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THE IMPACT OF ETHICS ON GROWTH AND DEVELOPMENT: ENVIRONMENTAL ECONOMICS VERSUS ECOLOGICAL ECONOMICS?*

EL IMPACTO DE LA ÉTICA SOBRE EL CRECIMIENTO Y EL DESARROLLO: ¿ECONOMÍA AMBIENTAL VERSUS ECONOMÍA ECOLÓGICA?

Renzo A. Jiménez Sotelo[†]

Summary

In this paper, it is argued that many of the prescriptions of economic policy to promote growth and achieve development tend to be divergent because they use different moral assessment systems at heart. This happens because the economics cannot define welfare without resorting to any particular ethic. The different ethics chosen explains the relationship between free market speech and the environmental economics and the evolution of the critique made by the ecological economics. This in turn reveals the differences between the concepts of growth and development: all profit needs consumption expenditure, but all welfare does not. Even, paradoxically, promoting indicators of sustained growth should not be a necessary condition for achieving sustainable development.

JEL Classification: A13, B41, D63, D70, H40, I38, Q01

Keywords: science, sustained growth, sustainable development, equity, moral philosophy, free market, economic thought, economic policy.

Resumen

En este documento se argumenta que muchas de las prescripciones de política económica para promover el crecimiento y lograr el desarrollo tienden a ser divergentes porque usan en el fondo diferentes sistemas de valoración moral. Esto sucede porque la economía no puede definir el bienestar sin recurrir a una ética particular. La diferente ética elegida explica la relación entre el discurso del libre mercado y la economía ambiental y la evolución de la crítica hecha por la economía ecológica. Esto a su vez revela las diferencias entre los conceptos de crecimiento y desarrollo: todo lucro necesita gasto de consumo, pero todo bienestar no. Incluso, paradójicamente, promover indicadores de crecimiento sostenido no tendría por qué ser una condición necesaria para lograr un desarrollo sostenible.

Clasificación JEL: A13, B41, D63, D70, H40, I38, Q01

Claves: ciencia, crecimiento sostenido, desarrollo sostenible, equidad, filosofía moral, libre mercado, pensamiento económico, política económica.

* This is the version directly translated into English by the same author from the Castilian (Spanish) version of the article sent before its publication in <https://doi.org/10.15381/pc.v23i1.15103>. This essay formalizes some aspects of the author's critical reflection on the theoretical framework that ultimately underlies the prioritization of economic policy in Peru, as a result of his participation in the prospective strategic planning process; study trips to Brazil, Mexico, Spain, Chile and New Zealand; experience as head of investor relations at the Ministry of Economy and Finance between 2011 and 2016 and as a PhD student. However, all analyses, opinions and conclusions expressed, as well as any remaining errors, are the sole responsibility of the author.

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1. Introduction

In the opinion of many, the current scale of global economic activity increasingly threatens the sustainability of development (Delgado, Ambrosio, and Riccioli 2014). Others, however, argue with increasing vehemence that it is necessary to continue increasing the pace of economic growth in order to alleviate poverty, even at the cost of a larger fiscal deficit and deterioration in the financial solvency of the state, such as that observed in Peru especially since 2015 *“with the aim of ensuring sustained growth [...] above 5.0% annually”* (MEF 2017, p. 8). Are the indicators being used adequate? What role do the different visions of environmental economics and ecological economics play in this discussion? Can science confirm which of the two approaches is more appropriate for achieving development?

Some say that behind environmental economics is the fundamentalist theory that the free market, adjusted for externalities, can always create the most efficient allocation of resources, including the most appropriate level of environmental protection for all, a theory that in reality would only serve the profit interests of large corporations (Ackerman and Gallagher 2000). In contrast, others say that ecological economics really only seeks to set harmful environmental goals for business through a political process of public deliberation that has little to do with economic science, positions that, for example, have led the United States to announce in mid-2017 its withdrawal from the Paris Agreement (Greshko 2017). Are the development visions of these economies definitively irreconcilable or could they be complementary at some point?

For many economists, the current dominant economic thought does not take ethical considerations into account in its analyses, nor should it. This position assumes that *“ethics is a philosophical concept and it is even considered that it can be ideological [...] which motivates most economists to flee from [the] value judgments, considering that they are not really scientific and that escape the purpose of economic science”* (Berzosa 2013, p. 273-274). Therefore, according to this position, as long as they can be efficient in the Pareto sense, no attention should be paid to whether economic activities generate greater inequality and pollution, as in the case of the social and environmental conflicts caused by mining in Colombia, Mexico and Peru (Saade 2013), because doing so would involve issuing value judgments about how a society should develop.

However, even if there were a general consensus that it is necessary to reduce levels of exploitation and pollution in order to preserve environmental sustainability, how would it be possible to close the usual monetary gap between the willingness to pay of the affected people and the higher amount that would actually be needed to achieve this? Could the sustainability of the solution be left exclusively to the interaction of sovereign individual preferences translated into monetary terms in the market as the only incentives? If these problems of natural resource depletion and environmental degradation were local, regional or global, would the solutions be the same?

In an attempt to outline answers to these concerns, the remainder of the document is organized into seven further sections. The second section briefly reviews the often forgotten and different role played by the environment in the evolution of traditional economic thought. The third section recalls the reasons why economics, as we understand it today, cannot be based exclusively on science, but inevitably also depends on the type of ethics or moral assessment that is chosen to be behind it. The fourth section explains how the divergences in policy prescription between environmental economics and ecological economics arise from their different moral assessments of how to in-

crease welfare. The fifth section reviews the relationship between free market discourse and environmental economics. In the sixth section, the evolution of the criticism expressed by ecological economics is analyzed. The seventh section reviews the conceptual differences between growth and development, as well as the different interpretations of sustainability. In the last section, the conclusions are summarized as final reflections.

2. The environment in economics

What role has economics given to the environment over the last three centuries? As is known, based on the ideas of Adam Smith (1723-1790), classical economics held that the best way to achieve the welfare of society was to leave individuals free to pursue their own selfish interests. However, these ideas, which prevailed between 1776 and 1870, took the unoptimistic view that the prospects for improving living standards in the long term were slim. This view was based on the assumption, especially of Thomas Malthus (1766-1834), that the amount of arable land was fixed and that the size of the population had a tendency to increase. Thus, the environment imposed limits on the expansion of economic activity and therefore, as David Ricardo (1772-1823) argued, the long-term tendency would be for workers' wages to fall to their subsistence level.

According to Common and Stiglitz (2008, p. 3-6), the failure of this prediction, considering that Western European economies maintained simultaneous population growth and an increase in their standards of living since the beginning of the 19th century, is typically explained by the fact that classical economists did not take into account technological progress, which began to change rapidly after the first industrial revolution in 1780-1840. However, they also did not take into account that the amount of relevant arable land did not remain fixed, since food was increasingly imported from the newly colonized lands in America and Australasia, lands to which, in addition, these countries exported part of their population.

As a result, the dominant economic thought began to evolve from the end of the 19th century towards what years later would be called neoclassical economics, which largely assumes that living standards can increase indefinitely with adequate economic management through the optimal use of resources (Vergara and Ortiz 2016, p. 22). Thus, the dominant objective of economic policy became economic growth, since, among other things, this would offer the possibility of alleviating poverty in a relatively simple way.

In fact, the growth theories developed by neoclassical economics until the early 1970s did not even include the environment. It was barely considered just another 'doctrine', as Schumpeter mentioned:

Like other 'theories', the doctrine of the environment can be extreme to the point where it becomes manifest nonsense [...] The doctrine of the environment and [the doctrine] of races accommodate so many things that not a single one nor other can make its presumed contribution to our understanding of social processes: its supporters and its enemies join together to prevent it (1954[1971], p. 492).

However, during the 1960s, concern had already grown about pollution caused by economic development in the most industrialized countries, since *"it is accepted and questioned that economic growth has been achieved at the cost of environmental deterioration"* (Pearce and Turner 1995, cited in Hartley 2008, p. 56). According to Rodríguez-Becerra and Espinoza (2002, p. 30): *"In industrialized countries, concern reached its highest point in the early 1970s due to the serious damage caused by acid rain, pesticides and industrial effluents, [which] motivated the holding of the Stockholm Conference on the Human Environment"* in June 1972, just three months after the publication

of the report requested by the Club of Rome in 1970 to a group of researchers from the Massachusetts Institute of Technology (Meadows 1972), which was based on the simulation of population growth, economic activity and the ecological footprint over 100 years. Not only did the environmental issue achieve a higher priority on state agendas, but the introduction of the vision of environmental management from the states began. For this reason, environmental legislation and public institutions were put in place and the first national environmental policies were issued in Latin America and the Caribbean, pioneered by Brazil, Mexico, Colombia and Venezuela.

Consequently, it was not until the early 1970s, especially after the 1973 oil crisis, that neoclassical economics began to show a renewed interest in the environment and gave rise to two specializations: environmental economics and resource economics. The former was concerned primarily with what the economy puts into the environment and with problems of environmental pollution, while the latter was concerned with what the economy takes out of the environment and with problems associated with the use of natural resources. According to Aguilera and Alcántara (1993, p. 11-14) and Valverde and Almagro (2011, p. 7-9), neoclassical economics had originally focused on two issues: the problem of externalities, based on Pigou's (1920[1946]) ideas on welfare economics and Coase's (1960[1981]) ideas on the problem of social cost, and the problem of the optimal intergenerational allocation of exhaustible resources, based on Hotelling's (1931[1987]) ideas on the relationship between resource depletion and interest rates and Solow's (1974[1975]) ideas on the relationship between the market value of resource deposits and the prospects for their exploitation and sale. Thus, the solution proposed by neoclassical economics, generally referred to as environmental economics, was based on solving the problem of the monetary valuation of environmental effects in general.

On the other hand, it had become increasingly clear to many scientists that human activity had harmful effects on the environment, which in turn had harmful economic consequences for future generations, making it inevitable to focus on the study of the interdependence between the economy and the environment, since all economic activity takes place within the latter. Therefore, the creation of the International Society for Ecological Economics in 1989 was based on the conviction of scholars from different disciplines that their study required a transdisciplinary and not just an interdisciplinary approach, since there were problems and phenomena of ecological economics that were beyond economics and ecology per se. Ecological economics is therefore based "*on the idea that the proper study of 'the way in which human beings subsist' must include the study of the relationships between human animals [sic] and their 'environment, organic and inorganic'*" (Common and Stagl 2008, p. 4).

3. Science and ethics in economics

Could economic studies ignore moral assessments issued by ethics and rely solely on science? As detailed in any introductory textbook, in any study one must distinguish between the positive and normative approaches. A positive analysis is purely descriptive, with facts and explanations, while a normative analysis includes prescriptive elements, that is, recommendations about what should be and what should not be. Thus, in principle, it would always be possible to determine the truth or falsity of positive statements so that all parties in dispute would be satisfied. In contrast, normative statements cannot be classified as true or false, so no experiment could resolve a difference of opinion.

And since science is "*a set of knowledge [...] systematically structured from which general principles and laws with predictive capacity and experimental verifiability are deduced*" (RAE 2014), it can classify positive statements into the categories of true or

false. Even, based on the established scientific knowledge that one fact always follows another, conditional advice can be established: if you want B to occur, you should do A because it has been experimentally proven that B always follows A. However, in economics, not all positive statements have been able to be classified as true or false because not all are susceptible to being the object of controlled experiments, which, thus defined, would imply that only a part of economics is 'scientific' (Schumpeter 1954[1971], p. 41).

Furthermore, since economic analysis requires abstractions, abstractions need to be defined, and any definition will require normative elements. Thus, in order to choose between different alternatives, the definition of normative criteria is required that apply as an abstraction of the tastes and preferences that will be considered relevant. Therefore, in the analysis of policy choices, all normative criteria involved are ultimately considered in terms of their foundation in some ethical position (Common and Stagl 2008, p. 6-8).

Ethics is *"the part of philosophy that deals with good and the foundation of its values"* (RAE 2014), it deals with the study of the moral principles or norms that should govern human conduct and hence its relationship with any normative approach. *"It does not matter in the case that the justification of a system of moral ideas is extramoral (for example, that it is based on metaphysics or theology); the decisive thing is that there is a rational explanation of the ideas or norms adopted"* (Ferrater 1964, p. 582), that is, ethics can also be atheistic. For this reason, Sedláček (2014, p. 21-23) states that *"all economics is, ultimately, [an] economics of good and evil [...] economics not only describes the world, but, generally, it is about how the world should be [...] in real life, economics is not a positive science"*. So, how do you decide whether or not an action is morally correct, whether it is good or bad? There are two large groups of schools of ethical thought in this regard, the deontological schools and the consequentialist or teleological ones.

According to Villarán (2012), deontological ethics maintains that what matters is duty for duty's sake, based on what Kant (1781[2006]) argued regarding the existence of a universal moral law inscribed in the reason for being of every human being, regardless of the place and time in which each one lives. This law *"orders to treat others and oneself always at the same time as an end and never merely as a means or instrument, regardless of the consequences and therefore, at the cost of one's own happiness if necessary"*. That is, in deontological theories of ethics what morally matters is the agent and his intention, regardless of the consequences that may arise from his actions: the end does not justify the means.

In contrast, for consequentialist ethics the moral correctness of an action is determined only by its consequences, whether on the agent, as in moral egoism, or on others, as in altruism, or on the majority, as in utilitarianism. Utilitarianism was born with Bentham (1789[2008]), who considered that *"man is moved by the principle of the greatest happiness: this is the criterion of all his actions, both private and public, both of individual morality and of political or social legislation."* An action would be correct if, independently of its intrinsic nature, it is useful or beneficial for the purpose of the greatest possible happiness: increasing pleasure and decreasing pain, in net aggregate terms. The most important follower was Mill (1863[1984]), who defined it as *"the creed that accepts as the foundation of morality 'utility' or the 'principle of greatest happiness', which maintains that actions are good insofar as they tend to promote happiness and bad insofar as they tend to produce the opposite of happiness. By 'happiness' is meant pleasure and absence of pain; by 'unhappiness', pain and deprivation of pleasure"* (Mill 2002, p. 50, cited in Sánchez-Migallón 2012).

According to Villarán (2012), “a fundamental detail to take into account is that, as Mill himself establishes, utilitarianism does not imply selfishness: there will be circumstances in which, to promote the greatest amount of happiness among the greatest number of people, one must give up one's own happiness”. According to Sánchez-Migallón (2012), utilitarianism later evolved into the so-called preference utilitarianism, as understood by Harsanyi (1955) and Singer (1980[1984]), that is, to the discussion of whether we should speak not so much of an ‘act utilitarianism’ but of a ‘rule utilitarianism’, where an action is correct if it complies with a norm that, in general, will entail better consequences than any other relevant norm, and to the discussion of whether the happiness that is sought to be produced by the correct action is the greatest total net sum of happiness or, on the contrary, the best average happiness for the majority, since an increase in total welfare can simultaneously or subsequently lead to a decrease in average welfare.

The important point of ethics for economics is how the term ‘welfare’ is used to represent the total utility of individuals, since, according to utilitarianism, morally correct actions would be those that increase welfare. Therefore, if utilitarianism turns out to be the ethical basis of economics, as there are different currents of utilitarianism, there would be different ethics or systems of moral evaluations that must be considered to increase ‘welfare’ in economics.

4. The effect of different ethics in economics

How to distinguish the different systems of moral valuation that are behind ecological economics and neoclassical (environmental) economics to define how to increase welfare? According to Common and Stagl (2008, p. 9-13), these variants can be distinguished according to the answers to three key questions: (i) whose utility counts?, (ii) how is utility measured?, and (iii) how are the utilities of individuals aggregated to obtain welfare?

In both ecological and neoclassical economics, the answer to the first question is that the utility of all human beings counts. This is despite the fact that some utilitarian philosophers believe that all affected ‘sentient beings’ should be included, since utility defines ‘happiness’ as pleasure and absence of pain and unhappiness as pain and absence of pleasure, in general. In any case, since normative economics is anthropocentric, the ‘utilities’ of non-human sentient beings are not taken into account when calculating welfare. In both economies, only producible human pain and pleasure are taken into account, even if it were caused by the animal suffering of an action or by the harm caused to a non-sentient entity, but if no human pain or pleasure is generated, it is not taken into account in the measurement.

However, in the answer to the second question there are differences. In neoclassical economics each individual is the sole judge who decides whether his utility has increased or decreased, a doctrine widely known in microeconomics as ‘consumer sovereignty’, and consequently there is no ethical basis for trying to modify his preferences, since it is assumed that each individual has all the relevant information. In contrast, in ecological economics individual preferences are not ignored, but they are not considered sovereign nor are they the only source of normative criteria, that is, there is an ethical basis for comparing, evaluating and trying to modify them, because sustainability requirements are a source of normative criteria (rule utilitarianism). According to Fuente (2008, p.76), “the satisfaction of the needs of present generations without detriment to future generations has become the most conventional meaning and aspiration involved in any definition of sustainability”.

And there are also differences in the answer to the third question of utilitarianism. In neoclassical economics, the simple sum of individual utilities represents the welfare of society, that is, the relative positions of those who are better off compared to those who are worse off are not taken into account, as if everyone were equally well off or bad off or as if all their marginal utilities were almost equivalent. In this way, for neoclassicals, an action that makes those who are better off better off more and those who are worse off worse off more would be morally correct, that is, if the simple sum of improvements and worsenings produces a positive net effect on the 'well-being' thus calculated. This would explain why there is increasingly more 'concern' about policies that promote 'Pareto efficiency', plain and simple. For example, as Sen and Giménez (2000, p. 78) point out: "a situation can be [...] Pareto-optimal – that is, no one can increase [his] utility or freedom [further] without reducing the utility or freedom of another – and yet exhibit large inequalities." In contrast, ecological economics is more inclined to advocate the use of weights that favor the relatively worse off, since the simple sum is also a weighted aggregation, but with the choice of units as weights and the choice of weights itself also an ethical issue. Thus, when alternative policies must be judged, there is greater consideration for 'fairness' in ecological economics.

5. The environmental economics and the free market

Is free market fundamentalism often behind environmental economics? According to Ackerman and Gallagher (2000), by the 1990s the public debate on environmental policy had already been transformed to focus primarily on the idea of market-based mechanisms. A near consensus had emerged in policy circles towards the theoretically more efficient and less costly environmental taxes, tradable emission permits and other market incentives. At the same time, the common sense approach that had been implemented since the 1970s, through laws and regulations that, recognizing the environmental problems generated, forced polluters to stop polluting, began to be stigmatized with the label of 'command and control'.

Therefore, as observed in Gómez-Gómez (1994), environmental projects constituted one of the most promising areas of application of cost-benefit analysis, so that not only was a more efficient and equitable decision-making process ensured, but it also made it possible to safeguard the welfare of the present and future generations. For this reason, international and local organizations had shown increasing interest in disseminating the best way to include the environmental impact of development projects in political decision-making. The key, supposedly, was to express in a single currency all the social advantages and disadvantages, using the methods of avoided or incurred costs, travel costs, hedonic prices, or contingent valuation, although four problems of cost-benefit analysis were already recognized when dealing with environmental 'goods and services': the possibility of irreversibility, the calculation of the non-use values of environmental goods, uncertainty about the future consequences of current decisions and the problem of choosing the social discount rate that allows achieving sustainable development.

For some debaters, however, the environment was ultimately just an afterthought, as the most ardent free marketers really sought to roll back all government programs, laws, and regulations affecting business and property. For these 'believers', the market was the answer no matter what the question, and even irreversible climate change would be just another private business opportunity: "Free market environmentalism suggests two paths to confront global warming. The first takes changes in the earth's temperature as given and asks whether individuals have [profit] incentives to respond with innovative solutions. The second focuses on the evolution of property rights in the atmosphere" (Anderson and Leal 1991, p. 163, cited in Ackerman and Gallagher 2000, p. 3).

In other words, there was no balanced perspective, one that understood what the market can do most effectively and appropriately, and what it cannot. The free market, as an economic policy goal, fails because there are many public purposes that cannot be achieved by prices and their markets alone. As Azqueta et al. (2007) recognize, presenting their text on environmental problems from the perspective of environmental economics: “good management of biospheric resources is greatly facilitated if there is an economic valuation of them, even when one is aware that economic value is, by definition, only a part of their total value”. That is, it is admitted that economic value is not the total value, but it is tacitly assumed that decision-making considering only that part, on average, would be basically the same as if the total value were known.

In this regard, Ackerman and Gallagher (2000, p. 6-12) pointed out that there were at least five general reasons why neoclassical economic policies based solely on the market fail to achieve the most basic environmental objectives:

- a) *Major irreversible damage must be prevented:* In neoclassical economics, free competition is implicitly based on a sequence of repeated trial and error, where there is no major social cost or damage caused by a few failed trials between producers and consumers. However, this interaction is not viable in certain high-impact issues; just think of the consequences that experimental learning would have in the treatment of radioactive waste, the irreplaceable destruction of wildlife and ecosystems, the extinction of species, or the emission of toxic and carcinogenic contamination.
- b) *Distant future outcomes are important:* The typical discount as a standard method of comparison between costs and benefits that occur at different points in time may be indispensable for the short term, but it is not essential for the long term. Firstly, because the preferences of the individuals who decide are not necessarily going to be the same as those of future generations who will later suffer the consequences. And secondly, because, by definition, the compound interest rate liquefies the present value of the future. According to Azqueta (2002), what in 200 years will be worth 17,000 or in 300 years would be worth 2,000,000, at an annual rate of 5%, today is ‘only’ worth 1. In other words, a problem of intergenerational equity occurs when the tyranny of the present or contempt for the future predominates.
- c) *Many environmental values are not goods that can be valued:* The neoclassical view of the market as a paradigm assumes that environmental damages can be well measured in monetary terms like any other tradable basic good, even though they do not have a market. Thus, contingent valuation surveys do not always produce reasonably meaningful responses. Moreover, three tons of pollutants at critical levels can have a much greater impact than three times the impact of a single ton of pollutant. At the extreme, assigning monetary values to goods such as human life, endangered species, or unique natural habitats faces ethical, philosophical, and religious objections.
- d) *Volatile market prices can cause a misallocation of resources:* If prices change too quickly, yesterday's profitable investment decisions may no longer be profitable today. In fact, they may have become wasteful decisions. Market volatility actually sends mixed signals about the value of environmental policies and initiatives. Hence, daily stock trading is not exactly an example of market efficiency: given high industry-specific sunk costs, there is a limit to the speed at which individuals and firms can respond to price signals. The state can therefore improve matters by imposing reasonable speed limits and establishing a sustainable pace of change.
- e) *If it ain't broke, it doesn't need to be fixed:* In any case, market incentives are not always superior to old environmental controls. For example, protecting public

health, providing urban infrastructure, and monitoring emissions, among others, are areas where traditional regulatory or government spending approaches remain more effective than market-based policies. The state can provide public goods, minimize transaction costs, and create an environment of transparent equity, while the market maximizes consumer choice and creates incentives to reduce costs. And since no one typically wants new taxes, regulation with rules that reduce or prohibit certain emissions may be more politically viable, even if market incentives might be more efficient.

According to Sandel (2013, p. 14), the era of market triumphalism began in the early 1980s, when Ronald Reagan and Margaret Thatcher proclaimed their belief that markets, not governments, held the key to prosperity and freedom, and continued into the 1990s, when the liberalism of Bill Clinton and Tony Blair consolidated faith in markets as a fundamental means to achieve the common good. According to Gómez-Baggethum and Muradian (2015, p. 6), “market environmentalism has acquired a great influence on the agendas of environmental science and policy in recent years” and has played a decisive role in the framework in which biodiversity loss and ecosystem functions decline occur, as well as in the solutions that are proposed. For Sandel (2013, p. 15), “the intrusion of markets, and of market-oriented thinking, (even) into aspects of life traditionally governed by non-market rules, is one of the most significant facts of our times”.

It remains clear, therefore, that there are arguments to show that getting everything ‘priced right’, as suggested by neoclassical economics with its generalised prescription of ‘market incentives’, is often a narrow or meaningless goal, as society may intentionally and appropriately choose to get ‘priced wrong’ to achieve its most important goals (Ackerman and Gallagher 2000, p. 6). As Azqueta et al. (2007) acknowledge, from the perspective of environmental economics, referring to the problems of climate change due to the greenhouse effect, the thinning of the ozone layer, the alteration of the nitrogen cycle, the loss of biological diversity, air pollution, water pollution and access to water, soil pollution and loss (erosion, deforestation and desertification), waste generation, marine pollution and overexploitation of fishing resources, and noise pollution, “the main environmental problems, although they constitute the raw material on which the reasoning of economic analysis is intended to be applied, are not the object of study of the economist as such” (2007, p. 2-16).

6. The ecological economics and the free market

Could ecological economics be complementary to neoclassical economics or will it always be antagonistic? Could their controversies be resolved? According to Correa (2006, p. 15), throughout history several thinkers questioned the principles and physical foundations of neoclassical economics as soon as it was born, but the theoretical reflections of authors such as Sergei Podolinsky (1850-1891), who wanted to study the economy as a system of energy conversion and its impact on entropy, and Frederick Soddy (1877-1956), who argued that the principles and ethics of human law and conventions cannot go against the laws of thermodynamics, were not taken into account.

However, Nicholas Georgescu-Roegen (1906-1994) took up these concepts and stated that “the economy is an open system that extracts energy and usable matter from the environment and returns it in the form of unusable waste” (Correa 2006, p. 26), so entropy is the measure of its qualitative difference. Furthermore, since growth faces physical barriers and its accounting has not usually taken into account the depletion of natural resources and the degradation of the environment, according to Correa:

Poor countries will not be able to escape poverty simply by turning the wheels of their circular diagram more [but] they will have to redistribute their wealth, control

their population, rethink the pace and manner of using their resources, [otherwise] a country could exhaust its mines, cut down its forests, erode its soils and wipe out wildlife and aquatic life, while its national accounts register growth and prosperity (2006, p. 28).

According to Georgescu-Roegen himself (1996[1971], p. 391-443), the key to the controversy with neoclassical economics lies in the fact that:

- i. It considers that the economic process has certain natural limits, as if it were an isolated system;
- ii. It assumes that economics is a theoretical science, as if every economic phenomenon were derived from a handful of elementary principles known by intuition and that, therefore, it would be deductive par excellence and valid in any institutional setting;
- iii. He argues that the economy only has to operate with arithmomorphic models, with an excessive cult of mathematical formalization, for example, as if the adoption of previously analyzed economic policies did not also require the art of governing;
- iv. It considers that there are no cultural propensities that affect the economic actions of man, as if man were not too complicated to be totally accessible to mathematics and could disappear, once the means at his disposal have been determined and an approximation of his tastes obtained;
- v. It assumes rational behavior and a rational society, without admitting that there is a normative criterion, whose results of 'irrationality' could be different if the normative criterion changes; and
- vi. It does not understand the role that tradition has for man, which causes the institutions or means with which each man acts within his own community to be transmitted from generation to generation, since he is not born with an endosomatic code capable of regulating his biological life and his social activity like social insects, so that the economy cannot be only behaviourist, as are the physical sciences, since man himself is an instrument in the cognitive process.

Therefore, unlike environmental economics, which limits its field of study to that which, while being of direct use to humans, is, in addition to being scarce, appropriable, valuable and producible, ecological economics seeks to develop methods of analysis and management that allow achieving the 'sustainability of the global system' because "*ecological economics considers that the entire biosphere and resources can be both scarce and in some way (more or less immediately) useful*" (Naredo 1994, p. 377-378, cited in Díaz 2011). According to Georgescu-Roegen:

"The law of entropy does not help an economist to say exactly what will happen tomorrow, next year, or in a few years [...] its effects manifest themselves only by accumulation over long periods: thousands of years of sheep herding carried out before the exhaustion of the soil in the Eurasian steppes gave rise to the great migration (1996[1971], p. 64-65).

For Díaz (2011, p. 6-8), this larger and more complex object of study forces ecological economics to adopt a systemic and evolutionary approach because biological and socioeconomic systems are open and living systems that exchange matter and energy with their environment and, in parallel, self-organize and seek to maintain themselves while evolving towards increasingly complex forms. However, as they are within a closed global system, planet Earth, these systems compete for finite material resources, interact and, therefore, co-evolve, which highlights three key issues:

- a) *Physical irreversibility*: Unlike neoclassical economics, which focuses on subjective scarcity, ecological economics is concerned with objective scarcity, which corresponds to physical reality, such as the scarcity of natural resources. The incorporation of the second law of thermodynamics and its effects on systems, both isolated and open, lead to considering the problems of irreversibility in terms of what is physically and economically possible to do and what is not (Faber et al. 1996, p. 116, cited in Díaz 2011) and to dealing also with the uncertainty inherent in the evolution of open systems.
- b) *System resilience*: For ecological economics, one of the important characteristics of the dynamics of the economic-ecological system is the existence of multiple locally stable equilibria, but separated by unstable equilibria. Thus, the transition from one stable equilibrium to another can entail profound changes, which do not have to be continuous or gradual, so resilience is a requirement for sustainability if it is defined as “a measure of the disturbance that can be absorbed before the system crosses an unstable manifold and converges to another equilibrium state” (Perrings 1996, p. 243, cited in Díaz 2011). Thus, the system’s resilience thresholds are important for maintaining a stable equilibrium: crossing them makes calculations of costs and benefits impossible because these are not reflected in market prices.
- c) *The sustainable physical scale*: Given the above approaches, the main prescription of ecological economics is that the economy in general should operate within the assimilation and regeneration capacities of the global ecosystem, for which the sustainable (optimal) physical scale of the economic system in relation to the global ecosystem must be determined, which in turn leads to considering three basic objectives of ecological economics: efficient allocation, equitable distribution and a sustainable scale (Daly and Cobb 1993, p. 61, cited in Díaz 2011). In this sense, the market, despite its flaws, which must be corrected, only allows the first objective to be achieved, so it will be necessary to first impose limits on the total consumption of resources and then allow market prices to adjust to the new conditions.

7. Sustained growth and sustainable development

Therefore, in economics, would it be enough to talk about economic growth to achieve economic development? Is sustained growth the same as sustainable development? According to Furtado (1979, p. 5-6), although economic growth had emerged to measure an aspect of development, “*this ambiguity produced a whole problem that caused economists themselves to differentiate development from growth and to attribute to the former a scope that necessarily transformed it into an interdisciplinary subject despite adding the qualifier of economic*”. The roots of the idea of development are found in three currents of European thought of the 18th century: one assimilated to the Enlightenment and its vision of history as a progressive march towards the rational, another related to the idea of the accumulation of wealth as a promise of well-being and another linked to the idea that the geographical expansion of civilization implied providing superior forms of life to others. Thus, even though at the end of the Second World War the reflection on development had as a starting point the awareness of the economic backwardness of certain countries, reflected in the levels of consumption and its dispersion among the population, social indicators such as infant mortality, incidence of diseases, literacy level and others were later added, to approximate the level of access to the forms of life generated by industrial civilization (Furtado 1979, p. 19).

For development to be (also) durable or sustainable, according to Brundtland (1987, p. 23), it is necessary to meet the needs of present generations without compromising the ability to meet the needs of future generations. This in turn implies that the concept includes the limitations imposed on environmental resources by the current state of

technology, social organization and the capacity of the biosphere to absorb the effects of human activities. Therefore, technology and social organization could be ordered and improved to open the way to a new era of economic growth that meets the basic needs of all and gives them the opportunity to fulfill their aspirations for a better life. Thus, economic and social considerations had to be combined with ecological ones. Therefore, in the 1980s and 1990s, various methodologies and indicators were developed to measure the sustainability of development.

According to Foladori (1999, pp. 23-25), the two main methodologies for measuring the economic part are that of green net national product (Repetto et al. 1989; Hartwick 1990), to include the assessment of the effect of the depreciation of natural resources and pollution, and that of genuine savings (Pearce and Atkinson 1993), to measure the extent to which a country is investing the profits derived from the extraction (depreciation) of natural resources in non-natural capital produced or built. The two main methodologies for measuring the social part are the index of sustainable economic welfare (Daly and Cobb 1989) and the genuine progress indicator (Cobb et al. 1995). And the three main methodologies for measuring the ecological part are that of net primary productivity (Vitousek et al. 1986), based on carrying capacity; the ecological footprint (Rees and Wackernagel 1994), comparing the degree of satisfaction of consumption demands within the same territory; and the environmental space (Schmidt-Bleck 1992), measuring equity in the use of resources with respect to the world average.

However, even accepting the addition of social and ecological dimensions to the economic ones, according to Díaz (2011), controversy re-emerges when determining the operational criteria for the implementation of sustainable development: what balance of capital should present generations bequeath to future generations, so that they also maintain the same possibilities of satisfying their own needs and developing, and what composition this capital can have, classified between natural capital and built capital. The answers will depend on the different conceptions that exist of the categories 'development' and 'sustainability'.

According to Van Kooten and Bulte (2000), cited in Correa (2006, p. 32), the central axis of the debate between neoclassical economics and ecological economics is centered on the assumption of perfect substitutability between natural capital (natural resources) and constructed capital (reproducible resources). The interpretation known as 'weak sustainability' has its roots in neoclassical economics and assumes that the elasticity of substitution between the two is high or infinite, so that what is important is the total capital, so as not to reduce consumption (Pearce and Turner 1995, cited in Correa 2006, p. 36) as an indicator of 'well-being'. In this way, there would be no reason to worry, because if natural resources become scarce, their prices will increase, which will lead to their conservation and replacement or technological change. In any case, for total capital to be maintained, it would be enough for all income derived from natural resources to be invested in accumulating constructed capital.

In contrast, the interpretation called 'strong sustainability', proposed by ecological economics, maintains that all functions of natural resources should be considered, and not only the function of providing inputs for productive economic activity, since there is no productive process that allows the reproduction of natural resources or their environmental functions such as regulation of the carbon cycle, hydrological regulation, water supply, soil formation or erosion control. That is, the role of market prices and technological change are not everything. Thus, not only manufactured or constructed capital should be maintained, but natural capital as well, independently, since they are basically complementary and marginally substitutes (Correa 2006, p. 36-38). In summary, the controversy could be summarized in that the sustainability of the neoclassical economy is understood as the durability of capital, flow and monetary income (profit) derived from sustained growth in consumption, while the sustainability of the ecological econ-

omy is synonymous with economic-ecological durability with a vision of equity related to current and future generations (Cadenas 2009, p. 2).

Therefore, it is not surprising that many of the economic policy decisions adopted under the concept of weak sustainability actually turn out to be *“condescending, lax and in many cases permissive in the face of the most complex environmental problems, where even environmental policy seems to give more priority to economic objectives than to environmental objectives”* (Vergara and Ortiz 2016, p. 47). It is enough to remember that in 1992 more than 1,500 scientists, including 99 Nobel laureates, had already warned about the process of collision generated by humanity in the natural world, due to its unsustainability and the absence of public policies to transform the development model that identifies progress with the domination of nature through the development of science and technology based on the market mechanism (Bermejo 2005, p. 360).

8. Final thoughts

The role of science in these two visions of economics is very important, but not sufficient, which is why both end up resorting to normative criteria based on an ethical position. Thus, the main basis of the differences in the prescription of economic policy between ecological economics and environmental economics rests on their different ethics or moral philosophy. Their moral differences explain, for example, their strong antagonism on what sustainable development should be and how it should be achieved.

Even in the unlikely event that development had the economic aspect as its only dimension, eliminating the social and ecological dimensions, indicators of sustained growth would not always imply greater development. For example, sustained growth of the gross domestic product might not actually be such if, in addition to the depreciation of built capital and net payments to foreigners, the costs of depletion (quantity) and degradation (quality) of natural capital (water, forest, hydrobiological, mining resources, etc.) were also included in a net ecological national product.

Nevertheless, it is possible to identify a complementarity if each school recognizes what each one studies better than the other. Environmental economics does better in the short term with goods and services that have moderately stable markets, that are consumed by the same generation and that do not produce risks of irreversible damage or face ethical, philosophical or religious objections. On the other hand, ecological economics has a much more prospective, strategic and equitable vision, especially for the interactions of different generations of human beings with their environment.

Therefore, the economic policy reasoning that simplistically assumes and demands indicators of sustained growth as a necessary condition for achieving sustainable development is audaciously fallacious. Growth and equity are not conditional. Furthermore, in the unlikely event that there were zero depletion and degradation of natural resources, a growth in the gross domestic product could only represent the growth of net income generated by foreigners, which in Peru was equivalent to between 4% and 9% in 2004-2017. In fact, if the exploitation of natural resources is carried out mainly by foreigners, it would be practically impossible to ensure that the country is investing the profits from their extraction in built capital. Thus, in addition to exploiting and depre-dating the environment irreversibly, it is possible to increase external vulnerabilities and register sustained economic growth in the national accounts of a country, without even eliminating its poverty. Doing that, or the opposite, necessarily implies value judgments.

To ensure sustainable development, an efficient intertemporal allocation achieved through markets would have to be conditioned by a minimum equitable distribution and

an ecologically sustainable scale. Otherwise, the obsession with increasing aggregate consumption, as if it were an absolute synonym for welfare, as assumed by the micro-economic foundations of many macroeconomic models, even at the cost of unsustainable fiscal deficits, would only have the effect of further increasing levels of inequality and environmental deterioration. Not in vain do economy and ecology share the same compositional element 'eco-', whose Greek root 'oiko-' means house, abode or living environment. This explains why the need and scientific viability of achieving zero-growth economies as an option to achieve a sustainable world was even debated (Jacobs 1996, Bermejo 2005, Plitt 2010, Trainer 2011 and Porter 2015).

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