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ECONOMICS 100: Overpopulation is a wicked problem

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1. Introduction

It is often said that if a problem is well defined a solution can always be found. This may be true for some problems as for example in mathematics or for chess games where the player is asked to check mate in three moves, but in social and economic sciences this is certainly not true. Think of the problem of unemployment ever present in capitalist economies. Is unemployment rate of 6% a problem or is it frictional? Is it because of deficient aggregate demand or is it structural? Is it a result of underconsumption or because of a fall in exports? How can we reduce unemployment, by reducing tax rate or by increasing investment in technical education?

Evidently, social problems are wicked. Ritter and Webber (1973, p.160) call some problems wicket not because they have ethically deplorable characteristics but because they are malignant (in contrast to benign), or vicious (like a circle) or tricky (like a leprechaun) or aggressive (like a lion in contrast to a lamp). They also give ten characteristics of wicked planning problems.

In general, a problem may be defined as wicked if it has no unique solution and the choice of any solution involves economic, political and/or ethical considerations. It follows that any choice we make will have to consider benefits and damages, economic gains and losses for those directly affected, and also the ethical value of the actions needed to be taken for an effective solution.

It is not necessary but perhaps it is useful to remind ourselves that on Earth there are nonliving things (e.g. stones), living things (e.g. trees), nonhuman animals and humans, and that the solution of social problems may involve, directly or indirectly, all these entities. Therefore, in making decisions about the best solution the effects of the possible solutions on each of these entities must be considered and this necessarily implies an axiology of humans relative to the other three. The axiology is done by humans because they are the only living animals that can make a judgment and support it with arguments. Nonhuman animals have sentiments and feelings but they cannot express them clearly in a dialogue.

In making judgments humans differ substantially because of differences in culture, in personal past and present experiences, in psychology, in education, in social or political ideologies etc. Thus, we now have at least four philosophical positions regarding the relationship of humans to the other entities: deep ecology, biocentrism, ecocentrism and anthropocentrism. The author of this paper tends to side with weak anthropocentrism which recognizes ethical responsibilities to other humans and leads to best life in the Aristotelian sense, namely a temperate and liberal life (i.e. a comfortable but not luxurious life).

2. Environmental Problems

We often read or hear about the problems of the environment. It is useful to point out that generally speaking this is an error in syntax. The environment has no problems. It is us humans that have the problems. If a glacier melts and the level of the sea rises this is not a problem of the glacier or of the sea, it a problem of the humans that may need to relocate. This is not a grammatical error; it is a subconscious tendency to shake off our guilt.

Any reference to environmental problems brings to mind air pollution, deforestation, soil degradation, water scarcity, loss of biodiversity, plastic pollution, ocean acidification and of course climate change. To these we should add scarcity of land for production of food. All these problems can be seen as results of transgression of the limits imposed by nature.

How is it possible, one may ask, for humans to observe galaxies thousands of light years away from the Earth and not see the limits in the resources of the Earth? To this question several answers can be given.

- Until very recently many people did not know what an environmental problem is. Most people know now because of the publicity given to the change of climate.
- Many people know but they do not care enough to participate in political movements or pressure groups involved in protecting environment.
- Many people, perhaps most, know and understand the importance of environmental problems but they discount the future by a 100% discount rate and continue to enjoy life without any remorse for the consequences of their action, e.g. many children per couple, overconsumption and wasteful living.
- After the 2nd World War a culture has been developing that encourages breaking the limits in many parts and norms of social life including economics, politics, arts, ethics, education etc. That led to rising demand, directly and indirectly, for economic growth. Huge flows of migration to Australia, Canada, USA and to some European countries (mainly Germany) helped all countries grow. Thus, production and consumption became the prime objective of economic and related policies. China and the Soviet Union had no choice but to compete with each other and with the developed countries in economic as well as in military power. Per capita GDP and its growth became the dominant statistic around the entire world. Thus, the perceived need for production and consumption prevented peoples and governments from seeing the limits of the Earth's resources. Consumerism has conquered human society.
- Wealthy people, politicians, businessmen, and the military, i.e. the ruling class, seem to believe that the dreadful consequences of the environmental disasters would not affect them. Only the weak and the poor will suffer but who cares.

Of course, the academic community, at least part of it, saw the dangers of approaching and surpassing the limits. Ehrlich (1968), Ehrlich and Holdren (1971), Boulding (1964, 1966), Daly (1968, 1972), Georgescu-Roegen (1971, 1975) and Meadows et al. (1974) in the sixties and early seventies sounded the alarm. However, capitalists in their attempt to maximize profits and grow willingly ignored the warnings while governments had neither the strength nor the desire to impose limits and rules in the use of resources.

Thus, we have reached the point where the ecological footprint is currently 2.75 global hectares per capita while biocapacity is only 1.63 global hectares per capita. In other words, we are using the resources of the Earth 70% faster than they can be replenished. That means we are overproducing and overconsuming.

3. Population

People need food, clothes, houses and many other commodities for a good life. It is self-evident that the origin of all environmental problems is the production of commodities. Assuming that all production activities are registered in the Gross Domestic Product (GDP) statistics, the impact of production on the environment can be written as

$$I = T \times GDP$$

where *I* is any kind of measurable impact and *T* is a parameter connecting production with its impact and its value depends on the technology used in production. This equation is not a scientific hypothesis; it is simply a description of an observed fact. It is informative to divide and multiply *GDP* by the size of population and write the above equation as

$$I = T \times \frac{GDP}{P} \times P$$

This is known as the IPAT equation and it is very useful in identifying the main source of the impact in comparing per capita *GDP* (*GDP/P*), as a proxy for affluence, with the size of population among countries or regions, for example USA with China or with India, and North with South.

This equation also tells us that there are only three ways by which the impact of production on the environment can be reduced; by reducing the value of the technological parameter T or by reducing per capita production or by reducing the size of population or by any combination of the three. It is useful to emphasize that this is true for any system of social organization. In other words, this is true for capitalism, for socialism, for a mixed economy, for developed as well as for developing economies. However, as will be shown later, a given social system may favor one way and reject the others.

Microeconomic theory teaches us that the production of commodities requires a combination of labor, resources, and capital in proportions determined by the type of commodity and the available technology. The usual textbook description of the production process is the Cobb-Douglas production function

$$Y = AK^{a}L^{1-a}$$

where *Y* is total product, *K* is capital and *L* is labor. The factor *A* is an expression of the technology used in production. This production function has the nice property of declining marginal product of either factor when the other factor remains constant. For simplicity all inputs to production other than labor are included in the definition of capital. In specific applications other inputs may be included as for example land in studies of agricultural production.

The concept of the production function reminds us of the obvious fact that for the production of commodities both labor and resources are necessary. In order to have an apple it is necessary to have an apple tree and to make the effort to cultivate it.

The labor force of an economy is part of population and is defined as the number of people who able and willing to work. This is usually half of the population. For example, in the European Union in 2024

the labor was 220 million and the population 450 million. For the USA in the same year the corresponding numbers were 170 and 340 million.

4. The Dual Role of Population in the Economy

4.1 Developed economies

Population has a dual role in the functioning of every economy. It is the source of labor for the production of commodities and at the same time it is the sum of consumers who buy the commodities produced. In other words, people produce and consume what they produce. Nothing strange or unnatural in this circular flow of goods often called *wheel of wealth.* However, our understanding of the circular flow of goods takes a different turn if we examine the differences among various groups of the population in their economic behavior. People with low income (mainly wages) necessarily spend all or most of it on consumption whereas wealthy people with high income (mainly profits) consume a very small proportion of their income and save the rest for investment. Generally speaking, in capitalist economies workers have a high propensity to consume and a low propensity to save whereas capitalists have a low propensity to consume and a high propensity to save. Of course, in terms of absolute size wealthy people consume and save much more than the low income people.

This difference in spending and saving between social classes, e.g. workers and capitalists (capital owners), together with the motive of capitalists for maximum profits explain why it is so difficult to solve the problem of overpopulation. The explanation in general terms is as follows. Under normal economic conditions the savings of each period (let say a year) are invested and increase the stock of capital thus increasing the productive capacity of the economy and the supply of goods and services in the next period. But there is no systematic reason that would automatically lead to higher consumption and therefore the problem of underconsumption appears. The best solution to the problem of underconsumption is to increase the number of consumers and this means to increase the size of population.

The last two hundred years of capitalist growth the size of the world population has increased from 813 million in 1800 to 8.19 billion in 2025 (June). During the last seventy years the world population tripled from 2.54 billion in 1950 to 7.8 in 2020, and in the last five years increased by almost four hundred million or 80 million per year. Thus, the increase of population provided the labor force for economic growth and at the same time the consumers needed for buying the commodities produced.

The need of capitalism for growing population is evidenced in the immigration policies of many capitalist countries. The USA, Canada and Australia have been countries of destination for very significant flows of migrants since 1850. Also many European countries (Germany, UK, France, Belgium and more recently Sweden) after the 2nd WW have welcome migrants from other European countries (Italy, Spain, Greece, Yugoslavia) and from their colonies. An important effect of increasing population either by high fertility rates or by immigration is that it keeps wages at a low level, at least lower than what it would have been without increasing population.

4.2 Less developed economies

In the less developed economies population is the source of labor supply to the growing industrial and service sectors and also to the agricultural sector including family farms and to small family business.

Very often this involves child labor which is criticized as an unethical and unproductive practice because it keeps children away from school.

The less developed countries are overpopulated. Only seven countries (India, China, Indonesia, Pakistan, Nigeria, Brazil and Bangladesh) count for about 50% of the world population, i.e. 3.95 billion of a total 8.19. The large family model that results in overpopulation of the country also serves as a social security plan for the old age. If a family has many children some will survive and will be able to take care of their parents in their old age. Of course, there are many reasons, economic, cultural, religious etc. that support the large family model.

The less developed countries are not just one category. Sometimes they are divided in two categories: emerging (or developing) and less developed. Other categories may be defined. For example the World Bank uses four categories on the basis of GDP: low, lower-middle, upper-middle and high income countries.

4.3 Comment

It is clear that there are many differences among countries in their historical background, culture, religion, resources and level of development. For our examination of the overpopulation problem it is necessary and useful to use the model of capitalism, which is the dominant social organization system today and ignore the specific characteristics it may have in any given country.

Thus we are going to briefly discuss the basic element of a democratic capitalist economy with two social classes, capital owners that possess the means of production and workers that possess their labor power. The country has a maximum of resources given by nature. The technology of the economy is embodied in the Cobb-Douglas production function. Capitalists maximize their profits; workers maximized their utility from consumption. Before we do that it is useful to present some data of the growth of GDP and Population in the last 65 years.

5. GDP and Population in the last 65 years.

The table below shows the world GDP in trillion of US$ in constant prices (2015), the size of world population in billion and per capita GDP in US$ for the beginning year of every decade since 1960.

Table 1

YEAR	GDP	Population (Pop)	GDP/Pop
1960	11.1	3.04	3651
1970	18.3	3.70	4946
1980	26.0	4.46	5830
1990	36.1	5.34	6760
2000	48.4	6.14	7816
2010	65.0	6.96	9339
2020	82.7	7.80	10603
2025	93.4	8.20	11390

Source: World Bank

The data on Table1 show that the world economy has done extremely well during the last 65 years. The world GDP increased by 745% and the world population by 166%. Per capita GDP increased by a little more than three times. The important factors in the growth of GDP are changes in technology and investment in human capital.

The enthusiasm caused by these data is greatly reduced by the negative effects of economic growth on the environment we have already mentioned in a previous section and by the great income inequality among countries and among people. In some countries (USA, Denmark, Germany, Australia etc.) per capita GDP is greater than 50 thousand US$ and in other countries (Indonesia, Mozambique, Jordan, Egypt etc.) is less than 5 thousand US$.[1] Also, poverty is not absent even in the most wealthy countries. In the USA the percent of poverty is 17.8, in Germany 14,8, in Canada 11.6, in Great Britten 18.6, in Sweden 17.1, etc.[2] These percentages correspond to millions of people.

The most impressive statistic for economic inequality is the distribution of wealth. According to the World Inequality Report Data Base of 2022 the poorest 50% of world population owns 2% of the global wealth, the middle 40% owns 22% and the upper (richest) 10% owns 76% of the global wealth.

Taking into consideration the environmental problems and the huge economic inequalities the sad conclusion is that capitalism is not exactly the paradise that economic growth has promised.

6. Grow or Die

Capitalism has often been characterized as a "Grow or Die" system. In reference to living organisms "grow or die" is a truism. In reference to individual firms in capitalism it may be true as in cases where a firm cannot grow for any reason and competitive firms grow and conquer the market. However, there are millions of small or middle size firms that do not grow and survive for decades. They may shut down for other reasons as e.g. death or heirs with different interests, but not because they do not grow.

The "Grow or Die" statement applied to capitalism as a system of social organization may be true under certain conditions and wrong under other conditions. This will be explained later on but let us now briefly say that if population continues to grow and resources are completely exhausted intensifying the environmental problems capitalism will end up in a messy and miserable situation with unknown future. However, if population stabilizes and begins to decline fast and capitalism reaches a steady-state position firms do not need to grow in order to survive.

The "Grow or Die" dictum may be taken as an indication of the instabilities of capitalism due to the behavior of capitalists who need to invest their profits but only when the profit rate is satisfactory. This behavior results in the phases of growth and recession of the trade cycle.

7. A Simple Model

A simple way to show the instability of the capitalist system is by means of Fig. 1. Macroeconomic equilibrium in the economy occurs when total demand is equal to total supply. Total demand is the sum of consumption (demand for consumption goods) and investment (demand for investment goods). The vertical axis of Fig. 1 measures the level of consumption and the level consumption plus

[1] World Bank Indicators, GDP per capita for 2021.
[2] World Population Review, Poverty rate by country, 2022.

investment. The horizontal axis measures the level of GDP. The 45^0 degree line is by definition the locus of points where *C+I=Y* or where total demand and total supply are equal, and the economy is in macroeconomic equilibrium.

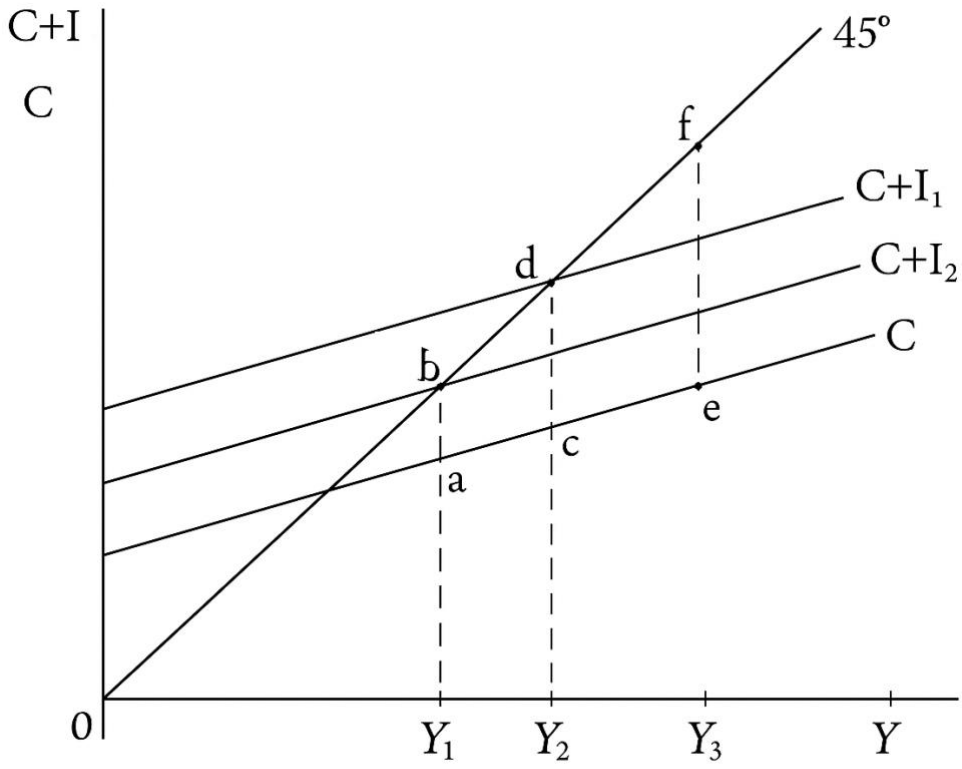

Fig.1.

For simplicity, consumption is assumed to depend only on *Y* and investment is independent of *Y*. In the period with consumption equal to aY_1 and investment equal to *ab* the equilibrium level of income is Y_1. Total demand (*C+I*) is equal to total supply (Y_1) as shown by the 45^0 degree line. But now the investment of this period (*ab*) becomes part of the capital stock of the economy and increases the productive capacity by the distance Y_1 Y_2. In the next period, equilibrium at Y_2 requires investment to increase to the level of *cd*. If that happens the productive capacity of the economy will increase to Y_3 and this requires a further increase of investment equal to the distance *ef.* If the increasing capacity of economy to supply goods does not meet sufficient demand the investors will be disappointed and income will decline and the economic will enter a period of recession. Thus the economy can either grow or decline. This is the essence of “Grow or Die” for every firm and for the economy as a whole.

Of course, new investment is not the only way to close the gap between total supply and total demand. Public works, exports, low interest rates and advances in technology, and methods to increase the propensity to consume are often used among others. One important factor that increases consumption, in the short run and in the long run, is the growth of population size. Increasing population means more consumers. When businessmen make plans for their future production they always take into consideration the size and the changing age structure of the population.

For the economy the ultimate limit to growth is the lack of resources, human and natural. However, there is an important difference between humans and nature. Human resources can increase in

numbers as the size of population increases whereas the resources of nature are limited by the size of the Earth. The inability and/or unwillingness to recognize this has led to the present dramatic condition of the planet and of human society.

8. Is the Earth Overpopulated?

In order to determine whether the Earth is underpopulated or overpopulated it is necessary to have an estimate of the optimal size of population. This, in turn, requires the selection of one or more criteria and a judgment about the extent the criteria are satisfied. The obvious candidate for such a criterion is the welfare of humans living at the present time and of the future generations. If we agree on the definition of welfare the next step is to make a judgment about the level of welfare that is deemed satisfactory.

In economics the term welfare means economics welfare, that is, the quantity of goods and services available to the individual and from which the individual derives utility. For a family the level of welfare is measured by the level of its income, and for the economy as a whole by gross domestic product per capita (GDP/pop). Of course, the GDP per capita may be misleading to some extent because it hides the differences among individuals and families. Even so, it is a useful measure of a country's welfare when comparisons are made.

Once the measure of welfare is accepted the next step is to determine what level of welfare is satisfactory. For example, if the measure is GDP per capita, the next step is to decide what level is satisfactory. Should we take the GDP/P of USA, of China, of India or of Luxemburg? On this issue everyone may have a different opinion. Depending on the economic and social environment, the wealth of the family, the tastes, the philosophy of life etc. there may be a big variety of opinions. Let us assume that a yearly income of 60000$ for a family of four (15000$ per capita) is sufficient for a satisfactory but not luxurious standard of life. The world GDP for 2024 was 110 trillion US$. Therefore, if everyone were to have 15000$ the world population should be 7.3 billion. The current world population is 8.2 billion. It follows that the Earth is overpopulated and the excess population is about one billion (8.2-7.3).

Of course, GDP is not all available for consumption. Part of the gross product is invested in order to replace the depreciated capital. The rate of capital depreciation is approximately 10-15% per year and thus the net world product is about 100 trillion US$. Dividing 100 trillion by 15 thousand gives a world population of 6.7 billion and strengthens the conclusion that the world is overpopulated.

Unfortunately, this is not the end of the discussion because the estimates of GDP ignore the existence of the environmental problems caused by the production of GDP. Therefore we need an estimate of GDP that minimizes the environmental problems or to put it differently a GDP that does not disturb the ecological equilibrium. One way to define ecological equilibrium is to say that the demand for resources should not exceed their supply. The demand for resources is approximated by the ecological footprint (EF) and the supply of resources by biocapacity (BC). The condition for ecological equilibrium is EF=BC. This means that the world production of commodities should use the resources of the Earth in such a way and to such an extent that the future generations will not be prevented from enjoying the same level of economic welfare. If we can find the level of world GDP at which ecological footprint is equal to biocapacity then we can make an estimate of the optimal population size.

9. Optimal World Population Size

We may define the optimal size of the world population as that size that satisfies two conditions: (a) total production should not violate the condition that ecological footprint should be equal to biocapacity (or less), and (b) the per capita product should be sufficient for everyone to have a comfortable but not luxurious life.

In 2022, the ecological footprint was 20589 million global hectares and the biocapacity was 12044 million global hectares. The world gross product of the same year was 102 trillion US$ (current prices).If the ecological footprint were to be equal to the biocapacity of same year the world gross product should be equal to 60 trillion {(12044/20589)x102}.This is a grosso modo calculation of the size of the world GDP that would be consistent with ecological equilibrium.[3]

As was pointed out in the previous section the per capita product that should be sufficient for comfortable life is difficult to estimate because there is no objective measure of what comfortable life is. Different people, if asked, would give different answers depending on their value system, their family income, their age, their country etc. Comfortable life is certainly related to the quantity and quality of goods and service we can enjoy with our income. Therefore, let us try three different levels of per capita GDP: (a) the per capita GDP of the European Union which in 2022 was approximately 38000 US$, (b) the per capita GDP of a country which is neither wealthy nor poor, i.e Greece with per capita GDP of 21000 US$ in 2022, and (c) the per capita GDP of Mexico of 10000 US& in 2022.

With these assumptions and with a world GDP of 60 trillion, i.e. consistent with ecological equilibrium, we can have three estimates of optimal population size. If we choose the per capita GDP of the European Union (38000 US$) the optimal population size is approximately 1.6 billion people (60 trillion/38000). If we choose the per capita GDP of Greece (21000 US$) the optimal population is approximately 2.9 billion people, and finally if we choose the per capita GDP of Mexico (10000 US$) the optimal population is approximately 6 billion. Thus, all three estimates of the optimal population are lower than the current population of 8.2 billion.

It is perhaps better instead of per capita GDP to use per family GDP because there are economies of size in a family and therefore life in a family of four is more comfortable than living alone. It is my experience that a yearly income of 84000 per family is more than enough for a comfortable life. The European Union per family GDP of 152000 US$ means extravagance and luxury. Therefore, under the present circumstances the optimal population size is 2.9 billion. It is interesting that others have reached the same conclusion using different methods (Pimentel et al. 1994, Daily et al. 1994, Dasgupta et al. 2017).

10. Yes, the Earth is Overpopulated

The conclusion to be drawn from the above calculations is clear: the Earth is heavily overpopulated. The present population of 8.2 billion is almost three times the optimal size of 2.9 billion. Even if ignore ecological equilibrium and the restriction of the ecological footprint to be equal to biocapacity (EF=BC), with the net world GDP equal to 100 trillion and a satisfactory per capita GDP of 21000 the world population should be only 4.8 billion. In brief, it seems undeniable that our planet is overpopulated.

[3] See Lianos and Pseiridis (2016).

However, there are people that believe the present size of the world population is not a problem and also people who prefer to ignore the significance of population as an important variable for the present state of the world economy and of human society. Businessmen, big and small, favor increasing population so that they have ample supply of labor, law wages and consumers for their products. Technology may substitute to some extent for labor but does not create sufficient demand for commodities. Growing population is the condition for the expansion of production.

Also, there are Marxists academics and politicians who prefer to ignore the problem of overpopulation and remain faithful to their master Karl Marx who was happy to severely criticize Malthus and simply say that each historical mode of production develops its own law of population. In the Marxian analysis the relevant variable is the industrial reserve army of the unemployed, not population.

11. How can the overpopulation problem be solved?

For our purposes solving the overpopulation problem simply means reducing the size of population to a substantial extent, i.e. to a size that allows the environmental problems to be adequately reduced and the excess of ecological footprint over biocapacity to be reduced or disappear.

Excluding causes of population reduction such as the bubonic plague, the epidemic known as “black death” that killed 50 million people between 1347-1351 and reduced the population of Europe by 50%, and the 2nd WW where approximately 80 million soldiers and civilians were killed, generally speaking, there are two ways to reduce the world population: (a) by persuasion and (b) by legal restriction.

To persuade couples to reduce the number of children they wish to have the following methods may be used and hope that they may have good results:

1. Information about the use of contraceptives at low prices.
2. Family planning.
3. General and relevant education of both men and women.
4. Economic motives, i.e. subsidies of various types to families with one child.
5. Supporting with various ways a culture of small family.
6. Moral persuasion and admonition.

The sad truth is that these methods have failed to deliver the expected results. The method of economic motives has been used by some countries to bring the opposite results, i.e. they subsidized families with three or more children. As a result the world population continues to grow by approximately eighty million people every year. It increased from 7.821 billion in 2021 to 8.162 in 2024, and it is expected to be 8.231 billion by the end of 2025.

There is a widely spread strong pro-natalist belief that big family increases the welfare of its members. The need of the capitalist economy for increasing labor to keep wages low and consumption high, and the religious teachings have cultivated pro-natalist ideas. Also, children serve as unpaid labor force in family business and more so in the agricultural sector. In countries with high child mortality and lack of social insurance system the big family is security for the old age. All these factors have led to the establishment of a pro-natalist attitude.

Legal restrictions are limitations imposed by the State restricting directly or indirectly the number of children per woman. Aristotle in his *Politics* and Thomas More in his *Utopia* suggest a minimum age for men and women before they can be married. In 1964, Kenneth Boulding suggested a plan with transferable birth license for every couple that has never been applied.[4] In modern times, China introduced the one child policy from 1979 to 2016 when two children per family were allowed.

Non-coercive policies may or may not produce the expected results but they do not create additional problems. Coercive policies may have the expected results but in addition to the ethical problem they create practical problems as well. In China, for example, the traditional preference for boys and the possibility of early diagnosis have resulted in millions of abortions and a large deficit of women. Also, the big fines on the family for having more than one child have resulted in many new births to remain unregistered. However, on the positive side, the Chinese claim that without the one child policy the population of China would be higher by 400 million people and also that the reduction of population was of critical importance for their economic development.

11.1 Should coercive policies be completely excluded?

It is true that coercive policies for population reduction seem offensive to human rights and may reduce the welfare of the individual affected by these policies. However, not all coercive measures are equally abusive and do not equally affect the individual and general welfare. We are subject to coercive measures every day. Even in the most democratic States we are coerced to follow general rules every day. We are forced to military service, to pay sales and income taxes every day and every year, to drive on one side of the road, to send our children to school, etc. We accept these rules because we realize than the benefits from following the rules exceeds the disutility involved. Also, if a coercive measure has general applicability people may not perceive it as binding their choices.[5]

Fifty five years ago Ehrlich and Holdren (1971) ended their essay with these words: “To ignore population today because the problem is a tough one is to commit ourselves to even gloomier prospects 20 years hence, when most of the ‘easy’ means to reduce per capita impact on the environment will have been exhausted. The desperate and repressive measures for population control which might be contemplated then are reason in themselves to proceed with foresight, alacrity and compassion today”. Unfortunately, in the years that followed, humanity proceeded neither with foresight nor with alacrity but rather with complete indifference with regard to the environment. Today, fifty five later, we are faced with an explosive situation. We are facing an extreme situation and we need to consider taking extreme measures.

In principle, coercive measures should be avoided but when a situation becomes critical they should be weighed against the alternatives. There is also an intergenerational justice issue involved in the present situation. By forcing people to have less children than they might want to have will certainly reduce their welfare. However, given the present situation and the finite resources, if they are allowed to have as many children as they want the welfare of the future generations will be greatly and negatively affected. In a real sense, the present generations by their numbers and their consumption habits are using resources that will be lost for the next generations. In essence, this is no different from the act of a thief who steals corn from the barn of his neighbor. Although freedom is a fundamental

[4] For a variation of Boulding’s plan see Lianos(2018).

[5] It is interesting to mention that an opinion poll published by the Pew Research Center (located in Washington, DC) in August 2008 said that the one-child policy of China was overwhelmingly accepted by the Chinese public with a 76% approval.

right, the thief is imprisoned. One might say that the comparison is not valid because the now alive people have no intention of stealing resources or harming the natural environment, and therefore there is no deceit. This defense of the present generations is not convincing because it is difficult now to find people who are unaware of the critical situation to which the Earth has been brought because of overpopulation and wasteful living standards.

In the history of the world, social problems have been solved or were limited to manageable proportion by command and by incentives (economic or otherwise) and by a combination of both.[6] In principle, coercive measures should be avoided but since the world situation is critical and nothing else seems to have worked in reducing fast enough the size of population the idea of imposing restriction on the number of children per family should be seriously examined.

11.2 Country differences

With respect to population size the countries of the world can be separated in three groups: countries which are not overpopulated, those which are overpopulated with declining population, i.e. with total fertility rate below 2.1 births per woman, and countries which are overpopulated with growing population, i.e. with total fertility rate greater than 2.1.

According to one study[7] there are six countries which can be said not to be overpopulated. These are Russia, Australia, USA, Canada, Ukraine and Argentina.

The countries with overpopulation but with low fertility rates are the countries of Europe with a TFR of 1.41, of Northern America with 1.59 TFR and the countries of Latin America and the Caribbean with 1.78 TFR.

The countries with overpopulation and high total fertility rates are the countries of Africa with a TFR of 3.96, the countries of Oceania with a TFR of 2.13 with the exception of Australia and New Zealand with TFR 1.64, and the countries of Central Asia (TFR 3.14), Western Asia (TFR 2.52) and Southern Asia (TFR 2.18). China and India have declining population with TFR 1.06 and 194, respectively.

The differences of total fertility rates among countries has created a dissension between North and South, that is, between countries with low fertility and countries with high fertility, and those who suggest measures for reducing fertility in Africa and Asia are accused of racism. This is only one of the reasons that make overpopulation a wicked problem.

12. Models for solving the environmental problems with no reference to population.

There are at least four theories (often presented as ideas or models) that promise, if applied, to solve the environmental problems. These are: ecomodernism, green growth, de-growth and ecosocialism.

12.1 Ecomodernism

[6] A recent case in point is the command and incentives used for dealing with the covid pandemic.
[7] Lianos and Pseiridis (2016)

Ecomodernists believe that there are no limits to growth and the environmental problems will disappear if the energy needed for the production of products is solar or nuclear energy. They also believe in absolute decoupling, i.e. that production can increase and at the same time the negative effects of production to the environment can decline. In their manifesto ecomodernists make clear that their views do not imply any political ideology. This is in contrast to the other views we present next.

It is certainly correct to say that termination of fossil fuels use in production would be a great improvement but carbon dioxide is not the only cause of environmental problems. Also, it is clearly wrong to believe that there are no limits to growth in a planet with limited resources. So far the optimism of ecomodernists is not supported by the facts. For example, there is no evidence of absolute decoupling.

From their belief that there are no limits to growth it follows that ecomodernists do not see problems coming from the increasing world population.

12.2 Green growth (Green economy)

Green growth and green economy mean the same thing: economic growth with efficient use of natural resources and production methods that minimize pollution will reduce the negative environmental impacts so that natural hazards and disasters are avoided. With green growth development will be sustainable and the future generations will enjoy a level of welfare at least as high as the present one.

Green growth can be the result of policies that promote investment (private and public) in green technologies, by removing subsidies for fossil fuels, by pricing negative externalities, by supporting the development of markets for green products , by better organization of cities (e.g. transportation and green buildings) etc.

It is true that the world economy is growing in terms of constant US$ but the growth is not green. During the last twenty five years CO2 emissions from fossil fuels increased from 25.3 billion metric tons in 2000 to 37.4 in 2024. It is interesting that during the last decade emissions per capita did not increase which means that the increase in the total came from increasing population. Also, during the twentieth century the global surface temperature increased by roughly 0.6^0 C (1.1^0 F), and during the twenty first century, from 2000 to 2024, temperature increased by 0.47^0 C (0.84^0 F), which means the global warming is accelerating.

The failure of the green growth model may be attributed to the failure of governments to apply the policies suggested by the model because of the resistance of organized groups opposed to these changes. Also, the green growth supporters, like the ecomodernists, seem to ignore that the resources of the planet are limited and GDP cannot grow indefinitely. As a consequence, they also do not recognize the size of world population as a source of problems.

12.3 De-growth

De-growth is theory and at the same time a political program that has two parts: first, it criticizes capitalism and second it suggests a different type of social organization. The de-growth critic of capitalism centers on the idea that capitalism as a “grow or die” system has an end because the limited natural resources set a limit to growth. De-growth advocates suggest reduction of GDP and of

consumption. To avoid unemployment that will follow GDP reduction they suggest job guarantee and work sharing schemes and also a basic income for all citizens.

In their own words "…degrowth signifies also a desired direction, one in which societies will use fewer natural resources and will organize and live differently than today. Sharing, simplicity, conviviality, care and the commons are primary significations of what this society might look like." The purpose is the "transition to convivial societies who live simply, in common and with less".[8] In brief, this is how de-growth advocates see social change.

All this sounds nice but it is not clear how these societies will be organized. There are references to eco-communities, cooperatives and community currencies but this does provide enough information with regard to the mechanisms that would allow these societies to function. De-growth has neither a well specified economic nor political model. It has no rules about income distribution or about political decision making.

In regard to the question of population degrowthers favor the idea of a voluntary restriction of procreation as a collective act of self-limitation, and reject any top-down policies for population control.[9] Obviously, this position includes the danger of economic disaster if GDP declines and population does not reduce or grows at the same time.

12.4 Eco-socialism

Eco-socialists believe that the environmental problems are the result of the perpetual circle of production and consumption within the framework of the capitalist system. Capitalism and a sustainable future for the Earth do not go together. Operating under the pressure of the forces described by the "grow or die" moto capitalists pursue maximum profits without distinction between quantity and quality of the products they produce, by creating artificial and insignificant needs by means of huge expenses for advertising, and by ignoring the negative externalities of their production. In short, capitalism cannot offer a solution to the problems we now face.

According to eco-socialists the policies suggested by eco-modernists or by green growth and green economy may help but they offer no real solution because they cannot change the nature of capitalism.

According to eco-socialists the socialist system of the future will have three basic characteristics: (a) the political system will be democratic socialism, (b) a basic element of the economic policies will be full employment and equality and (c) decisions for major issues will be taken on the basis of popular vote.

As in all variations of socialism, eco-socialists have no place for population in their program. It seems that Marx's severe critique of Malthus makes it an ideological sin to even mention the size of population as a variable that should be examined for its effects on the economy. For socialists population is not a matter of concern neither in capitalism nor in socialism.

12.5 Comments

[8] Quotations are from G. D' Alisa, F. Demaria and G. Kallis (2015).
[9] Martinez-Alier. J. 2015. Neo-Malthusians in D' Alisa et al. (eds) A vocabulary for a new era, ch.27.

Environmental problems are scientifically and empirically documented. It is also undeniable that these problems stem from the increasing production of products and from exceeding the limits set by the planet we live on. The increase in production is due to the increase in the world population and the improvement of the standard of living worldwide as measured by per capita product. In the improvement of the standard of living, production technology was and remains crucial. Regardless of one's political ideology, the above cannot be disputed.

Over the past sixty years or so, the volume of production worldwide has increased to a degree that exceeds the limits set by the Earth's resources, resulting in the emergence of environmental problems that are constantly worsening and creating fears of irreversibility. Despite the central role of the growing population in production and, by extension, in the creation of environmental problems, supporters of capitalism as well as supporters of socialism refuse to correlate the size of the world's population with the severe problems we face today. Neoliberals and socialists place their hopes for improving the environment in technology. Socialists also believe that the fall of capitalism will automatically bring the solution to the problems. The omission by supporters of green growth and green economy to consider population size is completely understandable because capitalism can survive without a growing population, but it cannot grow. With a stable population, growth will come only from technological improvements. Like neoliberals, ecosocialists ignore the problem of overpopulation. They may believe that there is no such problem, or that, if there is, it will disappear when socialism takes hold. They may also fear that a program of population reduction will not be acceptable by the working classes.

13. A model with constant population: Steady-State Economy

The model of the steady state economy (SSE) is based on the idea that the resources of the Earth are limited and therefore economic growth cannot continue forever. The environmental crisis is evidence that the planetary limit have been crossed and therefore total production, i.e. GDP, should be reduced to sustainable proportions, but reduction of GDP without reduction of population would be disastrous and would results in more poverty and social unrest. Thus, GDP and population should decline together.

The steady-state economy has the following characteristics:

- There is private property of the means of production, i.e. of land and produced capital.
- The working and the coordination of the economy is based on the mechanism of the free markets.
- Population is constant at some chosen sufficient level.
- Production of goods and services is constant at some chosen sufficient level. Population and production are co-determined.
- Institutions are established to make sure that population and production stay at the chosen level. For that purpose some have suggested family planning, transferable birth license (Boulding, 1964), an international market for limited birth licenses per family (Lianos 2018), monetary benefits for small size families etc. To reduce persisting economic inequalities, minimum and maximum limits to personal income are recommended and also maximum limits to personal wealth.

Two questions arise immediately: how is the chosen population size determined, and how is the chosen production of goods and services determined? As we have already explained in a previous

section the level of production should be that which corresponds to ecological equilibrium, and the size of population should be that which corresponds to a comfortable standard of life. Of course, it is not easy to simultaneously determine the right population size and the right level of production, but generally speaking it is possible to find combinations of population and production that would be widely acceptable.

In a steady state economy the role of technology is very important because it can raise the efficiency of production and increase per capita product without disturbing ecological equilibrium.

Herman Daly (1991) has argued that what is needed now is moral growth rather than economic growth. Modern societies are conditioned to believe that economic growth is the ultimate goal. They rarely consider whether their aims are morally sound or rooted in meaningful values, prioritizing size over quality. In other words, economic growth often occurs without corresponding moral development. While economic growth relies on efficiency, moral growth depends on the pursuit of higher values.

One issue occasionally discussed in the literature concerns the social organization of the steady state economy. The central question is whether it can function as a capitalist economy or whether a socialist economy is necessary. Daly argued that the SSE is neither capitalist nor socialist but something different (Daly, 2010). Richard Smith states that since capitalism cannot exist without constantly expanding markets, a steady state economy cannot therefore be a capitalist economy (Smith, 2010), while in contrast Philip Lawn believes the opposite(Lawn, 2011). My own opinion is that the crucial characteristic of a SSE is ecological balance and stable population and therefore a SSE can be either capitalist or socialist (Lianos, 2021).

Finally, it should be said that reduction of population will not automatically solve the existing economic and social problems of the world but it is certain that the solution of the problems would be easier.

14. Why is overpopulation a wicked problem?

Overpopulation is a wicked problem for the following specific reasons:

- While solving environmental problems is urgent, population reduction will be slow. Even with one child per family, it will take decades to significantly reduce the population.
- In many countries of the world there is (in many cases) a justified bias in favor of large families. Changing this family pattern requires a lot of effort and great expense.
- The governments of various countries do not seem to be interested in encouraging reduction of population. On the contrary, in some countries efforts are being made to increase the birth rate.
- Political parties and political movements and the majority of those who are concerned about the state of the environment and climate change do not recognize overpopulation as a problem and rely on either technology or a change in the social system, that is, the fall of capitalism, to solve the problems.
- For the world as a whole the number of births per woman was 2.24 in 2024. There are 101 countries with more than 2.1 births per woman and all these countries are in Africa, Asia and South America. Because of this some people argue that efforts to limit the world population imply discrimination against peoples of these countries.

- There's another reason why overpopulation is a wicked problem. Not only is it big but it is projected to grow to 9.7 billion by 2050. This means adding 64 million people every year. Still worse, another 1.5 billion is projected to be added between 2050 and 2100 so that the global population will reach 11.3 billion at the end of this century.

If overpopulation is a serious wicked problem for which no solution is on sight the question that naturally comes to mind is "What next?" Before we can say something about the future it is necessary and useful to look at some data.

15. The prince and the pauper

It was shown on Table 1 that between 1970 and 2020 the world GDP has increased from 18.3 trillion to 82.7. This is a remarkable growth that has given to many the opportunity to become very rich while at the same time billions of people are left behind and live in poverty. According to a World Bank report[10] in 2022 there were in the world 3574 million people were poor at 6.85 $ (in PPP) per day. Among them there were 1783 million people at 3.65 $ per day and 713 million at 2.15 $ per day.

The world population in 2022 was 7.99 billion. Thus, 45% (3.574/7.99) of the world population are really very poor people. It is interesting to ask what will happen to the 1.6 billion people that will be added to the world population[11] in the next 25 years. In general, one may say that the answer depends on the opportunities they might have for good education, good health and good employment. However, there is nothing to guarantee that these opportunities will be available. An unpleasant feeling arises when one thinks that the resources of the earth are limited and fully utilized. Arable land, for example, is limited and in short supply if one considers that forests are burned to convert them into arable land.

According to FAO[12] "Land and water systems are managing to meet the demand placed upon them by an increasingly complex global food system driven by unrelenting population growth…There is little room for expanding the area of productive land…High levels of land and water use are stretching the productive capacity of land and water systems to the limit, and severely degrading land and environmental services in the process".

In 2021, when the FAO report was published, the world population size was7.9 billion. In 2050 it is predicted to be 9.7 billion increased by 20%. Will it be possible for the already fully utilized resources to increase food production by 20%? The message from FAO is clear: In the next two decades it will not be easy, perhaps impossible, to feed the population which is predicted to reach 9.7 billion.

16. What is next?

The increase of the world population by about two billion in a global economy that is fully utilizing its resources and already has 3.6 billion hungry people means only one thing: social unrest and by extension political instability and upheavals from which no one knows what will emerge and what changes will come. However, the consequences will not be the same for all countries. Some will lose a lot, others a little, and some will gain from the global turmoil.

[10] Poverty, prosperity and Planet report, 2024.
[11] To be exact the addition of 1.6 million is the new born minus the dead in the 2025-2050 period.
[12] FAO,2021, p.58

The question that logically arises is this: are the powerful of this world, presidents, governors, generals, major economic actors, etc. blind? Do they not see the coming turmoil or do they simply think that it does not concern them and that they can only profit from the misery of the many?

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