

A DESCRIPTIVE REVIEW ON ECOLOGICAL ECONOMICS AND AN INTRODUCTION OF ECOLOGICAL CIRCULAR FLOW MODEL

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ABSTRACT

Perhaps the only assumption that all economists have accepted is that human needs are endless but natural resources are scarce. Mainstream economics assumes that this problem can be solved by price mechanisms without considering the ecological effects. Therefore, they continue to promote economic growth. On the contrary, ecological economics oppose the promotion of economic growth because it has ecological effects such as pollution, ecological degradation, climate change, global warming, etc. So, they call attention to economic degrowth.

In this paper, the aim is to briefly present the focus of ecological economics, to set forth the similarities and differences between ecological and environmental economics, to put forward economic degrowth discussions and to fill a certain gap in the literature. Circular flow model which is one of the main pillars of economics is illustrated with a more realistic consideration and a broader view and named as “Ecological Circular Flow”. This broader version, inspired by relevant primary studies, is essentially a simple ecological version of the mainstream’s circular flow model and has a crucial role to reconsider today’s economic activities and their consequences.

Keywords: Ecological Economics, Economic Degrowth, Sustainable Economy, Ecological Circular Flow.

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Makalenin gönderilme tarihi: 8 Mayıs 2019

Kabul tarihi: 13 Aralık 2019

EKOLOJİK İKTİSAT ÜZERİNE BETİMSSEL BİR DEĞERLENDİRME VE EKOLOJİK DEVRİ AKIMLAR MODELİNİN TAKDİMİ

ÖZ

Belki de bütün iktisatçıların kabul ettiği tek varsayım, insan ihtiyaçlarının sınırsız olup doğal kaynakların kıt olmasıdır. Anaakım iktisat ekolojik etkileri göz önünde bulundurmadan bu sorunun fiyat mekanizmalarıyla çözülebileceğini varsayar. Bu nedenle, ekonomik büyümeyi teşvik etmeye devam etmektedirler. Bunun aksine, ekolojik iktisat ise, kirlenme, ekolojik tahribat, iklim değişikliği, küresel ısınma vb. ekolojik etkilere sebep olduğu için ekonomik büyümenin teşvik edilmesine karşı çıkmaktadırlar. Dolayısıyla, ekolojik sorunlara önem veren ekolojik iktisatçılar, bu sorunlara bir çözüm olarak ekonomik küçülmeyi savunmaktadırlar.

Bu çalışmadaki amaç, ekolojik iktisadın odağını kısaca sunmak, ekolojik iktisat ile çevre ekonomisi arasındaki benzerlik ve farklılıkları ortaya koymak, ekonomik küçülme tartışmalarını iletmek ve literatürdeki belli bir boşluğu doldurmaktır. Ekonominin ana sütunlarından biri olan devri akım modeli, daha gerçekçi ve daha geniş bir bakış açısıyla ele alınarak “Ekolojik Devri Akım” olarak adlandırılmıştır. İlgili öncü çalışmalardan esinlenen bu daha geniş versiyon, temel olarak, ana akım iktisadın devri akım modelinin basit bir ekolojik versiyonu olup günümüzdeki ekonomik faaliyet ve sonuçlarını tekrardan değerlendirmek için çok önemli bir role sahiptir.

Anahtar Kavramlar: Ekolojik İktisat, Ekonomik Küçülme, Sürdürülebilir Ekonomi, Ekolojik Devri Akım.

INTRODUCTION

Now, it is a common fact that the temperature of the world has increased averagely by 0.85°C (and by over 1.5°C in some parts of the world) since the late mid-20th century (IPCC, 2018, p. 53). Therefore, global warming and climate change are a reality that human beings must face and take some serious measures. Although the standards of living for many have increased since the industrial revolution, a tremendous inequality has been legitimized and unprecedented effects that hinder survival for not only humans but also for countless other species have been created (Gibson-Graham and Miller, 2015, p. 1). In other words, humanity has been gambling with nature by means of a wide range of interventions such as dissipating gases in the atmosphere such as carbon dioxide which causes the global climate change, engaging ozone layer depleting substances, radical changes in large land use and causing the extinction of many species in their natural habitats (Nordhaus and Boyer, 2000, p. 3). The problems and potential threats caused by climate change because of the carbon emissions are examples of how economic activities push global boundaries (Harris and Codur, 2004, p. 15). In other words, it actually means the rate of acceleration of reaching our own ending is increasing. Needless to say, environmental

degradation is mostly the result of human activities as in IPCC report in 2018, it is stated that human effects on global climate have been the ascendant reason for global warming (IPCC, 2018, p. 53). Moreover, it should be emphasized that the size of these problems is global. It is because regardless of their source, global environmental problems² are serious issues that need global solutions since their results affect all of us. Therefore, as the scope of human activities grows, the impacts of these activities on the natural area also enlarge greatly and reach the global dimension. On the other hand, the reason for this irresponsible human activities is explained by Harris and Codur (2004, p. 14) as follows: “*As long as natural limits were not apparent, as long as nature seemed endless to humans, everything obtained from it could be taken from granted. In particular, economics, the science dealing with scarcity, was not concerned about these free gifts of nature to humankind.*” In this sense, especially after the post-World War II period, mainstream economics has focused greatly on economic growth by either neglecting nature or simply considering it as an external source of production, regardless of the natural or ecological boundaries. Nevertheless, the increase in production and consumption required for economic growth reduces the amount of resources provided by the environment while it also deteriorates the environment through waste generated by production and consumption. This degradation has caused major environmental problems such as global warming and climate change. Thus, in the economic growth literature, “environment” is modeled as a factor whose stock decreases as it is used (Ulucak and Erdem, 2017, p. 140).

According to Meadows, Meadows, and Randers (1982, p. xv), using fundamental resources enormously has become physically unsustainable. With no serious contradiction in material and energy flows, there will be a downturn in per capita food production, energy use, and industrial production in the next decades. So, with today’s economic paradigm, this is not sustainable regarding the fact that natural resources and biodiversity which play an essential role in ecosystems have been threatened when taking into account snow and ice melts, sea level rises and global average temperature measures (Ulucak, Yücel, and Koçak, 2019, p. 47). That’s exactly why ecological transformation to economics is essentially required since observed changes in the global climate raise the importance of ecological perspectives in economics.

In this context, there is a need to reconsider the current economic paradigm and gravitate towards an alternative: Ecological economics. The motivation of this paper is the fact that ignoring ecological limits by mainstream

² Global environmental problems fall into two categories: Micro environmental problems and macro environmental problems. While micro-environmental problems involves problems such as soil erosion and destruction of forests; macro environmental problems cover environmental problems such as climate change, global warming and ozone depletion which cannot be escaped by any (Krishnan, Harris, and Goodwin, 1995, p. 293).

economics is an unfortunate truth. Therefore, to give any contribution to increasing the awareness of ecological economics whose main focus is both ecological and economic sustainability is the main purpose of this paper. So, by raising the scream of the global world a bit more, some gaps in the literature will be modestly fulfilled. For that purpose, the paper is set apart into three main subtitles. In the following section, the principles and concerns of ecological economics will be held. Then, in the third section, degrowth discussions in the literature will be briefly presented. After the introduction of a new ecological version of the traditional circular flow in the fourth section, the paper will be summarized in the conclusion part.

I. ECOLOGICAL ECONOMICS: PRINCIPLES AND ITS RELATIONSHIP WITH ENVIRONMENTAL ECONOMICS

Macroeconomic policy, traditionally, aims a stable economic system. A broader perspective of macroeconomics also takes into account other objectives such as ecological sustainability. To put it differently, “Ecological Economics” which reckon with macroeconomics comprehensively is in question. The reason why this field of study is named as ecological economics is that this expression brings an ecological, interdisciplinary and comprehensive perspective. A significant increase in environmental and natural resource problems faced at local and global levels has led some economists to center on these problems. In other words, problems such as climate change, depletion of natural resources and the increasing negative effects of environmental pollution on welfare have encouraged some economists to analyze the effects of economic activities on ecology. The most discussed topics are as follows: The economics of climate change, the relationship between carbon emissions and economic growth, the relationship between carbon emissions and business cycles, economic degrowth, sustainable development, and the relationship between economic growth and environmental quality, etc. In this field of study, it is aimed to design new perspectives that respond to needs such as the need for being more aware of dependency of the economy on ecology and its effects on ecology; the need for making economy more responsive to ecology; and the need for handling of economic-ecological systems with conceptual and analytical tools. Although different expressions such as “Economic Ecology”, “Ecology and Economics”, “Ecolnomics” or “Econology” were chosen before, “Ecological Economics” has actually been the closest expression to the desired meaning (Costanza, 1989, p. 1). Moreover, both economy and ecology words come from the Greek root “oikos” which means home or living place.

Historical backgrounds of ecological economics can be found in Smith’s Invisible Hand, Malthus’s Population Growth, Ricardo’s Geographic Pattern of Economic Activity, Mill’s Steady State, and Jevons’s Scarcity of Stock Resources and so on. However, although it has deep historical roots, ecological economics seems relatively a new work area. The starting point of this debate is

the fact that the economy is dependent on the ecosystem. It began with the “Scarcity and Growth” by Barnett and Morse (1963) and, attracted attention with the famous report “Limits to Growth” of the Roman Club published by Meadows et al. (1972). Therefore, it emerged as a new field of research and work especially after the 1980s. Similarly, according to Ulucak (2018, p. 130), the increasing concerns about environmental destruction and the environment and also the traditional economics’ approach to environmental issues in a secondary and deficient way have been the initial point of ecological economics.

This new approach is based on addressing the issue of ecological boundaries to economic activities. It also argues that mainstream economics is insufficient to address the complexity of issues such as coping with the crises of environmental-human interactions, global climate change, extinction of species, and degradation of ecosystems and so on. While mainstream economics centers on the problems of allocating scarce resources, illogically, it has been observed that it cannot put environmental problems such as the destruction of natural resources or the deterioration of ecological systems to forefront (Harris and Codur, 2004, p. 17). That inadequacy in mainstream economic theories leads ecological economists to try to fill that gap.

While Paavola and Fraser (2011, p. 1266) denominate ecological economics as an interdisciplinary field of study covering a wide range of environmental issues, Stern (2012), who briefly describes it as a relationship between economic systems and ecosystems, argue that there is no consensus on whether this field of study is interdisciplinary or transdisciplinary. On the other hand, most of the environmental economists consider that ecological economics is only a subfield of a new study area in mainstream economics or a subfield of environmental and natural resources economics.

The main assumptions and approaches of ecological economists who believe otherwise are as follows (Stern, 2012):

- i. Economics is a sub-system of the human-environment systems.
- ii. While mainstream economics does not consider the role of natural sciences, ecological economics assumes that economic models must comply with the principles of biophysics.
- iii. In terms of both production and consumption, there are limits to man-made inputs that may substitute for natural resources and the environment.
- iv. Economic policy should take economic efficiency, equality and sustainability goals in hand together. Ecological economics is defined as the science and management of sustainability.

Thus, these principles explicitly imply that unlimited growth is not possible.

It is worthy to mention that ecological economics considers the relations between ecosystems and economic systems in a more comprehensive way. These relations are central to many of the most urgent problems such as sustainability, global warming, extinction of species, wealth distribution. However, they are not effectively covered by any existing discipline. For instance, environmental and natural resource economics only cover the solutions of mainstream economics to environmental and resource problems. Nevertheless, while ecological economics includes some of the issues of neoclassical environmental economics, it also promotes new approaches to the connections between ecological and economic systems (Costanza, 1989, p. 1). Another important point where environmental economics and ecological economics differentiate is that environmental economics focuses on *price* while ecological economics focuses on *quantity*. On the other side, ecological economics considers environmental problems as a problem of scale. More precisely, it claims that the scale of natural resource exploitation and waste production is much larger than the capacity of the planet Earth can bear. In spite of the fact that the focus of subjects is different, there has been a rapprochement between the neoclassical environmental and natural resources economics and ecological economics (Stern, 2012).

In short, environmental economics is generally taking into account the issues within the framework of mainstream economic theories. It gives no importance to values or quantities, only focusses on price. On the contrary, ecological economics try to bond and even unite the distinct disciplines of ecology and economics by focusing on values and as well as quantity.

II. ECONOMIC DEGROWTH VS. ECONOMIC GROWTH

In the 21st century, the ongoing greenhouse gas emissions at current rates or above are thought to cause more heating and more changes in the global climate than observed in the 20th century. For instance, by the end of the 21st century, it is estimated that the cost of the effects of global warming on the Africa continent is expected to be at least 5-10% of Africa's GDP (IPCC, 2007, p. 9). Therefore, these and similar predictions have led to the conclusion that carbon absorption should be immediately reduced to limit the possibility of world temperature increase exceeding 2°. In this sense, Matthews and Caldeira (2008, p. 4) argued that the greenhouse gas level in the atmosphere should be reduced for a stable global climate. In their study, they showed that if CO₂ emissions were reduced to almost zero, a stable global climate could be achieved in the next few centuries although it is stated as economically infeasible. As a result, in order to avoid human-induced global warming in the future, the solution would be to implement policies aiming at zero CO₂ emissions. However, just like Matthews and Caldeira claimed that it is economically infeasible, according to Harris, (2008, p. 3), these conclusions and policy recommendations apparently contradict the existing models of economic growth,

which are highly based on the further use of fossil fuel energy. Nevertheless, the current economic paradigm basically assumes that economic growth is unlimited. In addition, most of the traditional economists define a healthy economy as a stable economy with high growth rates and also, they believe that technological progress will eliminate the limits of natural resources. According to them, history has shown that resource boundaries can be overcome through new ideas and inventions. Moreover, they claimed that Malthus' horrific predictions about the population had not been experienced and the energy crisis of the late 1970s is a thing of the past. On the other hand, the opposites support that the overcoming of some natural resource problems in the past does not mean that the basic natural resource problems in the future can be managed. In addition, technology cannot be a remedy for the basic energy and natural resource boundaries and therefore, economic growth will sooner or later stop (Costanza, 1989, pp. 2-3).

Despite all negative social and ecological effects, the growth ideology has served significantly to strengthen the economic growth process and these effects' social legitimacy. However, since the 1970s, environmental degradation and destruction have encouraged many to question "unlimited growth" and to take into account its ecological impacts (Liodakis, 2017, p. 2). In a nutshell, the dominant paradigm and the applied economic model after the post-World War II have caused many environmental problems that affect all, such as air pollution, destruction of forests, loss of biodiversity since traditional economics has been basically economic growth-oriented with irrespective of the natural or ecological boundaries. That is to say, the current model can be criticized in many respects and therefore, there is a need for alternatives (Costanza et al., 2012, p. 4) and new perspectives which can be urgently applicable because neither traditional economics nor natural sciences can deal with social and environmental problems alone (Stern, 2012). Regardless of all of this, a more ecological approach to the economy and a more economic approach to ecology are required (Costanza, 1989, p. 3). Therefore, there is an urgent need for a radical change in economic growth models since global warming, climate change, and other environmental degradation are related to unlimited growth. In other words, making major changes in economic growth models is a way to reduce environmental problems. According to Nordhaus and Boyer (2000, p. 9), steps to slow down greenhouse gas emissions today mean less ecological damage, less consumption today and more consumption in the future since both the potential of catastrophic climate change and its effects on agriculture and environment will decrease. That is, nations face a tradeoff and so they must make a choice whether to consume today or in the future and act accordingly. Similarly, according to Costanza and et al. (2012, p. 75), this is the time to make some certain decisions. They claimed that three options nations have are as follows:

- i. To keep following the traditional economic growth paradigm that has been a part and parcel of most of the countries' economic policy since the end of the Second World War.
- ii. To follow an environmental-oriented version of the traditional economic growth model and make a real effort to accomplish "green growth"³.
- iii. To take a radical action taking into account sustainable prosperity rather than considering economic growth as a real ultimate goal as mainstream does.

The first option is the source of the problem and the second option is insufficient to obtain a sustainable economy and ecology since it contributes to ever-increasing consumption, although it promotes the use of eco-efficient technologies. Therefore, nations should choose a more fundamental change which is basically the third option. It is noteworthy to claim that choosing the third option means promoting "economic degrowth" which means literally economic contraction.

Degrowth is defined as "a voluntary transition towards a just, participatory, and ecologically sustainable society" in the Degrowth Declaration of the Paris 2008 Conference. To provide basic human needs and high standards of living and to decrease the economies' effects on ecological systems are the main goals of degrowth which basically cannot be accomplished involuntarily (Research and Degrowth, 2010, p. 524). The idea and the term are not new but the proposal for degrowth or the reduction of GDP has become popular with Latouche's studies. According to him, it is neither a concept nor an ideology but a way to consider the alternatives for ever-growth economies we have (Latouche, 2004). Moreover, he claims that the goal of exponential growth should be abandoned because it causes catastrophic effects on the environment and consequently on humanity (Latouche, 2009, p. 8). That is because economic growth continues to contribute carbon emissions and therefore leads to the acceleration of climate change. Although economic degrowth still seems to be an infeasible solution for most of the economists, some think that it is the only way to efficaciously deal with global climate change (Stuart, Gunderson, and Petersen, 2017, p. 99). On the other hand, economic degrowth means not only promoting less GDP but also reconsidering economic, social, cultural and ecological values. That is why it represents a radical and fundamental change. Similarly, Schneider, Kallis and Martinez-Alier (2010, pp. 512-513) address "sustainable economic degrowth" and define it as "an equitable downscaling of production and consumption that increases human well-being and enhances ecological conditions at the local and global level, in the short and long term".

³ Green economics which is fundamentally social justice- oriented is remarkably different from the current economic paradigm.

According to them, degrowth is a social choice that needs repoliticization of the economy and the reduction of both consumption and production. It can be seen that there is an emphasis on “sustainability” in this definition. Moreover, they do not highlight only the downscaling of the economies; they also consider both ecological and social beneficence. In addition, it is not an obligation; societies should be keen to have a radical change. Moreover, according to Klitgaard and Krall (2012, p. 251), degrowth, which is a necessity for economic systems, must be constructed with the recognition of external biophysical limits, internal capitalist limits, and interrelation of these limits.

In a nutshell, the current macroeconomic theory has been growth-oriented and so, the main objective of mainstream economics is to increase the gross domestic product. In other words, for mainstream economics, higher GDP is desirable and it is assumed to be possible. However, ecological economics considers the welfare concept in a wider perspective. It aims to establish a more profound understanding of the link between economic and natural systems and to use this understanding to develop feasible policies that enable an ecologically sustainable world and efficiently allocated scarce resources.

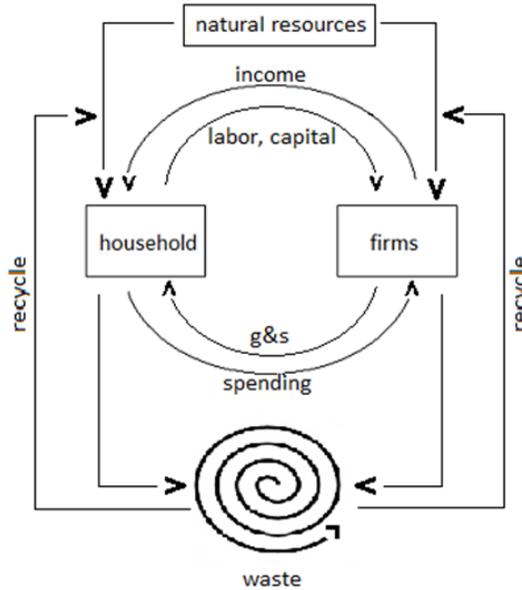
III. “ECOLOGICAL” ADAPTATION OF MACROECONOMICS: ECOLOGICAL CIRCULAR FLOW

One of the fundamental elements of economic theory is the circular flow model of a standard economic system. This model developed by Quesnay is a good way to see the economic interactions among economic agents. Assuming there are only two economic actors, namely households and firms, in the economy, the model basically reflects the exchange of goods and services and production factors between them. However, environmental and natural resources that make economic production possible are not adequately included in the usual version of the circular flow model. There is no doubt that environmental and natural resources are crucial for production. For instance, primarily drinking water; fertile soil for agriculture; fuel, water, and mineral resources for industries and so on are needed (Harris and Codur, 2004, p. 1). Therefore, the usual circular flow basically ignores both the scarcity of natural resources and also the costs of ecological degradation. In addition, the circular flow diagram in any mainstream textbooks neglects to illustrate the ecological flows. Consequently, the articulation of such essential factors to the circular flow chart is required.

Considering circular flow within an ecological view, Hutchinson et al. (2002) give a complex diagram including social resources while Harris and Codur’s diagram is quite simple (Harris and Codur, 2004, p. 8; Hutchinson, Mellor, and Olsen, 2002, p. 180). However, in both, there is an endless flow as if there were infinite natural resources and the unlimited world (although Harris and Codur admit that natural resources are limited and they make an objection to the traditional circular flow verbally, their diagram still displays an endless flow). Therefore, both diagrams lack the needed realistic approach. In this sense,

the circular flow model which is one of the main pillars of economics needs to be illustrated with a more realistic and broader view. That is why an ending circular flow (just as we live in a finite world as we claim) would be appropriate.

Figure 1. Ecological Circular Flow Model



This new and realistic version of circular flow in Figure 1 is essentially an ecological version of the mainstream's circular flow model and named as "ecological circular flow (ECF)". In the model, there are two economic agents: Households and firms⁴. Households supply labor and capital and earn income. On the other hand, firms demand labor, capital, and natural resources and supply goods and services. So, they interact with each other via income and spending just as in the usual circular flow. However, apart from the usual version, households also demand natural resources (considered as a third agent⁵) through consumption and then, in both consumption and production process, some waste and pollution is created. Some amount of waste is recycled naturally and/or industrially but the rest of them gets bigger and bigger and causes ecological degradation while consumption and production increase. That's why there is a spiral in the new model. So, this is the point where circular flow is not endless.

⁴ Although firms and households are in contact with the government through taxes, premiums, subsidies, transfers, pensions and etc., and in contact with other countries through exports and imports, the existence of the government and other countries does not change the relationship between firms and households. That's why "government" and "other countries" are not included in this diagram.

⁵ This assertion is inspired by the work of Horst Siebert (1982). According to him, nature supplies a flow of goods like oxygen, the ozone layer, water supplies and etc. (Siebert, 1982, p. 133).

Since the natural resources are limited and diminish day by day and the increasing amount of waste and pollution harms ecology, the flow will stop somehow.

On the other hand, ECF expresses a few facts. First of all, environmental and natural resources are crucial for economic activity. Secondly, and more realistically, that flow will have an ending if any actions aren't taken. Therefore, ECF is not only the graphical representation of the economic activities but also a call for a reconsideration of the ecological effects of economic growth. In other words, it has a crucial role to reconsider today's economic activities and their consequences. For example, non-renewable natural resources⁶ like coal, oil, mines, and elements are used in the production process and they are scarce. On the other hand, renewable natural resources such as water, fertile land, plants, air, solar and wind energy can naturally replenish themselves over time although some of them can be depleted faster than they can renew via pollution, exploitation, deforestation and etc. It is a fact that in both production and consumption processes, there occur waste and pollution that deteriorate the ecosystems. For a sustainable world, these wastes must be recycled and/or renewable and/or reusable resources should be used in consumption and production process. Therefore, the objection to disposable material usage is not surprising. In other words, some effective actions must be taken in the sense of consumption and production culture of today's world; otherwise mass waste and pollution will accelerate global climate change and ecological degradation.

CONCLUSION

To sum up, ecological economics is a new work area that has deep historical backgrounds. In addition, it differentiates from environmental economics by enabling an ecologically sustainable world and efficiently allocated scarce resources. Economic activities and economic welfare are fundamentally dependent on natural resources or so to speak, ecological systems as a whole. However, mainstream economic theories are sensitive neither to natural sources nor to ecological degradation. Therefore, with an ecological point of view, some arrangements in not only economic theories but also economic activities are urgently needed since economic policies are being implemented as if there are no natural boundaries. Moreover, it is noteworthy to mention once again that the size of these problems is global so they need global solutions since their results affect all of us. So, economic degrowth as an

⁶ Natural capital is set apart two: renewable natural capital and nonrenewable natural capital. The main feature of renewable natural capital is an important regeneration capacity based on the input of solar energy and wind power (Costanza and Daly, 1992, p. 38). As the exploitation of natural regeneration rates continues, renewable resources can turn into nonrenewable resources. The most characteristic feature of nonrenewable natural resources (like fossil fuels and mineral resources) is that the renewal capacity is close to zero or zero (Harte, 1995, p. 158).

economic goal for especially developed countries has a crucial role here. As another contribution, to develop a consciousness of the ecological consequences of consumption and production processes and to provide a more realistic, broader and ecological version of usual circular flow model, an ECF model inspired especially by Siebert (1982), Hutchinson et al. (2002) and also Harris and Codur (2004) is illustrated in this paper. It is actually a simple visual presentation for flows between producers and consumers in its current version with reflecting ecological impacts. Since economics is a sub-system of the environmental systems, economic policies and economic activities must be suitable for a sustainable world. So, the main goal of the economies should be reaching both ecological and social sustainability rather than having a higher GDP not only because ever-increasing economic growth is unsustainable ecologically but also that “growth” is too materialistic and does not include equality and quality of life. In other words, economic values must include respect for ecosystems.

REFERENCES

- Barnett, H. J., and Morse, C. (1963). *Scarcity and growth: The economics of natural resource availability*. Baltimore: Johns Hopkins Press.
- Costanza, R. (1989). What is ecological economics?, *Ecological Economics*, 1(1), 1–7. [https://doi.org/10.1016/0921-8009\(89\)90020-7](https://doi.org/10.1016/0921-8009(89)90020-7)
- Costanza, R., Alperovitz, G., Daly, H. E., Farley, J., Franco, C., Jackson, T., ... Victor, P. (2012). *Building a sustainable and desirable economy-in-society-in-nature*. New York: United Nations Division for Sustainable Development.
- Costanza, R., and Daly, H. E. (1992). Natural capital and sustainable development, *Conservation Biology*, 6(1), 37–46.
- Gibson-Graham, J. K., and Miller, E. (2015). Economy as ecological livelihood. In K. Gibson, D. B. Rose, and R. Fincher (Eds.), *Manifesto for Living in the Anthropocene* (pp. 7–16). Brooklyn: New York: Puncum Books.
- Harris, J. M. (2008). Ecological macroeconomics: Consumption, investment and climate change, *Global Development and Environment Institute, Tufts University*. Working Paper No: 08–02.
- Harris, J. M., and Codur, A. (2004). Macroeconomics and the environment, *Global Development and Environment Institute, Tufts University*. <https://doi.org/10.1016/j.ecolecon.2009.11.015>
- Harte, M. J. (1995). Ecology, sustainability, and environment as capital, *Ecological Economics*, 15(2), 157–164. [https://doi.org/10.1016/0921-8009\(95\)00043-7](https://doi.org/10.1016/0921-8009(95)00043-7)

- Hutchinson, F., Mellor, M., & Olsen, W. (2002). *The politics of money: Towards sustainability and economic democracy*. London and Sterling, Virginia: Pluto Press. https://doi.org/10.1111/j.0013-0133.2005.976_10.x
- IPCC. (2007). Climate change 2007: Synthesis report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, [Core Writing Team, Pachauri, R.K and Reisinger, A. (eds.)]. IPCC, Geneva, Switzerland. <https://doi.org/10.1256/004316502320517344>
- IPCC. (2018). Global warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]. In Press.
- Klitgaard, K. A., and Krall, L. (2012). Ecological economics, degrowth, and institutional change, *Ecological Economics*, 84(2012), 247–253. <https://doi.org/10.1016/j.ecolecon.2011.11.008>
- Krishnan, R., Harris, J. M., & Goodwin, N. R. (1995). *A survey of ecological economics. ecosystems and human well-being: A framework for assessment*. Washington D.C.: Island Press. <https://doi.org/10.1007/s13398-014-0173-7.2>
- Latouche, S. (2004). Why less should be so much more: Degrowth economics, *Le Monde Diplomatique*. Available at <http://www.hartford-hwp.com/archives/25/126.html>
- Latouche, S. (2009). *Farewell to growth*. (Translated by David Macey, Ed.) (First Edit). Cambridge: Polity Press. <https://doi.org/10.15713/ins.mmj.3>
- Liதாகி, G. (2017). Capital, economic growth, and socio-ecological crisis: A critique of de-growth, *International Critical Thought*, 8(1), 46–65. <https://doi.org/10.1080/21598282.2017.1357487>
- Matthews, H. D., and Caldeira, K. (2008). Stabilizing climate requires near-zero emissions, *Geophysical Research Letters*, 35(4), L04705. <https://doi.org/10.1029/2007GL032388>
- Meadows, D. H., Meadows, D. L., Randers, J., and Behrens, W. W. (1972). *The limits to growth: A report for the club of Rome's project on the predicament of mankind*. New York: Universe Books. [https://doi.org/10.1016/0007-6813\(73\)90029-3](https://doi.org/10.1016/0007-6813(73)90029-3)

- Meadows, D. H., Meadows, D. L. and Randers, J. (1992). *Beyond the limits: Confronting global collapse, envisioning a sustainable future*. Post Mills, Vt.: Chelsea Green Publishing Company. (*Limits II*)
- Nordhaus, W. D., & Boyer, J. (2000). *Warming the world - economic models of global warming*. Cambridge, Mass: The MIT Press. <https://doi.org/10.1038/432677a>
- Paavola, J., & Fraser, E. D. G. (2011). Ecological economics and environmental history, *Ecological Economics*, 70(7), 1266–1268. <https://doi.org/10.1016/j.ecolecon.2011.03.008>
- Research and Degrowth. (2010). Degrowth declaration of the Paris 2008 conference. *Journal of Cleaner Production*, 18(6), 523–524. <https://doi.org/10.1016/j.jclepro.2010.01.012>
- Schneider, F., Kallis, G., and Martinez-Alier, J. (2010). Crisis or opportunity? Economic degrowth for social equity and ecological sustainability. Introduction to this special issue, *Journal of Cleaner Production*, 18(6), 511–518. <https://doi.org/10.1016/j.jclepro.2010.01.014>
- Siebert, H. (1982). Nature as a life support system. Renewable resources and environmental disruption, *Zeitschrift für Nationalökonomie*, 42(2), 133-142. <https://doi.org/10.1007/BF01293355>
- Stern, D. I. (2012). Ecological economics, *Crawford School Research Paper*, No: 17. Available at SSRN: <https://ssrn.com/abstract=2066195>
- Stuart, D., Gunderson, R., and Petersen, B. (2017). Climate change and the Polanyian counter-movement: Carbon markets or degrowth?, *New Political Economy*, 3467, 1–14. <https://doi.org/10.1080/13563467.2017.1417364>
- Ulucak R. and Erdem E. (2017). Ekonomik büyüme modellerinde çevre: Ekolojik ayak izini esas alan bir uygulama, *Hacettepe Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, 35 (4) , 115-147. <https://doi.org/10.17065/huniibf.372407>
- Ulucak R. (2018). İktisatta çevreci dönüşüm: Ekolojik makro iktisat, *Erciyes Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, 51, 127-149. <https://doi.org/10.18070/erciyesiibd.402928>
- Ulucak R., Yücel A.G. and Koçak E. (2019). The Process of Sustainability: From Past to Present, In book: *Environmental Kuznets Curve (EKC) A Manual*, Chapter: 5. (p. 37-53). Amsterdam: Elsevier. <https://doi.org/10.1016/B978-0-12-816797-7.00005-9>