employment, allows for higher wages and for improvement of the condition of the labor force, thus, leading to an increase in population. This process will be terminated at point E when population increases to P_2. At point E the stationary state is reached at zero profits. Improvements in the production process that raise the total product curve to TP' will motivate investment once again and the new process will bring the economy to a new stationary state at point E'.

Figure 1. 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 remain at a steady state position at zero profits. The answer given by classical economists is affirmative.

The Marxian View

A steady state economy in the Marxian sense is supposed to be described by his simple reproduction scheme of chapter XXIII of volume One of *Capital*. The case of simple reproduction can be a steady state economy only if capitalists consume the surplus value acquired as revenue that year at any given period.

Usually, the reproduction scheme is presented in value terms. However it is easier to see what is involved if we present it in physical or money terms. Consider the following simple example of a two-sector economy which produces machines and corn using machines and labor. The technical coefficients are shown in Table 1.

Table 1. Technical coefficients of a simple economy

	M	C	L
M	0.5	0.05	0
C	0	0.02	2
L	2	0.01	0

In this economy the production of one machine requires half a unit of machines and two units of labor. One unit of corn requires 0.05 units of machines, 0.02 units of corn and 0.01 units of labor. The subsistence wage is 2 units of corn (which is required for one unit of labor). Assume that, in this economy, a surplus of 100 units of corn is produced for the consumption of capitalists and landowners. Equilibrium requires that demand and supply of machines, corn and labor should be equal. Thus,

$$M = 0.5M + 0.05C$$
$$C = 0.02C + 2L + 100$$
$$L = 2M + 0.01C$$

The equilibrium values for this system are M = 17.9, C = 178.5 and L=37.5. These quantities are reproduced year after year and this is an example of simple Marxian reproduction.

For some (e.g. Blauwhof, 2012) this is also a steady-state economy. However, this equilibrium position will not be sustained because in capitalism only a small part of the surplus is consumed and the rest is invested. Therefore, the economy always follows the expanded reproduction path.

The Marxian steady-state is not the simple reproduction scheme, but, rather, the higher phase of communist society, very briefly mentioned in the Critique of the Gotha Program. 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 a necessity, not just a means to survive, and each member of society

would offer to production what they can and take what they need. According to Marx, human history ends at that phase of the truly communist society when the word 'scarcity' is removed from the dictionary.

Given the circumstances prevailing today, namely a world population of 7.5 billion and the 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 it is in the classical tradition or in Daly's present-day context.

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 Geogescu-Roegen's arguments. However, Daly's steady-state economy and de-growth are two different concepts, at least for economic policy purposes.

In the words of Latouche (2009), "De-growth is a political slogan with theoretical implications… The slogan of de-growth is primarily designed to make it perfectly clear that we must abandon the goal of exponential growth, as that goal is promoted by nothing other than a quest for profits on the part of the owners of capital with disastrous implications for the environment, and, therefore, for humanity". Although Daly and Latouche share some common concerns, they should not be discussed together as they have very different political 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 a constant stock of capital, maintained by a low rate of throughput 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 SSE in terms of a constant flow of throughput at a sustainable (low) rate, 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 waste (Daly, 2008). The long-run equilibrium position of Daly's steady-state economy can be presented in a diagram similar to that of the classical model. The equilibrium position of the classical model is based on the stability of the subsistence wage and on the Ricardian mechanism of the labor market. If the real money wage, which is determined in the labor market, exceeds the subsistence wage, the population will increase. In the opposite case, the population will decline. Thus, deviations from point E of figure 2 will be temporary. Now, suppose that the economy is at point E1 with the population

at P1. Since, by definition, the population is stable, point E cannot be reached. The equilibrium position will now be at point E', at higher wages, indicated by the higher slope of line S'. The gap of BE' will be closed not by a movement towards E but by an increase of the wage rate. The horizontal supply of the labor curve implied in the Ricardian model is now replaced by a vertical labor supply curve because of constant population.
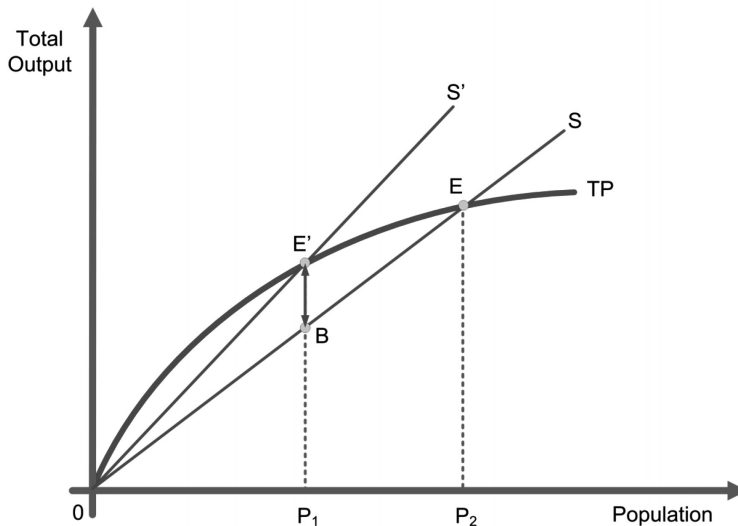
Figure 2. Equilibrium with stable population

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 the population. Economic policy requires setting quantitative targets. It is not sufficient to say that the population should be stabilized by equating birth and death rates. This leaves the SSE undetermined. It is necessary to specify the size at which a 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 technology remains constant), the size of the population should be stabilized at a level dictated by the sustainable level of total product.

There are several studies that have estimated the size of world population that corresponds to a sustainable level of economic activity worldwide. Studies by Daily *et al.* (1994), Pimentel *et al.* (1994), Pimentel *et al.* (2010), Lianos (2013) and Lianos and Pseiridis (2015), based on different criteria and reasonable levels of *per capita* consumption, have all estimated that the world population should be stabilized at around three billion. Even if an error of 50% has occurred in these studies, the

desired level of population is approximately half of its present level. It seems that it is a safe conclusion to say that the world is heavily overpopulated.

Although the burden of overpopulation on the resources of the planet is obvious and recognized by the majority of researchers, it seems that no one is willing to raise the issue of population control. It is still a taboo.

Furthermore, 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 income. If the 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 simply 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 another. Besides, 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 in the 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 being "Nationalize money, not banks" (2017). This can be achieved through treating demand deposits differently from time deposits. For demand deposits, 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 revenue, i.e., 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 reserves required and all savings could be loaned to potential borrowers. Banks would 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 could not change the money supply and the risk of financial crisis disappears. This suggestion is not without problems. There are two important cases in which Daly's suggestion appears to be too restrictive. One case has to do with the time structure of time deposits, which 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 enterprises. In a capitalist steady-state economy there will certainly be changes in consumers' tastes, new products will be introduced and new technologies will be

implemented for production. Therefore, new firms will be created and old ones will disappear. A banking system with 100% reserve requirements will make financing new firms difficult. 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, these suggestions do not define a steady-state economy. The heart of the matter is the size of the population, which needs to be determined at a level that would be in harmony with ecological balance.

3. Population and Steady State Economy

As pointed out earlier, it is not enough to say that in a steady-state economy the population should be stabilized. What also needs to be known is the actual size of the population. For example, with the current population of 7.5 billion the economy cannot be sustained at its present level because of the ecological deficit we are experiencing. The choices we have are presented in Figure 3. Curve EC shows the combinations of Population (P) and *per capita* income (Y/P) that are compatible with ecological balance. Points to the right of EC imply ecological deficit. The present situation of the world population (7.5 billion) and total product ($75.2 trillion) with a per capita income of approximately $10 thousand is shown at point C and it is clearly unsustainable. It is estimated (Lianos 2013) that the world GDP corresponding to ecological balance is 34.6 trillion dollars. If we want to stabilize the population at its present size, ecological balance requires that per capita income be reduced to $4.7 thousand (point A). Alternatively, if we wish to keep *per capita* income at its present level, the population must be reduced to the size shown by point B. This means that there are many positions a steady-state economy can occupy along the EC curve. The decisive factor is the size of the population.
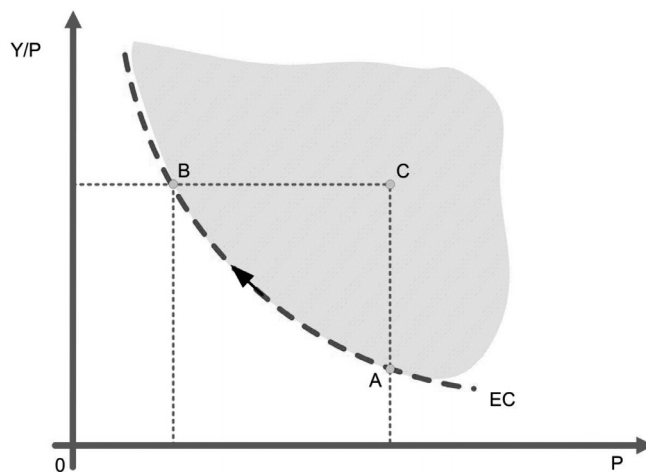

Figure 3. The ecological balance constraint

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

At the theoretical level, a steady-state economy requires three fundamental elements. First, the population must be stable at a size that would be compatible with ecological equilibrium, or less. If technological advances make more efficient use of resources possible and total product can increase, population and/or 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 resources use. Third, the prices of products and of factor 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, such flexibility means 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. Furthermore, there should not be subsidized products (like bread, for instance). Problems of poverty should be solved by other means. 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 the population should be determined by the scarcity of resources made imperative by the need for ecological balance. If the population is fixed at a certain level, everything else will be adjusted in relation to that level.

Economists and policy makers in modern economies have been unjustly accused of "growth-mania" 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 the population. Stability of population is the cure for growth-mania.

4. 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 (1970, p. 116) "There would be as much scope as ever for all kinds of mental culture,

and moral and social progress". 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 or 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 have to take. What is urgent today is to discuss and think of ways to control the size of world population.

5. A Market for Human Reproduction Rights

Currently, the world population is close to 7.5 billion people and it is projected to increase in the next decades. Every day a new city of approximately 250 thousand people is born.

According to a recent study by the International Institute for Applied Systems Analysis (Lutz *et al.*, 2014a, 2014b), the 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 thirty percent increase in world population in the next forty to fifty years.

The earth is overpopulated and the size of its population has to be reduced if the natural powers of the planet are to be preserved. The best possible way of doing this is by persuading families that it is in their long-run interest to keep their family size small. If this is an ecumenical effort, supported by governments and other institutions, and it is also accompanied by relevant institutional changes, as, for example, old age security systems, there is a good chance for the effort to succeed.

Another way is by monetizing the problem and creating a market for human reproduction rights. One model for implementing such a program could be defined as follows.

(i) Every couple is given three shares by the government, each share giving them 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 tradeable in the world market. Thus, a couple in Canada who wish to have two children can buy one share from a couple in China. Similarly, a couple who wish to have three children would have to buy three shares, and so on. If no couple wishes to sell shares and if all couples wish to have two children the one-and-a-half policy becomes in practice a one-child policy.

(iii) There are people who do not wish to, or cannot, have children, people who are happy with one child, and people who will be tempted to sell one or all their shares to make some money. It is certain that there will be people in all countries that would be able and willing to buy 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 ones, within each country and between countries.

(iv) 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 emerge if the application is ecumenical. Thus, it is desirable that the scheme should have the support of all governments and also the support of various institutions, e.g. the Church and other social organizations. It is very likely that some governments that favor 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, then popular demand for adopting the plan would be strong in those countries.

(v) In addition to reducing world population, some other positive side effects are also possible. For example, the black markets for children adoption that exists in some (perhaps many) countries would disappear. Also, very substantial money flows would be directed from rich families and countries to poor ones. Of course, negative side effects are bound to appear as in the case of unintended pregnancies of married couples 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, distinct from the way couples decide to live. Furthermore, 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 population decline.

To facilitate exchanges of reproduction rights an international stock exchange can be established where reproduction rights will easily and at a minimum cost be sold and bought. Thus, a couple in one geographical region could 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 control will often be violated, at least in

the beginning. Problems of non-compliance will certainly arise and there is no easy remedy 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 of the proposed solution by the public.

Of course, controlling family size in this way violates a basic human right. However, the offence of this violation should be weighed against the alternatives. It should also be pointed out that a policy or a rule, if generally applied, is not perceived as a coercive restriction by the public.

In the history of the world, social problems have been solved or limited to manageable proportions by command rules, by motivating economic forces, and by a combination of both. Of course, monetizing a problem does not necessarily lead to the best solution, but a second best solution is often better than letting things run their own course. Under 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.

Reduction in population worldwide will be followed by a general drop 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 a substantial remedy for the waves of demand reduction and, therefore, very active government policies of demand and of income redistribution will be necessary. At the same time, income previously spent on the needs of children will now be spent on other items and, therefore, the decline of total demand need not be so high.

If such a plan were generally adopted, the world population would be reduced to half within three to four generations, i.e. in about one century.

6. 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. If the population has been stabilized at a level at which the ecological deficit is maintained, society will, in the long run, suffer from problems of insufficient resources to support that population size and, therefore, to poverty. Thus, it is important that the steady-state economy be defined as one with a population at a level compatible with ecological equilibrium as well as comfortable lifestyles.

Additionally, the steady-state economy will have the problems that capitalist societies have, i.e., problems related to changing tastes, new technologies, risks, natural disaster, etc. Therefore, state policies that facilitate economic and social adjustments would be necessary.

Finally, we have emphasized the need for birth control even if that means some violation of human reproduction rights. The justification for such an approach is that it is less onerous than poverty, starvation, social unrest and wars that result from overpopulation.

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