
SOME THEORIES OF ENVIRONMENTAL SUSTAINABILITY

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Abstract

The paper deals with the arguments with which the neoclassical have approached the problems of sustainability, giving life to that branch of political economy that studies the problems related to the use of natural resources and environmental externalities.

Environmental Economics studies, insights and additions that bind knowledge economy with the application of economic theory to environmental problems seek to provide in this paper an comprehensive framework and as exhaustive as possible of speculations around the concept of sustainability. We highlight, also, how environmental aspects are processed within a defined perimeter of economic instruments to defend the neoclassical orthodoxy in front of the market failure and to support the undertaking of a path of development that is sustainable.

Keywords: *growth models, neoclassical approach, scarcity of resources, sustainability*

1. The neoclassical sustainability of the growth

The neoclassical vision of economics (Cozzi T., Zamagni S., 1989, p. 733) on which are based the neo-liberal policies has as its stated goal the maximization of welfare (Varian Hal R., 1990, p. 505), identified with the willingness to offer to the widest number of people greater opportunities for consumption. The neoclassical theory of growth (or development) considers the increase of production and, therefore, of disposable income in higher levels of consumption as a solution to poverty for progress and development. The neoclassical approach is based on the assumption that the capacity for self regulation (Tietenberg T., 2006, p. 8) of free markets and not bound, and technological advances are able to ensure capacity of substitutions endless between the various forms of capital, mitigating so, the constraints arising from the possible scarcity of resources, allow sustainable growth, a level of consumption does not decreasing over time.

Within this theoretical framework, an essential point of reference is the Solow model (Solow R.M., 1956). Economic development (as economic

growth) is identified with a level of consumption does not decreasing over time and its sustainability takes the form of constraints on the use of resources according to the rule of Hartwick-Solow (Solow R.M., 1974).

The rule provides that if royalty or user cost (Tietenberg T., 2006, p. 60) generated by the extraction, according to an efficient plan, of non-renewable resources are fully saved and reinvested in renewable capital, the level of resulting investment would be sufficient to provide a value of the capital stock (economic) at least constant over time, making it possible product levels and consumption of non-decreasing (ie, the sustainability of development). Thus becomes almost irrelevant the fact that is limited the availability of natural resources also non-renewable. In fact, it is possible that consumption levels remain non-decreasing with exhaustible resources that decrease (Musu I., 2003, p. 156), if you do so that the capital stock remains unchanged at least, guaranteeing in any period an adequate investment in man-made capital.

The crucial assumption underlying these models is the perfect substitutability between natural capital (including both renewable and non-renewable resources) and other forms of capital (both physical capital and human capital man-made) (Hartwick J., 1977).

In the thought of Solow, capital has diminishing marginal productivity, which implies that at some point the growth stop, in other words, the per capita consumption remains constant. Only the technical progress, taken as exogenous to the model (Fischer S., Dornbush R., 1995, p.350), may counterbalance this trend allowing that the function of production increases and the growth does not stop. The endogenous growth models, even if they share the basic philosophy of Solow, removing both the assumptions of capital productivity decreasing, and exogeneity of technical progress. The removal of these assumptions leads both to deny that in the future we have the process of convergence between the growth rates of the various countries, and to predict the tendency to continue expanding: there are no implicit mechanisms of stop (it was, in fact, the diminishing marginal productivity of capital, which has led to the arrest of growth unless it was offset by exogenous technical progress).

2. Revision of the neoclassical view

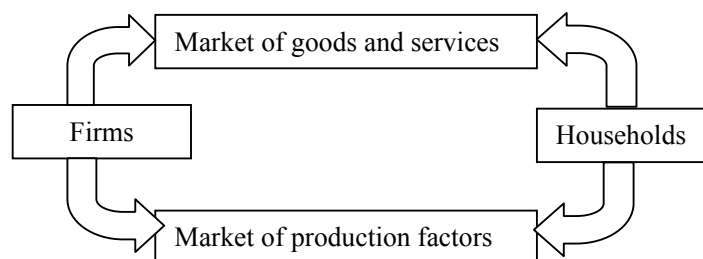
The neoclassical approach offers, for an economic system considered as closed and linear, a model of continuous growth. The endogenous growth models, even if they share the basic philosophy of Solow, removing both the assumptions of decreasing productivity of capital and exogeneity of technical progress. The removal of these assumptions leads both to deny that in the future we have the process of convergence between the growth rates of the

various countries, and to predict the tendency to continue expanding: there are no implicit mechanisms of stop (it was, in fact, the diminishing marginal productivity of capital, which has led to the arrest of growth unless it was offset by exogenous technical progress). In addition, the heightened interest for the market equilibrium, believed to be able to ensure economic efficiency (Tietenberg T., 2006, p. 27) and the maximization of well-being, has obscured almost completely the study of long-term, eliminating thus any “pessimistic” consideration, typical of classical studies (Cozzi T., Zamagni S., 1989, p. 35 et seq.). For classical economists like Malthus, Ricardo, Mill, Marx, very clear the economic activity was conditioned by the environment, they believed in the role of the market as a indispensable basis for economic growth. The market would have, in fact, distributed merits and efficiency generating wealth for all. An optimistic vision well evident in studies of Adam Smith and many other great economists of the late 1700s-early 1800s.

This theoretical conclusion should not draw of deception, however, the confidence in the market by the classics classical stood only in a short-term context. In the long term the economy would still be found in stationary state coinciding with the mere subsistence level by all. The reason for this negative view was full awareness of natural resources as scarce and limited entity, or as a finite set of elements. Economic growth in the long term would have reached the limit of the set of natural resources, causing a brake on growth. The point of view “pessimistic” of the classics in the long term is well expressed in the studies of Thomas Malthus and David Ricardo. Malthus and Ricardo watched the constraints imposed by the environment in terms of scarcity of fertile land for cultivation.

The economic system: a closed system and linear

Figure 1



Source: our elaboration on Turner K., Pearce W., Bateman I., p.28

The traditional neoclassical economists considering the economic system as a closed system and linear (Turner K., Pearce W., Bateman I., p.28) (Fig. 1) do not take into account, unlike the classical, the hypothesis of a binding connection between the economic system and the environment. The environment has only instrumental value, there is to be shaped and resources to be used in the production function must adapt to meet the market equilibrium. The unlimited exploitation of natural resources is commonly accepted as the price to pay for fuelling economic growth and provide employment.

The low attention to long-term considerations, driven by excessive confidence in the Pareto efficiency of the market mechanism and to technological has prevented from considering natural resources such as a limit of growth. The market has always solved the scarcity through price changes, encouraging research and technological progress. The blind trust towards the market and technological progress favored investment policies without taking into account environmental aspects. An optimistic view, the neoclassical, that during the twentieth century led to the construction of large environmental destruction. It should be noted the particular historical context in which they lived neoclassical economists. The world was full of positive stimuli, progress marching rhythms ever higher while they were still far from seeing the negative effects that would produce. The world was still just an empty territory to be conquered according to a logic of "Far West" (Boulding K., 1966).

The neoclassical growth model it worked until the company had agricultural structures or pre-industrial (Ravera O., 1998, p. 39), with population density and low productions and disseminated; the prevailing culture, especially in agricultural areas, was to reuse and recycling of material resources; process residues economic activities were taken up and disposed of in the natural cycle of self-purification and there was a substantial balance between man, production, consumption and the environment. With the growth of the population, its concentration in urban areas of increasing size, with the increase in production and consumption, it has been a strong use of natural resources and high production of waste, causing rupture of the initial equilibrium and the cycle that occurred spontaneously in nature.

The optimistic view of the economy growing that characterized most of the 20th century began to enter a crisis in the '60s, when, with the first phenomenon of smog, scarcity and pollution, the idea that economic growth driven by progress was unlimited collided with the evidence of the environmental consequences, of the pollution and the impact on human health (Carson R., 1962; Commoner B., 1971).

3. The economic system as a subsystem open and circular

The excessive trust towards perfectly substitutable resources through market mechanisms and technological progress, led to the general assumption neoclassical to clash with the finite reality of the natural environment and to become aware that human communities are part of a well-wider, which also includes those, so to say, non-human (Daly H., Cobb J., 1990).

From this point of view, the traditional economy, the “real” (ie, the economic system made up of institutions, activities intended to produce and exchange goods and services using scarce resources to be allocated more efficiently among alternative uses to satisfy human needs (Turner K., Pearce W., Bateman I., 2003, p.27.) should be considered only as a part of a larger economy, the so-called “extended”, which supports the entire global fabric of life: a kind of economy that takes into account the interdependent relationship between the environment and the economy.

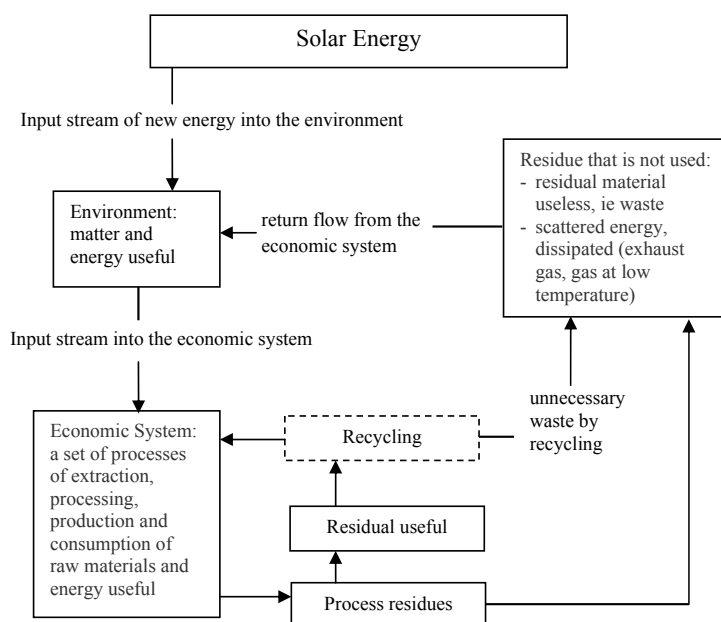
In the years ‘60s, therefore, you begin to recognize that there is a relationship of interdependence between economics and environment (Georgescu R., 1971) and to see the real economy as a subsystem open and circular which can work only with the support of its ecological foundation. It is, however, a system in continuous growth inserted within a larger system but finite, non-increasing, closed at the entrance of new matter, open only to solar energy. These aspects, taken over by Daly last twenty years, had previously been supervised by Boulding (Boulding K., 1966) in his famous essay “The Economics of the Coming Spaceship Earth”.

In this paper are described the necessary changes to economic science that from “cowboy economy”, as pioneers in a world yet to conquer, in which the limited resources is not perceived, must work towards “spaceman” economy. Spaceship, of course, is a circular system where you need to concentrate our efforts in the recycling of materials, waste reduction, maintenance of exhaustible sources of energy and in the exploitation of renewable energy sources such as solar (Turner K., Pearce W., Bateman I., 2003, p.20).

The synthesis work of Boulding is formalized in the materials balance models with interrelationships between the economic system and the environment (Fig. 2).

**The economic system as a subsystem open and circular.
A materials balance model**

Figure 2



Source: our elaboration

In this model the economic system is open and circular, characterized by a set of extraction processes of matter and energy from the environment, then basic processing, production and consumption. Each of these processes makes at the end of its residues by now no longer usable in the environment, in its receptor bodies. Such accounting shall be governed by the first and second law of thermodynamics (Musu, 2003, p.14) that highlight the environmental constraints that the system must be taken into account.

4. The modern neoclassical

When in the 60's the obvious consequences of the logic of "cowboy economy" rather than by "spaceman" fuelled the debate on the environmental and social limits to economic growth, in the literature were highlighting two positions: the neo-Malthusian and neoclassical resulting from revision of its nucleus. It was, in fact, revised its hard core, were called into question the critical points, like the blind trust towards the market, the logic of equilibrium

prices, the potential of technological progress, the ability of the system to ensure maximum growth. In a nutshell, were accepted the main criticism of the neoclassical theory pure to save its own orthodoxy.

New study elements became part of the theories, just think to the dynamic efficiency review that includes the “E” variable (Turner K., Pearce W., Bateman I., 2003, p. 106), recognized the importance of the externalities, the costs of pollution and the need to internalize “external costs” in the private sector. These aspects put in crisis the market further and its ability to achieve optimal balance, so that there was talk of “market failure” and the need to address these public intervention.

The decision-making rule of Cost-Benefit Analysis model, functional to an intertemporal allocation of resources is socially efficient (dynamic efficiency), must be corrected to include any Benefits and/or Costs that may result from environmental changes that the project, or the policy measure under evaluation imply. In order therefore that a project or a policy measure is adopted it is necessary that the algebraic sum of present values of non-environmental benefits, non-environmental costs and net value of environmental change is positive.

5. The neo-Malthusians

The close relationship that links population growth, economic growth, use of resources and capacity to assimilate, led many economists to argue that the only sustainable path development was characterized by economic growth and population anything, the deliberate creation of a situation of “steady state”, before arriving at a situation of absolute physical scarcity of resources (Daly H., 1977). Since the publication of Daly gave noted that its main merit was that it would bring the attention on the limits of nature and subordination to critical review of the concept of indefinite neoclassical growth. In subsequent years the author focuses his analysis on the differences between growth and development and on the purely quantitative character of the first one than qualitative of second. Proposing this distinction comes to talk of “development without growth” as the only possible path of development that can take into account the biophysical limits that nature imposes on human activities (hence the proposal for exceeding the GDP because it is considered merely indicator of growth and not of the development). In this perspective, Daly speaks of steady state economy to be achieved through: i. birth control (a kind of permits market of birth), ii. maintaining the level of entropy below the limits of regeneration systems; iii. redistribution of constant stock of wealth within a constant population. The most famous expression of this inescapable conclusion, is bound up in what is defined as the “Malthusian point of view” (Malthus, 1909), contained in “The Limits to

Growth” (Meadows D.L., Randers J., Beherens W., 1972 and 1981). In 1968 Italian Economist Aurelio Peccei created a cultural center named Club of Rome whose first report published in 1972 was just “The Limits of Growth”.

The report data were derived using a technique known as “systems dynamics” and the construction of a computer model to simulate the likely outcomes of the global economy in the future. The study concluded that, although the known reserves of mineral and energy were multiplied by five (due to new discoveries and technologies), the exponential nature of growth would lead to the depletion of much of resources within less than a hundred years at rates to annual growth of consumption. This would lead to the collapse of the foundation of the entire modern society, if there were no changes in important physical - economic - social relationships that had traditionally guided the world development. In the document drawn up by Meadows and other Boston scholars is clearly expressed the neo-Malthusian position (Turner K., Pearce W., Bateman I., 2003, p. 228), the conviction of the impossibility of continuing economic growth at infinity in limited environmental conditions due to the inevitable progressive exhaustion of resources of the planet. The same viewpoint was also more recent accession (Daly, Cobb, 1990).

Despite the general theoretical consensus, there were criticisms of the setting Meadows. The catastrophic conclusions contained in “The Limits of Growth” were considered excessive and false by modern neoclassical (Tietenberg, 2006, p. 8) on the basis of a series of arguments:

- Technological progress increases the productivity of resources and thus to ensure that available resources will last longer and longer. Therefore, it is believed that the economy will evolve in such a way that economic growth reduces more and more its environmental effects.

- Technological progress capable of making more efficient use of resources and reduce the creation of harmful residues, then steps in on the materials balance to achieve this separation between the economic and the environment.

- Given the laws of thermodynamics, a complete separation is impossible. The economic activity will always use a certain amount of resources, but due to higher productivity, could decrease the quantity used more and more per unit of product, the impact on the environment may gradually decline.

- New reserves are discovered all the time: the idea of a “fixed amount” is an illusion.

- We are able to keep under control the amount of slag reintroduced into the environment by recycling the materials and withdrawing the gases before they leave the economic system.

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- We can replace polluting technologies with less dangerous ones.
 - For market laws of supply and demand, when a resource becomes scarce raises the price of supply and demand contracts, that is, inducing individuals to use more conservative (incentive for conservation) and move to other more accessible (incentives for substitution).
 - Even if the population is growing in absolute terms, in many countries the rate of growth is shrinking because people realize the benefits of a small generic family (Turner K., Pearce W., Bateman I., 2003, p. 54).

Final remarks

The topic analyzed is very timely and has played in recent years considerable importance as a result of the increasing attention given to environmental protection by national and supranational law, in view of the considerable social costs resulting from environmental degradation and the role of “tax shift” which are known as Pigovian taxes. From the optimistic view of the neoclassical theory of growth, in order to deepen the relationship between the economic system and the environmental system, poses as a basis the assumption of capacity of self regulation of free markets and unconstrained. It is, therefore, of self-limiting process generated by a negative feedback on a problem of lack of resources. Any decrease in the availability of a resource results in an increase in price which will lead to the gradual abandonment of its use, at least in those productions where it may be replaced by another at a lower cost. In this way, the demand drops to levels compatible with the availability of the resource in question.

Simultaneously, the scarcity of the resource triggers a process of technological research to find new technical solutions for the attainment of the same production targets, using different materials. Both reactions (increased price and striving for alternative solution) tend to reduce the magnitude of the initial problem. Among the scholars who deepen and pose critics to marginalist approach (Georgescu R., 1971) suggest that economic science should take greater account of the laws of nature by demonstrating real irreversibility of materials and energy implications of production processes. Rejects the depiction of the economic process as separate from the environment in which it takes place, suggesting the physical connection with the terrestrial system subjected to gradual increase of entropy. The environment is a finite set. The flow of matter/energy that the system takes from the environment must eventually return, overall, to the environment and then returns in the form of useless residues generated by economic processes. Waste that will be deposited in receiving bodies because there is no way their absolute destruction. In fact, the part that exceeds the capacity of assimilation leads to a build-up that causes an

alteration, deterioration, destruction of environmental resources (environmental damage), the so-called “physical pollution”. These environmental damage will most likely produce negative effects on third parties, effects that economists define “economic pollution”, ie welfare losses not compensated (environmental externalities). Describing the relationship of interdependence through the materials balance, it is argued how the economy is a subset of the environment and the environment represents the natural limit to any economic initiative, or the limitations imposed by the laws of thermodynamics. An economic and social assessment widespread and that the global equilibrium State should be designed so that the needs of each person on earth are met, and each has equal opportunity to realize their human potential.

References

- Boulding, K. E., 1966. *The Economics of the Coming Spaceship Earth*, in H. Jarrett (ed.), *Environmental Quality in a Growing Economy*, Johns Hopkins University Press, Baltimore.
- Common M. and Perrings C., 1992. Towards an Ecological Economics of Sustainability, *Ecological Economics* 6, 7–34.
- Cozzi T., Zamagni S., 1989. *Economia Politica*, Il Mulino, Bologna.
- Daly H.E., 1991. *Steady-State Economics*, Earthscan, London.
- Daly H.E., Cobb J., 1990. *For the Common Good*, Beacon Press, Boston.
- Daly, H.E., 1990. *Toward Some Operational Principles of Sustainable Development*. *Ecological economics* 2, 1-6.
- Fischer S., Dornbush R., 1995. *Macroeconomia*, Il Mulino, Bologna.
- Georgescu R., 1971. *The Entropy Law and the Economic Process*, Cambridge: Harvard University Press
- Hartwick J., 1977. Intergenerational Equity and the Investing of Rents from Exhaustible Resources, *American Economic Review*, 67, December.
- Malthus T.R., 1798. *An essay on the principle of population*, Johnson, Londra.
- Meadows H.D., Meadows D.L., Randers J., Behrens W., 1972. *I limiti dello sviluppo*, Mondadori, Milano.
- Musu I., 2003. *Introduzione all'Economia dell'Ambiente*, Il Mulino, Bologna.
- Ravera O., 1998. *La Questione Ambientale alle Porte del Terzo Millennio*, Gregoriana libreria editrice, Padova.
- Solow R.M., 1974. *Intergenerational Equity and exhaustible Resources*, *Review of Economic Studies*, Symposium, pp. 29-46.
- Solow R.M., 1956. *A Contribution to the Theory of Economic Growth*, *Quarterly Journal of Economics*, Vol. 70, No. 1. (Feb.), pp. 65-94, published by The MIT Press.
- Solow R.M., 1986. *On the Intergenerational Allocation of Natural Resources*, *Scandinavian Journal of Economics*, Wiley Blackwell, vol. 88(1), pages 141-49.
- Tietenberg T., 2006. *Economia dell'Ambiente*, McGraw-Hill, Milano.
- Turner R.K., Pearce D.W., Bateman I., 2003. *Economia Ambientale*, Il Mulino, Bologna.
- Varian Hal R., 1990. *Microeconomia*, Cafoscarina, Venezia.