A Survey: The Impact of Air Pollution to Health in Neoclassical Economics and Other Alternative Economic Approaches

Dilek DEMİRBAŞ[1]

Abstract

Although there has been reasonable progress in the epidemiology of air pollution, significant changes in international air pollution guidelines, and the emergence of more systematic approaches to air pollution control, there has been little attempt to explain the origin of the air pollution problem in the first place. How did we come to this point? It is a fact that Neoclassical Environmental Economic view, even if it is not the sole cause, is still a major influence for the theories of natural capitalism and environmental finances. Therefore, with this increasing influence, Neoclassical environmental economics have been at the very centre of public policies on environmental issues for decades. The question of whether Neoclassical Environmental Economics is the best economic approach for policy decision-making is a very controversial subject, and there are few alternative approaches to Neoclassical Environmental Economics. This study with the intention to fill the gap in this literature provides some insight into air pollution and its impacts on health, starting from the Neoclassical Economic perspective and reviewing the main alternative approaches to reach a very balanced global environmental understanding.

Keywords: *air pollution, health impacts, economics, policy aspects, environment.*

[1] Professor in International Trade and Business, YBU Business School, Yıldırım Beyazıt University, Ankara, ddemirbas@ybu.edu.tr

Neoklasik Ekonomide ve Diğer Ekonomik Yaklaşımlarda Hava Kirliliğinin Sağlık Üzerindeki Etkilerine Yönelik Bir İnceleme

Öz

Son yıllarda hava kirliliğine yönelik bilimsel felsefi yaklaşımlarda önemli gelişmeler, uluslararası hava kirliliğini önleyici yayınlarda kayda değer ilerlemeler, hava kirliliğinin kontrolüne yönelik daha sistematik yaklaşımlar olmuş olsa da hava kirliliği probleminin neden ve orijinini açıklayacak çok az sayıda kayda değer yayın yapılmıştır. Bu noktaya nasıl geldik sorusu önemlidir. Aslında Neoklasik ekonomik yaklaşım, tek başına bir sebep olmasa da çevre ve hava kirliliğini finansmanında ve ekonomiye olan etkilerini incelemede hala en önemli etkileşime sahip olan yaklaşımdır. Bu yüzdendir ki Neoklasik Ekole ait Çevreci Ekonomi yaklaşımı uzun zamandır çevrecilik sorunlarında kamu politikalarını belirlemede merkezde belirleyici bir güce sahip olarak görülmüştür. Bu sebeple çevresel sorunların çözümünde Neoklasik Ekonominin en iyi yaklaşım olup olmadığını soran yaklaşım az sayıda alternatif yaklaşımların olmasından dolayı da oldukça tartışmalı bir konudur. Literatürdeki bu açığı kapatma amacıyla hazırlanmış bu çalışma, hava kirliliği konusuna bir açıklama getirmeyi amaçlamaktadır ve küresel çevreci anlayışı ulaşmak için bazı temel yaklaşımları incelemeyi hedeflemiştir.

Anahtar Kelimeler: *hava kirliliği, sağlık etkileri, ekonomi, politik* ö*zellikler,* ç*evre.*

1. Introduction: Environment and Neoclassical Economics

For the last two hundred years, largely through human activity, unprecedented environmental challenges and irreversible mass extinctions have been caused on the Earth. With this greatest damage, some estimates suggest that not only are more than one hundred species a day becoming extinct, but also our natural resources that sustain life on the planet-air, water and soil are becoming polluted or depleted on an alarming scale together with exponentially increasing human population growth.[2] This means that as the prospects for continued degradation and depletion of natural resources multiply as a result of this population growth, natural resources on the planet such as clean water, clean air and clean soil will become a luxury and resources for the survival of future generations will be scarce.

It is true that human beings are greedy and treat nature as a renewable source. It is also frightening to know the extent to which the illusion of having solved the problem of production is still on the agenda. If we continue to ignore the difference between income and capital for nature, mistakenly treating nature as an income item rather than a capital item, we will reach a stage where the adverse effects of damages to nature will not be reversible and we will continue to destroy our planet and possibly even cause our own extinction.

To bring to an end these arguments, over the last half a century, developed countries have begun to reverse the health effects and to reduce the cost of environmental pollution in urban cities. For this reason, Environmental Economics has emerged as a subfield of economics to deal with environmental issues using standard methods of Neoclassical Economics, and to undertake theoretical and empirical studies of the economic effects of national or local environmental policies around the world. As a result, issues including the costs and benefits of pollution, alternative environmental policies to deal with air pollution, water quality, toxic substances, solid waste, and global warming, have become very important subjects for analysts to solve.

Over the last fifty years in particular, the health effects of environmental pollution, especially air pollution, have become the centre of many

[2] J. Des Jordins, *Environmental Ethics: An Introduction to Environmental Philosophy*. Canada: Wadsworth, 2001.

epidemiological studies for risk assessments issues, and of environmental economics for policy decision making processes. With an increasing community awareness of human health and air quality concerns, a large body of epidemiological research has emerged showing the adverse health effects of air pollution and focusing on the damaging effects of air pollutants on public health. Based on these research findings, which demonstrate that air pollution causes different levels of risk to human health and the environment, environmental regulatory authorities in many countries have implemented stringent air quality measures.[3] These researches have also revealed that human health might be affected by these exposures more than was previously believed.[4] Evidence is still emerging that long-term exposure to low concentrations of *particulate matter* in the air is associated with mortality and other chronic effects, such as increased rates of bronchitis and reduced lung function.[5]

According to World Health Organization[6] there are different stages of the health effects. The sequence of health impact of air pollution within the population affected ranges from mild or subtle health effect, which is sub clinical effects; to most severity of health effect, which is premature mortality. In between impaired pulmonary functions, restricted activity/ reduced performance, visits to doctors, emergency room visits and hospital admission can be accounted as different types of severity of health effects in the population affected.

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[3] Bureau of Transport and Regional Economics (BTRE), Working Papers. *Health Impacts of Transport Emissions in Australia: Environmental Cost.* Australia: The Department of Transport and Regional Services, 2005.

[4] World Health Organization (WHO), *Overview of the Environment and Health in Europe in the 1990s.* Third Ministerial Conference on Environment and Health. London, Copenhagen: WHO Regional Office for Europe, 16-18 June 1999.

[5] G. W. Fisher, K. A. Rolfe, T. Kjellstroom, A. Woodward, S. Hales, A. P. Sturman, S. Kingham, J. Petersen, R. Shrestha, & D. King, *Health Effects due to Motor Vehicle Air Pollution In New Zealand.* Wellington, New Zealand: A Report Submitted to Ministry of Transport, 2002.

World Health Organization (WHO), *Quantification of The Health Effects of Exposure To Air Pollution,* Report of a World Health Organization working group, Bilthoven, Netherlands, November, 2000.

World Health Organization (WHO), *Air Quality Guidelines for Europe*. second edition, WHO Regional Publications, European Series, 91, Geneva, 2000.

Bureau of Transport and Regional Economics (BTRE), Working Papers, *Health Impacts of Transport Emissions in Australia: Environmental Cost*. Australia: The Department of Transport and Regional Services, 2005.

Department for Environment, Food and Rural Affairs (Defra), *An Economic Analysis to Inform the Air Quality Strategy Review Consultation*. London: Crown, 2006.

[6] World Health Organization (WHO), *Quantification of the health effects of exposure to air pollution.* Report of a World Health Organization working group, Bilthoven, Netherlands, November, 2000.

What are these air pollutants, which endanger our health? According to a report produced by BTRE,[7] air pollutants are usually classified into suspended *particular matter* such as dusts, fumes, mists, smokes; and *gaseous pollutants* such as gases and vapours, and *odours*. Many epidemiological studies have demonstrated that these pollutants are a risk to human health. They reported that, especially in the long-term, air pollution in urban areas can cause bronchitis, respiratory diseases, lung cancer and early deaths. Their results also suggested that carcinogenic chemicals in the smallest air particles and carcinogenic gases – such as benzene and benzopyrene could be possible causal agents.[8]

Therefore, trends in the concentration of these pollutants in urban air, such as, nitrogen dioxide or particulate matter, became the focus of concern for international air pollution guidelines and many agencies such as, the European Environment Agency.[9] In addition, policy-makers in developed countries in the West also employed more systematic approaches to measure the economic costs of air pollution on human health and to develop effective environmental strategies for both social and economic efficiency objectives.[10] The qualification of environmental-related health effects and their valuation in monetary units play a key role for policy measures.[11]

If it is an undeniable fact that environmental pollution exists and the economic costs of pollution on human health are very high, we have to find urgent answers to a number of questions, such as: What are the fundamental responsibilities of economics and economists? What should economists do to reduce or to eliminate the level of pollution? And finally, why do we have to select the best environmental policy among alternatives?

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[7] Bureau of Transport and Regional Economics (BTRE). Working Papers, *Health Impacts of Transport Emissions in Australia: Environmental Cost*. Australia: The Department of Transport and Regional Services, 2005.

[8] T. Kjellstrom, A. Neller & R. W. Simpson, 'Air Pollution and Its Health Impacts: The Changing Panorama', *Medical Journal of Austria* 177 (2), 2002, pp. 604-608.

[9] European Environment Agency (EEA), *Air Pollution in Europe 1999-2000*. Copenhegan: Topic Report 4/2003, 2004.

[10] Ad-Hoc Group on the Economic Appraisal of the Health Effects of Air Pollution, *Economic Appraisal of the Health Effects of Air Pollution*, Department of Health, The Stationery Office, London, 1999.

[11] R. K. Seethaler, N. Kunzli, H. Sommer, O. Chanel, M. Herry, S. Masson, J. C. Vernaud, P. Filiger, F. Jr. Horak, R. Kaiser, R. S. Medina, V. Puybonnieux-Texier, P. Quenel, J. Schneider, M. Studnicka, & J. Heldstab, 'Economic Costs of Air Pollution Related Health Impacts: An Impact Assessment Project of Austria, France and Switzerland', *Clean Air and Environment Quality,* 37 (1), February 2003, pp. 35-43.

The main objective of this study is to evaluate some of these questions starting from the perspective of Neoclassical Environmental Economics and reaching the interdisciplinary approach. Therefore, this study is an attempt to look at the whole picture, from the angles of air pollution, economics and policy matters in order to evaluate the extent of pollution on Earth.

In section two the main economic approaches which shaped current Neoclassical Environmental Economics will be examined to understand why Neoclassical Economics analyze air pollution in a particular way and come up with particular prescriptions. Then, three other approaches - utilitarianism, welfare economics and efficiency theory - will also be examined as they are an alternative approach to Neoclassical environmental policies in both developed and developing countries. It is true that economics is an important subject which can shape the activities of the modern world with its criteria. Without understanding the main assumptions of Neoclassical Environmental Economics, it is not possible to understand the rationality of international air pollution guidelines or decision-making processes regarding pollution control.

In section three alternative approaches to Neoclassical Environmental Economics will be examined, such as *Austrian Economics, Green Economics,* and *Ecological Economics*. After examining Neoclassical Environmental Economics and its analyzing techniques, this section is essential as we need to substitute existing assumption with more realistic ones. We must do that not only to eliminate problems of Neoclassical Environmental Economics, but also to have a better economic understanding in order to deal with the environmental issues.

The final section, section four, will conclude our findings and make a number of proposals for decision makers.

2. Theoretical Basis of Neoclassical Environmental Economics

Economics plays a central role in shaping the activities of the modern world by imposing criteria of what is economic and what is uneconomic. So, far there is no other set of criteria that exercises a greater influence over the actions of individuals, groups and governments than economic criteria. Neoclassical Environmental Economics was, and still is, a major influence on the theories of natural capitalism and environmental finances, which are the two sub-branches of environmental economics concerned

with resource conservation in production, and the value of biodiversity of humans. With increasing influence Neoclassical Environmental Economics moved into the very centre of public concern on environmental issues. There are three very important economic approaches within the Neoclassical Environmental Economy, which are still very dominant views on environmental policy matters in both developing and developed countries. These are: utilitarianism, neoclassical efficiency theory and welfare economics.

2.1. Utilitarianism

Utilitarianism is an early 19th century ideology and differs from ethical theories that make the rightness or wrongness of an act dependent upon the motive of the agent. According to the Utilitarian, it is possible for the right thing to be done with a bad motive. Among the well-known utilitarians; Jeremy Bentham and John Stuart Mill should be mentioned as the leading figures.

Utilitarian's commonly agree that *happiness* should be the objective of individuals, and they take happiness as the basis of judgments about actions.[12] As the ultimate objective is to maximize aggregate utility or welfare, for the same reason they believe utility has to be something that can be easily quantified or measured. On one level the decision on whether one state of affairs is better than another depends on the sum of personal utilities and nothing else. For example, inequalities in distribution are bad because they lower the sum of utilities. More production is good if it increases total enjoyment. Utilitarians believe that low levels of pleasure count as much as higher pleasures. In their idealistic world, if utility is to be measured it should be possible to tell how many units an individual enjoys and how many more the same individual enjoys in one situation compared to another one.[13]

It is also believed that individuals pursue their own self-interests, because they are the best judges of their own welfare or happiness. Therefore, there should be no interference with their choices on the individual level. In contrast, utilitarians also argue that social and private

[12] J. S. Mill, *Principal of Political Economy,* 2 (3), Edited by J. M. Robson. UK: Oxford University Press, 1965.

[13] J. Bonner, *Economic Efficiency and Social Justice; The Development of Utilitarian Ideas in Economics from Bentham to Edgeworth*. England: Edward Elgar, 1995, p. 4.

utility can be merged by governments for public policy programs in order to maximize the aggregate utility. It is for this reason that utilitarianism was and still is very influential in the areas of economics, public policy and government regulations, and plays a significant role in environmental policy.[14] According to Bonner,[15] 'because many believe that utilitarianism gave reasons why one is better than another it made discussion of policy possible'. As the total of individual happiness itself should be the objective of public policy, redistribution of income will be desirable if total utility, which is the sum of all individual utilities, increases. Consequently, there is no basis for the condemnation of the existence of extreme inequality as the main goal is to satisfy as many individual preferences.[16]

A number of challenges are raised against utilitarian thinking. The most important ones are the *measurement* of utilities, *comparison* of individual welfares, and *aggregation* of inter-personal utility information. In fact measuring, comparing and aggregating individual utilities is not easily done and in some cases is impossible. How is it possible to measure or to scale choices or to find their origins? How can we compare satisfaction of individuals? How should we aggregate individual welfare to obtain social utility? How can we quantify pleasure, happiness, desire and so forth? These are the key questions to which even utilitarians themselves cannot find easy answers.[17] Firstly, we cannot simply assume that all desires or pleasures are qualitatively the same. In the words of Des Jardins,[18] 'Is the pleasure that I received from breathing clean air equal to the pleasure that you receive from smoking.' If this is the case how can we measure them? According to what scale? What do the utilitarians do when they cannot quantify pleasure, happiness or satisfaction?

For critics one challenge is based on the *measurement* issue. Utilitarians substitute for the good something that can be quantified in

[14] J. Des Jordins, *Environmental Ethics: An Introduction to Environmental Philosophy*. Canada: Wadsworth, 2001.

[15] J. Bonner, *Economic Efficiency and Social Justice; The Development of Utilitarian Ideas in Economics from Bentham to Edgeworth*. England: Edward Elgar, 1995.

[16] J. Des Jordins, *Environmental Ethics: An Introduction to Environmental Philosophy*. Canada: Wadsworth, 2001.

[17] J. Bonner, *Economic Efficiency and Social Justice; The Development of Utilitarian Ideas in Economics from Bentham to Edgeworth*, England: Edward Elgar, 1995.

[18] J. Des Jordins, *Environmental Ethics: An Introduction to Environmental Philosophy*, Canada: Wadsworth, 2001, p.27.

money terms, and this is seen as a major mistake. Utilitarians measure and compare the health consequences of pollution control decisions by using some quantifiable variables such as life expectancy, infant mortality and per capita expenditure on health care as proxies for health; however, these variables cannot cover all the aspects of the *value of life*. To be able to overcome this problem utilitarians propose that, in the market place, everything should have a price in order to make them exchangeable, and there is nothing that has not got a price. According to critics this is exactly what goes wrong when environmental regulation is subjected to cost-benefit analysis. For environmental policy, regulators measure different economic factors associated with health as proxies as they are unable to measure the value of health itself. Then, they assume that comparing the cost of health to the cost of eliminating the source of pollution would be enough to make policy decisions. Even simple non-economic values like beauty, cleanliness and health, can survive only if they are proved to be 'economic' and subject to cost-benefit analysis. How easy is it to measure something, which cannot be measurable?

Another challenge is based on the nature of utilitarian *judgments*. Because for utilitarians there is no act, in and of itself, that is ever right or wrong, so they do not take into consideration the consequences of a particular act. Critics claim that this approach is incomplete and is unable to account for certain ethical issues. Each society has its own rights and wrongs, and actions can be altered according to what the value each society puts on certain things.

In summary, utilitarianism is one of the most influential approaches that shapes our public policy decisions on environmental issues, but it is also one of the most controversial ones. Hence, it is the reason why environmental debates today are so widely cast in utilitarian terms.

2.2. Neoclassical Efficiency

The second influential approach to environmental policy decision-making process is the Neoclassical Efficiency Theory, which can also be seen as an extension of utilitarianism. What is Neoclassical Efficiency Theory? How can we relate it to the environmental decision making process? This subsection will deal with these questions.

Three main assumptions of Neoclassical Economy are; (1) existence of perfect information; (2) existence of transitivity of alternate

choices; (3) positive marginal utility/product if and only if non-zero inputs exist. The main reason for perfect information assumption is to enable rational choices.[19] Neoclassical theorists assume that consumers are rational agents who act rationally and who make rational consumption decisions in order to maximize their own self-interests and to maximize on their individual rational choices. So, utility maximization, which is constrained by income and prices, is the ultimate goal of consumption for a rational consumer.[20] Therefore, the same consumer will always choose the most preferred bundle of goods from a set of feasible alternatives, and the same consumer will be able to compare various bundles of goods.

Consequently, 'economic efficiency' appears to be the utilitarian goal of providing the greatest good for the greatest number for the whole economy. If the goal of economic efficiency is to achieve the optimal satisfaction of consumer preferences, 'an efficient market is one in which more people get more of that for which they are most willing to pay'.[21] This leads to independence among rational agents, thus establishing a causal relation between economic competition of any kind and the degree of agent-specific independence attained. That is, competition is realized in the presence of key assumptions. Besides, if competition exists, then optimal information must be available to agents.[22]

For Neoclassics, the basic reason for social inefficiency lies behind the fact that the social costs associated with external effects, such as health impacts of air pollution are not incorporated into the cost of producing the pollution generating product or its market price. From this perspective, the key solution is to increase the overall value of production to a level that would be generated if the pollution costs were being reflected in its price. Under such circumstances there would be an efficient reallocation of resources. When production and consumption are arranged in such a way that all air pollution costs are accurately reflected in product prices within

[19] R. Choudhury, 'Ethics and Economics: A View from Ecological Economics', *International Journal of Social Economics*, 22(3), 1995, pp.18-25.

[20] N, Hanley & C. L Spash, *Cost-Benefit Analysis and the Environment*, England Edward Elgar, 1993.

[21] J. Des Jordins, *Environmental Ethics: An Introduction to Environmental Philosophy*, Canada: Wadsworth, 2001, p. 59.

[22] R. Choudhury, 'Ethics and Economics: A View from Ecological Economics', *International Journal of Social Economics*, 22(3), 1995, pp.18-25.

competitive markets, the market is said to be Pareto efficient, i.e. society, on net, cannot be made better off.[23]

It is on this point that Neoclassical Theory has been subjected to the most criticism. One such criticism comes from environmental ethics, which claims that if an efficient market is one in which more people get more of that for which they are most willing to pay, why should we take the satisfaction of individual preferences as an overriding goal? How do we know that individual preferences are right or wrong for us in the long term? Especially when we are concerned with environmental issues, why should the satisfaction of individual preferences be the goal of public policy? Critics claim that these are the fundamental questions that Neoclassical economists should answer urgently in order to deal with today's environmental problems.

These critics also claim that it is true that Neoclassical economic analysis plays a key role in many contemporary environmental policy issues. In particular, cost-benefit analysis is the major public policy methodology used in reaching environmental decisions and shaping environmental regulations at national or international levels. However, when the economic efficiency idea becomes so dominant for policy makers, we cannot simply accept the criteria of the satisfaction of individual preferences.

Sagoff[24] argues that much economic analysis rests on a serious confusion between, on the one hand, wants or preferences and, on the other, beliefs and values. Indeed, Neoclassical economics deals only with wants and preferences because these are what get expressed in an economic market in monetary terms, but excludes beliefs and values because they are not accountable.

It is true that the market can measure the intensity of our wants by our willingness to pay (by price), measure and compare individual preferences through cost-benefit analysis, and determine efficient means for optimally fulfilling wants. However, markets cannot measure or quantify our beliefs

[23] R. E. Cordato, 'An Austrian Theory of Environmental Economics', *Quarterly Journal of Austrian Economics*, 28, 2004, pp. 3-36.
R. E. Cordato, 'Pollution Taxes and the Pretence of Efficiency', *Journal of Private Enterprise,* 10, 1997, pp.105-118.
R. E. Cordato, *Welfare Economics and Externalities in an Open Ended Universe*. Boston: Kluwer Academic Publishers, 1992a.

[24] M, Sagoff, *The Economy of the Earth.* New York: Cambridge University Press, 1990.

or values. Because many environmental issues also involve our beliefs and our values, economic analyses become incomplete. In particular, when Neoclassical economics is involved in environmental policy it treats our beliefs as if they were mere wants, and, thereby, seriously distorts the issue.

2.3. Welfare Economics

Pigou[25] developed a formal welfare theory that could be applied to economic policy. His study was to highlight the question of whether perfectly competitive markets lead to an optimum allocation of resources. Therefore, Pigou showed that firms' marginal cost functions may not accurately reflect the social costs of production and the demand curves of individuals may not accurately reflect the social benefits from consumption. Thus, in his study, Pigou[26] examined the divergences between private benefits and social benefits, and between private costs and social costs. Then, he called these divergences externalities, spill-over effects, and third-party effects, which are often used to justify government actions. The costs which a firm considers in its profit maximisation decisions are private costs borne by the firm. But social costs, such as pollution, are not borne by the firm thus there is a divergence between private and social cost at the margin. A free market will therefore result in the production of an excessive quantity of goods whose marginal social cost exceeds their marginal private cost. When this is the case governments intervene and correct the externalities.

Before Neoclassical Theory, Classical Economic Theory also used the concept of welfare. While classical economists considered welfare as an increasing output, Neoclassical economists perceived welfare as more than an increase of output with the help of marginal utility concept.[27] Then, by distinguishing economic theory from policy, welfare economics became an integral part of the Neoclassical Economics policy decision-making process. When economic theory became more formal, welfare economy was also specialised as a separate field.

As with previous approaches, Welfare Economics is also subject to criticism. As its conceptual framework is based on both Classical and

[25] A. C. Pigou, *Memorials of Alfred Marshal,* New York: Kelley and Milman, 1956.

[26] A. C. Pigou, *Memorials of Alfred Marshal,* New York: Kelley and Milman, 1956.

[27] L. Colander, *History of Economic Theory*, USA: Houghton Muffin, 1989.
E. Roll, *A History of Economic Thought*, Fifth edition. England: Faber and Faber, 1992.

Neoclassical Economics it uses the same conceptual framework, but the literature on welfare economics, according to Churdhury,[28] is seen as more of the reformulation of the underlying Neoclassical methodology. Neoclassical welfare approach might be seen as offering a new concept, such as, externalities, however, it does not noticeably challenge the idea of the ultimate objective, which is to maximize aggregate utility or welfare. In other words, it is still not very clear how to determine aggregate happiness, satisfactions and beliefs in order to maximize aggregate welfare.

3. Alternative Approaches to Neoclassical Environmental Economic View:

3.1. Austrian Economic Theory

The Austrian economists, such as Cordate,[29] Mises,[30] Rothbard,[31] Kirzner,[32] Krecke, [33] Menger[34] and Lewin[35] argue intensively as to why they are against the Neoclassical efficiency approach and list their problems with this standard approach. The Austrian School economists reject standard Neoclassical theories as they have conceptually specious assumptions

[28] R. Choudhury, 'Ethics and Economics: A View from Ecological Economics', *International Journal of Social Economics*, 22(3), 1995, pp.18-25.

[29] R. Cordato, 'An Austrian Theory of Environmental Economics', *Quarterly Journal of Austrian Economics*, 28, 2004, pp. 3-36.
R. E. Cordato, *The Polluter Pays Principle: A Proper Guide for Environmental Policy Studies in Social Cost, Regulation, and the Environment*. Washington, D.C.: Institute for Research on the Economics of Taxation, 2001.
R. E. Cordato, 'Time Passage and the Economics of Coming to the Nuisance: Reassessing the Coasean Perspective', *Campbell Law Review,* 20 (2), 1998, pp. 273-292.
R. E. Cordato, 'Pollution Taxes and the Pretence of Efficiency', *Journal of Private Enterprise,* 10, 1997, pp.105-118.
R. E. Cordato, *Welfare Economics and Externalities in an Open Ended Universe*, Boston: Kluwer Academic Publishers, 1992.
R. E. Cordato, 'Knowledge Problems and the Problem of Social Cost', *Journal of the History of Economic Thought,* 14 (Fall), 1992, pp. 209-224.

[30] L. von. Mises, *Human Action,* Scholar's Edition, Auburn, Ala.: Ludwig von Mises Institute, [1949] 1998.

[31] M. Rothbard, *Toward a Reconstruction of Utility and Welfare Economics,* New York: Centre for Libertarian Studies, [1956] 1977.
M. Rothbard, 'Law, Property Rights, and Air Pollution', *Cato Journal* 2 (1), 1982, pp. 55-100.

[32] I. Kirzner, 'Welfare Economics: A Modern Austrian Perspective', In *Man, Economy, and Liberty: Essays in Honor of Murray N. Rothbard.* Edited by Walter Block and Llewellyn H. Rockwell, Jr. pp. 77-88. Auburn, Ala.: Ludwig von Mises Institute, 1988.

[33] E. Krecke, 'Law and the Market Order: An Austrian Critique of the Economic Analysis of Law', *Journal des Economistes et des Etudes Humaines* 7 (1), 1996, pp. 19-37.

[34] C. Menger, *Principles of Economics,* New York: New York University Press, [1870] 1981.

[35] P. Lewin, 'Pollution Externalities, Social Costs and Strict Liability', *Cato Journal* 2 (1), 1982, pp. 205-30.

which do not reflect the real world. The Austrians claim that even though these unrealistic assumptions have led to policy prescriptions for the last two hundred years, in reality they are completely non-operational.[36] In particular, the theory of externalities, which is one of the most important concepts of Neoclassical Environmental Economics, has been subjected to criticisms by many Austrian economists. For the Austrians the key problems with the conceptual framework of Neoclassical Environmental Economics are: i) efficiency is an individual goal seeking problem, not a value maximization problem; ii) costs are subjective and therefore social costs and social value do not exist as either measurable or even theoretical concepts; and iii) Pareto optimality is irrelevant as a real world efficiency benchmark.[37]

Fundamentally, the Austrians claim that the Neoclassical approach and its analysis does not explain a methodological foundation for identifying what is and isn't a pollutant [38] unless interpersonal conflicts are removed. To suggest a better definition the Austrian economists formulized their views on positive and normative analysis of environmental problems and defined pollution, environmental costs and policy matters from their conceptual framework. Therefore, unlike Neoclassical Economic solutions such as taxes and tradable permits to remove inefficiencies, Australians emphasize on eliminating interpersonal conflicts, such as privatization, 'polluter pays' and 'first come first served'.

i) Their Definition of Environmental Pollution

According to the Austrians, pollution is the kind of problem that creates an interpersonal conflict over the use of means, rather than only being a 'social cost' issue as Neoclassical Environmental economists claimed.

[36] R. E. Cordato, *The Polluter Pays Principle: A Proper Guide for Environmental Policy Studies in Social Cost, Regulation, and the Environment*. Washington, D.C.: Institute for Research on the Economics of Taxation, 2001.

[37] R. Cordato, 'An Austrian Theory of Environmental Economics', *Quarterly Journal of Austrian Economics*, 28, 2004, pp. 3-36.
A. Kneese, R. U. Ayres &. R. C. Arge, 'Economics and the Environment: A Materials Balance Approach', In *Pollution, Resources, and the Environment*, Edit. Alain C. Enthoven. New York: W.W. Norton, 1973.

[38] I. Kirzner, 'Welfare Economics: A Modern Austrian Perspective', In *Man, Economy, and Liberty: Essays in Honor of Murray N. Rothbard.* ed. Walter Block and Llewellyn H. Rockwell, Jr. pp. 77-88. Auburn, Ala.: Ludwig von Mises Institute, 1988.
R. E. Cordato, 'Time Passage and the Economics of Coming to the Nuisance: Reassessing the Coasean Perspective', *Campbell Law Review,* 20(2), 1998, pp. 273-292.

For this reason, the Austrians focus on how to compensate victims whose health is affected by air pollution, rather than how to deal with the costs to restore the environment. So the Austrians claim that once the concept of costs is separated from individual human beings, it loses its ground to conduct any economic analysis. In short, they believe that pollution, such as air pollution and its impacts on human health, cannot be separated and costs should be compensated.[39]

ii) Property Rights and Minimizing the Interpersonal Conflict

The Austrians recognize the importance of property rights in resolving environmental problems and they also believe that, unless the concept of property rights are clearly defined, environmental problems will continue to persist and people will suffer as a result of pollution. Menger[40] argued that all goods are to be classified as economic and non-economic goods. While economic goods must come under the rule of private property in order to avoid conflicts of interest regarding their usage, non-economic goods, such as air and water, are the cause for conflict of interest. Menger also proposed that the only practical solution to this conflict is to look at the economic aspects of these otherwise non-economic resources from the private property point of view and to solve the problem.

In terms of health impacts of air pollution, the Austrians first define the characteristic of air pollution as a consequence of human conflict over the use of this resource. Then they claim that the reasons for the impact of air pollution on human health must be found in property rights, which are neither clearly defined nor enforced, in the existing economic view.[41] To rectify the problem, the Austrians suggest conflict resolution. This means that once the source of conflict is described possible ways of resolving the issue can be identified by focusing on issues related to property rights.[42]

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[39] R. Cordato, 'An Austrian Theory of Environmental Economics', Quarterly Journal of Austrian Economics, 28, 2004, pp. 3-36.
P. Lewin, 'Pollution Externalities, Social Costs and Strict Liability', *Cato Journal* 2 (1), 1982, pp. 205-30.
M. Rothbard, 'Law, Property Rights, and Air Pollution', *Cato Journal* 2 (1), 1982, pp. 55-100.

[40] C. Menger, *Principles of Economics.* New York: New York University Press, [1870] 1981.

[41] L. von Mises, *Human Action,* Scholar's Edition, Auburn, Ala.: Ludwig von Mises Institute, [1949] 1998..
M. Rothbard, 'Law, Property Rights, and Air Pollution', *Cato Journal* 2 (1), 1982, pp. 55-100.

[42] R. E. Cordato, 'Pollution Taxes and the Pretense of Efficiency', *Journal of Private Enterprise,* 10, 1997, pp.105-118.
G. North, 'Undermining Property Rights: Coase and Becker', *Journal of Libertarian Studies,* 16 (4), 2002, pp. 75-100.

For example, if the tax is collected only to bring about the correct price/output combination and an 'optimal level of pollution', leaving the initial conflict unresolved, there would be no reason to consider the solution to be efficient from an Austrian perspective. Some of those solutions suggested by the Austrians will be discussed below.

iii) Property Rights, Public Policy and Solutions

Unlike Neoclassical Environmental Economists, the Austrians suggest that public policy decisions on environmental issues must focus on resolving conflicts over the use of resources that cause pollution, not on obtaining an ultimately unobtainable "efficient" allocation of resources. For Austrians the conflicts will be resolved in a much better way once we focus on clarifying titles to property and the enforcement of rights.

If a pollution problem and its health consequences exist, then its solution must be found in either a clearer definition of property rights to the relevant resources or in the stricter enforcement of rights that already exist. This has been the common approach, which has been taken regarding environmental problems by nearly all key Austrians.[43] In Neoclassical Environmental policy there are two solutions in order to compensate environmental pollution. These are the *polluter pay principle* and *first come first served principle*. The Austrians believe that both solutions have their own strengths and weaknesses. Therefore they look at them closely and examine their solutions critically.

iv) The Polluter Pays Principle

The polluter pays principle is a distinctive Neoclassical Economic welfare solution. As can be seen from the title main principle is to ask polluter to compensate the pollution. According to the Austrians there are two fundamental problems with this approach: a) it is fundamentally a form of market socialism and promotes central planning[44] as it gives too

R. Posner, *Economic Analysis of the Law*. Boston: Little Brown, 1973.

[43] L. von. Mises, *Human Action*, Scholar's Edition, Auburn, Ala.: Ludwig von Mises Institute, [1949] 1998.
M. Rothbard, 'Law, Property Rights, and Air Pollution', *Cato Journal* 2 (1), 1982, pp. 55-100.
P. Lewin, 'Pollution Externalities, Social Costs and Strict Liability', *Cato Journal* 2 (1), 1982, pp. 205-30.
R. E. Cordato, 'Pollution Taxes and the Pretense of Efficiency', *Journal of Private Enterprise,* 10, 1997, pp. 105-118.

[44] R. E. Cordato, 'Pollution Taxes and the Pretense of Efficiency', *Journal of Private Enterprise,* 10, 1997, pp. 105-118.

much power to the central authority, who is expected to set in advance what the efficient outcome will be; and b) the conflict or harm generated through pollution might still not be eliminated even if efficient price/output combination is achieved.[45]

Even if authorities agree on the efficient level of pollution and issue permits to potential polluters, in the aggregate, for the Austrians, after implementing such a policy you are still likely to be left with a pollution problem. The level of pollution will be less than before, but will still be there. Nevertheless, they suggest that once the property rights issue is redefined exactly as the Austrian economists pointed out, then the polluter pay principle could make sense. The polluter will be forced to compensate the costs of his/her pollutive activities to those whose property usage is being limited, or whose health is endangered. This might be done by eliminating the emissions, confining them to the polluter's own property, or by compensating the victims of the polluting activity by an amount that fully addresses the grievance.

v) First Come First Served

The second solution is the first come first served principle. This solution is used when the pollution problem arises and when property titles, and therefore property rights, are unclear.[46] However, in the case of air pollution it might not be as efficient a technique as the polluter pay principle. In order to reduce the uncertainty in the formulation process the amount and quality of information is captured in relative prices, but this might not be a good way to deal with air pollution.[47]

3.2. Green Economics

Green Economics is an influential approach, in which an economic system is considered to be a component of the ecosystem. Main contributors to Green Economic Theory are E. F. Schumacher, Murray Bookchin, Lewis Mumford, Miriam Kennet, Rachel Carson, Brian Tokar, Robert Costanza,

[45] R. McGee & W. Block, 'Pollution Trading Permits as a form of Market Socialism and the Search for a Real Market Solution to Environmental Pollution', *Fordham Environmental Law Journal,* 6, 1994, pp. 51-77.
D. Pearce, & K. Turner, ' Packaging Waste and the Polluter Pays Principle: A Taxation Solution', *Journal of Environmental Management and Planning,* 35 (1), 1992, pp. 5-15.

[46] M. Rothbard, 'Law, Property Rights, and Air Pollution' *Cato Journal* 2 (1), 1982, pp. 55-100.

[47] R. E. Cordato, 1998. 'Time Passage and the Economics of Coming to the Nuisance: Reassessing the Coasean Perspective', *Campbell Law Review* 20 (2), 1998, pp. 273-292.

David Korten, Buckminster Fuller, Herman Daly, Paul Hawken, Amory Lovins, Jane Jacobs, and Robin Hanson.

Like the Austrian Economists, Green Economists also claim that their view is fundamentally different from the Neoclassical Economic view. They argue that even though Neoclassical Economics represents the main body of modern economics today, Green Economics shares broader ecological and social concerns, including rejecting capitalism itself. For that reason, Green Economics goes beyond the narrower concerns of Neoclassical Environmental Economics, Resource Economics, and Sustainable Development, which are considered as subsets of Green Economics. Many Green Economists have been heavily influenced by Marxian views to develop an understanding of ecological issues and ecological economic alternatives. Now their main differences and key principles will be examined.

i) Main Difference Between Green Economics and Neoclassical Environmental Economics:

One of the most important differences between Neoclassical Economics and Green economics is based on localization. While Green Economy generally favours *local measures* and localized *grassroots* institutions[48] over paternalistic and elite-driven global institutions such as the IMF, World Bank, WTO, Neoclassical Economics goes for global measures and global institutions.

Another very important difference between these two views is that Green economists put the ecosystem at the centre rather than classifying the ecosystem as an externality as defined with Neoclassical economists. For this reason Green economists believe finite space cannot be expandable forever and finite resources cannot be used forever and everything in this ecosystem is interconnected.[49] It is because of these reasons that almost

[48] H. Colin, *Localization: A Global Manifesto*, London: Earthscan, 2000.

[49] M. Brian, *Designing The Green Economy: The Post-industrial Alternative to Corporate Globalization*, Lanham. MD: Rowman & Littlefield, 2000.
W. Derek, *Babylon and Beyond : The Economics of Anti-Capitalist, Anti-Globalist and Radical Green Movements*. London: Pluto Press, 2005.
J. Michael, *The Green Economy.* Vancouver: University of British Columbia Press, 1993.
G. McRobie, *Small is Possible*, England: Abakus, 1981.
M. Woodin & C. Lucas, *Green Alternatives to Globalization: A Manifesto, London: Pluto Press, 2004.*
M. S. Cato & M. Kenneth, *Green Economics: Beyond Supply and Demand to Meeting People's Needs*, Aberystwyth: Green Audit Books, 1999.

all Green Economists regard *economic growth* as a delusion. The idea of economic growth not only contradicts the idea that it is impossible to expand forever into a finite space, but it also causes destruction and degradation in the life support capacity of the natural ecosystem: air and water filtering, food production, fibre growth. For them nature is a service producing natural capital and life on the earth depends on this basic capital. Therefore, we have to maintain, preserve and protect nature. In their mind when we look after nature, so there will be no pollution and there will be no negative impact of pollution on human health. To be able to control our damaging activities they recommend we should focus on local measurements rather than global ones as they are much more achievable.

For example, Schumacher[50] was one of those scholars who emphasized the value of localization. In his argument he says that activities such as gardening, would require *use-value* in the economic process and would de-emphasize the value of resource, commodity or product measures. In addition, Schumacher also looked critically at the concept of economic growth and agreed to the impossibility of expanding forever. Many other Green economists contributed significantly to a green microeconomics, and proposed to establish an educational network that both formalizes its educational tasks and systemizes connections with the rest of the community.

ii) Their Key Principles:

To be able to eliminate environmental pollution and its negative impacts, such as health related problems, Green economists suggest a number of key principles, such as:

a) We need to focus simultaneously on both human and environmental needs, not *materialistic wellbeing* itself. We should understand that matter is to satisfy our needs, and it is not the main purpose for our existence. However, human beings need more than material wellbeing. They also need things like values, peace, harmony, etc.

b) For million and million of years nature itself has not created as much waste as we have over the last one or two hundred years. In nature there is no waste, as every process output is an input for some other process. So we can copy nature in terms of our economic activities, such as production, which can be non-toxic food for some other process.

[50] E. F. Schumacher, *Small is Beautiful,* England: Abakus, 1973.

c) Each regenerative activity should have its own matching appropriate scale of operation. Even the smallest activities have larger impacts on nature and human health. Therefore, we have to be very careful when we decide what to produce and how much to produce in order not to cause any irreversible action.

d) We should protect the diversity of life on earth as our existence depends on it. Each day, more than one hundred species are becoming extinct, and our natural resources that sustain life on the planet - air, water and soil are becoming polluted or depleted at an alarming scale together with exponentially increasing human population growth. Even though we cannot reverse this extinction, we can stop it. We should realize that our existence depends on clean water, air and soil.

e) Self-reliance is a very important ingredient to be independent. In an economy which moves with ecosystem processes, there is tremendous scope for local response. Design and adaptation must be provided for these local and regional responses for more flexible and holistic interdependence. This will bring about greater success.

f) Participation in environmental related decisions is fundamental for direct and widening democracy. Pluralistic societies with established democracy will take better environmental related decisions than non-democratic societies.

In short, Green Economy has been affected by the Marxian Economic perspective and favours 'local measures' and localized 'grassroots' institutions over paternalistic and elite-driven global institutions, such as the IMF, World Bank, WTO and multinational organizations. This idea directly opposes that of the Neoclassical Economic view.

3.3. Ecological Economics

Ecological Economic Theory is a newly-adopted branch of economics that addresses the interdependence and co-evolution between human economies and natural ecosystems. The main scholars in this field are Robert Costanza, Herman Daly, Nicholas Georgescu-Roegen, David Harvey and John Bellamy Foster. It has similarities to Green Economics but it also differs from this theory in its distinctive objective, which combines economic thinking, knowledge of biology and the laws of physics. In other words it is a mixture of social science and scientific realities. Therefore its

goal is to improve human welfare through economic development, which is based on balance between ecology and human needs. Similarly, the main differences, principles and solutions of Ecological Economics will be examined closely to understand the basic conceptual framework.

i) Main Difference Between Ecological Economics and Neoclassical Environmental Economics:

Like other schools and approaches, Ecological Economics also criticises Neoclassical Environmental Economics as they are myopic, closed-minded to the environmental facts, and they believe the environment to be a subset of human economy. They claim that it is unfair for Neoclassicists to suggest that economic pollution and its harmful impacts on human health are something that can be eliminated very easily by paying compensations. Nevertheless the Ecological Economic Theory combines ecology with human economy and ecological economists suggest that they offer better solutions to the problems. For them, while the ecology side deals with the energy and matter transactions of life and the earth, the human economy is by definition contained within Ecological Economics.

Similar to the Green Economic Theory, Ecological Economists also believe that infinite economic growth is not possible and not desirable as our resources are limited and cannot be expanded forever. Even though nature is limited it is claimed that it already provides us with what we need and there is no need to destroy nature to get more. According to some estimations the price of the services provided by the environment, in looking at the price to filter water and other such services, is to be something around 33 trillion dollars.

Rather than focusing on economic growth they suggest sustainable development. Furthermore, they believe that sustainable development is the only means of improving the standard of living for citizens worldwide. According to Ecological Economists while quantitative economic growth emphasizes per capita consumption, which can have harmful effects on the environment and even on the broader societal wellbeing, sustainable development concentrates on improving the quality of life.

ii) As an Interdisciplinary Approach:

In addition Ecological economists are inclined to acknowledge that much of what is important in human well-being is not analyzable from

a strictly economic standpoint and they suggest an interdisciplinary approach to complex issues such as pollution. They claim that both social and natural sciences, as a means to address issues, should form a platform to solve problems.

iii) Solution of Ecological Economics to Protect the Environment:

Costanza and Perrings[51] provide an example of how to combine *what we now know about the uncertainties of environmental protection* with *what we also know about the difficulties of more direct forms of social control such as regulation or outright prohibition*. In order to develop more cost effective, less intrusive, and generally more positive stimuli to protect and/or manage environmental use, they evaluated a *flexible assurance bonding system*. This bond would be required by developers and would be set equal to the largest estimated potential environmental damage that might occur from the proposed action. The bond would be kept in an interest-bearing account and would be returned to the developer with some of the interest as soon as the firm proved that the damage would or could not occur. If the catastrophe did occur the bond would be used to compensate those harmed or to help repair the damage. But no further payment would be required from the developer.

They also suggest that a better solution to achieve a sustainable ecological and societal system is to educate consumers about the need for living in harmony with nature. This will prevent government intervention and allow consumers and producers to act in the interest of the ecological economy.

3.4. Conclusion

Three very distinct views on environmental problems, like the Austrian Economics, Green economics, and Ecological Economics are presented in this study to highlight their key differences with Neoclassical Environmental economics as well as with each other. However, they strongly agree on the fact that each of them is against Neoclassical Environmental economic assumptions and they all criticise this standard view from different angles. The efficiency problem, as typically seen by Austrians, is the generation of human conflict and disruption to inter- and intra-personal plan formulation and execution. This is in contrast to either

[51] R. Costanza & C. H. Perrings, 'A Flexible Assurance Bonding System for Improved Environmental Management', *Ecological Economics,* 2, 1990, pp. 57-76.

Pigouvian environmental economics, which defines pollution problems primarily in terms of resource allocation. On the other hand, for Green economists, the highest efficiency is achieved through self-sufficiency and optimal scale of operation. Finally, for Ecological Economy, efficiency means to protect the social and ecological system.

It is also demonstrated that the property rights approach to policy analysis taken by the Austrians is different from the Neoclasssical view in the context that the social purpose of private property is to resolve interpersonal conflicts and allow for the peaceful pursuit and fulfilment of plans. However, as Green Economics object to capitalism and defend socialism, the property rights issue has a different dimension in their arguments. However, some Green economists have begun to look at more holistic and internally consistent aspects even though they are led by materialist philosophies.

Nevertheless, with the constructive criticism of alternative approaches the formulation of environmental policy within the standard approach has recently experienced some improvements as there is general understanding among Neoclassical Economists that their indefinable concepts of social cost and general equilibrium might not be implemented in the real world. In addition, they accept the idea that their role is to devise efficient methods for achieving politically determined pollution or emissions targets.[52]

4. Conclusion: What Must The Role Of Economics Be To Eliminate Air Pollution In The Future?

Once Colander[53] stated, 'Economics is a relatively young discipline', but is a very powerful tool. Even though the history of economics as a distinctive subject does not go back beyond 1500 AD and the quantity of economic literature only increased significantly in Western Europe between 1500 and 1750 and a body of economic knowledge only began to evolve during the period from 1776 to 1876 with an increasing interest in the discipline of political economy, Economics plays a central role in shaping the activities of the modern world by imposing criteria of what is economic and what is uneconomic[54] If there is no other set of criteria

[52] L. D. Orr, 'Social Costs, Incentive Structures, and Environmental Policies', In *Bureaucracy vs. Environment: The Environmental Costs of Bureaucratic Governance*. (Edited) by J. Baden and R. Stroup,. Ann Arbor: University of Michigan Press, 1981.

[53] L. Colander, *History of Economic Theory*, USA: Houghton Muffin, 1989, p. 1.

[54] E. Roll, *A History of Economic Thought*, Fifth edition. England: Faber and Faber, 1992.

that exercises a greater influence over the actions of individuals, groups and governments more than economic criteria, so there is no reason for us not to understand the role of economics in the context of environmental pollution. The influencing power of economics over the policy decision mechanisms and over the economic education is so powerful that we need to use its pragmatic solutions for the environmental problems before it is too late.[55]

The birth of Neoclassical Economics was very impressive. In particular the final three decades of the nineteenth century witnessed the beginning of the modern microeconomic theory. Notably the introduction of a new set of analytical tools, such as marginal analysis, helped to transform classical economics into neoclassical economics. The development of marginal analysis was significant because it initiated an appreciable increase in the use of mathematics in economic analysis. Even today Neoclassical Economic analysis plays a fundamental role in any economic decision, such as consumption, production and policy-making. For example, as mentioned in section three, cost-benefit analysis is the major public policy methodology used in reaching environmental decisions and shaping environmental regulations at any national, international or supra-national level.

Despite the fact that Neoclassical Economics is very influential over the decisions of individuals, firms and governments, it has received a great deal of criticism from different economic schools, environmentalists, philosophical approaches and religious ethics. As discussed in previous sections Austrian Economics, Green Economics and Ecological Economics are among the most influential critics of Neoclassical Economics. Although all these critics have their differences they agree, however, on the ethical side of the misuse of the environment For example, an from ethical point of view some scholars claim that methodological individualism assumption is the key to a better understanding of the mental structure of the Neoclassical school. For Choudhury:[56]

"Neoclassics present the individual as self-seeking individual, who chooses himself/herself against others for optimal share of resources

[55] Institute for European Environment Policy, *Workshop on Best Practices in Analysing and Developing Environmental Policy*, 15 November 2005. Brussels: Workshop Report, 2005.

[56] R. Choudhury, 'Ethics and Economics: A View from Ecological Economics', *International Journal of Social Economics*, 22(3), 1995, p.17.

under the motive of enhancing the goals of economic efficiency in the midst of market consequentialism. The resulting competition explained by the Neoclassical principle of substitution, in fact, can be interpreted as a picture in duality of being. In respect to the trade-off between economic efficiency and distributive equity, there is duality between these moral and material aspects of human welfare."

Unfortunately the moral aspect of human welfare is the one which, in most cases, is sacrificed in exchange for material aspects of human welfare.

It is widely accepted that that distributive equity is not the priority for Neoclassical Economic order and, as long as there are rational choices, the economic motive would be enough to maximize profits, utility, output and productivity. So the ethical goal of distributive equity will inevitably be less attractive, and more costly to attain than economic efficiency. As a matter of fact it is inevitable that individuals will face a very important dilemma here. If less equity is chosen over more equity it implies an unethical choice. Because the demand and need for equitable distribution remain unsatisfied, there will be imbalances in the economy. On the other hand, if more equity is chosen over less, then a sacrifice of economic efficiency must be made somewhere in the economic system. Nevertheless, in much more complicated economic systems such a trade-off between greater distributive equity and lesser economic efficiency becomes unrealistic in a market of output-optimizing firms and utility-maximizing consumers.

Therefore the principle of substitution, as can be observed in the context of environmental pollution, permits the choice between ethical and unethical bundles as a permanent possibility that cannot change in the long run with the advance of knowledge respecting these choices. The choice between ethical and unethical bundles, in fact, should not even be a subject for environmental issues as we depend on nature. Economics should recognize the fact that humans and their economies are parts of larger natural ecosystems. There is a material and energy basis for the relations between human economies and their ecosystems, defining not only economic, but social, structures and processes.[57] Economies possess general ecosystem properties, such as dynamism, evolution, integrity, stability and resilience. The magnitude of potential impact on their own

[57] M. Paul, *Energy Beyond Oil,* Leicester: Matador, 2005.

welfare through effects on natural systems requires that human decisions be guided by some notion of the value of their actions and the value of their impacts on ecosystems, either in terms of benefits of use or costs of abuse. Some concept of value is required for rational activities of human economies within their natural systems.

We have moral and cultural values for the natural system. These values are immeasurable and incomparable using traditional human preferences on the assumption that agents are rational, and may not be reflected in the simple summation across social members of individual values, since they are social and not wholly private. Establishing conditions on human economies would allow for the sustainability and growth of human welfare, conditioned upon the sustainability of the economy's supporting ecosystem.[58] In that sense, sustainability has developed as an additional consideration for public policy decision making precisely because of the concern that the process of discounting may steer us towards policies that overly emphasize short term gain. However, we have to keep in mind that, like the consideration of efficiency, consideration of sustainability provides the decision maker with additional information, but does not itself make the decision. Our main task should be establishing a way of using the ecosystem more effectively to enhance human wealth and welfare.

To reduce environmental pollution, we should:

1) Examine the implications of various moral systems for the sustainability of human welfare and place in bold relief those instances where there are apparent incompatibilities between moral systems and sustainability norms

2) Understand the interdependence between economies, human beings and natural systems. This includes understanding the tolerances of ecosystems to human-induced changes as well as the tolerances of economies to ecosystem changes.

3) Create opportunities for human economies that would allow for the sustainability and growth of human welfare, conditioned upon the sustainability of the economy's supporting ecosystem and effectiveness of solutions

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[58] C. Lord, *A Citizens' Income: A Foundation for a Sustainable World*. Charlbury: Jon Carpenter, 2003.

4) Develop key regulatory instruments, laws and associated institutions that assist human economies in attaining sustainable welfare development goals.

To control air pollution and its health impacts specifically we should:

1) Create an emerging technology for a greater convergence between the economics and public health approaches to assessing the burden of diseases from air pollution causes as a positive sign that should be further encouraged.

2) Establish an interdisciplinary approach from different fields and combine the effects of various experts and institutions that work in the overlapping areas of public health, environment and economics which can significantly contribute to influencing the policy makers and the public and leverage decisions that bring large environmental health benefits.

3) Valuate illness and premature death as consequences of air pollution in particular in developing countries as this issue needs more attention from the international communities of economics and supporting institutions

In summary, air pollution causes real damaging impacts on people's health. From asthma to heart disease to certain kinds of cancer, the air we breathe can have a fundamental bearing on our health. Achieving tighter air quality standards through regulations could be an appropriate policy aim as a range of technologies, tools and alternatives are available to help clean up our air, and companies and governments should regard this as a priority - especially for those areas and communities who remain most polluted and at most risk. However, the most important thing we need to change should be the way we think about what to produce, how to produce and for whom to produce. These are the fundamental questions for economics and we need to change our understanding of economics in the first place to reverse the damage that we have caused to nature. We should also understand the fact that the Earth is for all of us, not only for a minority. We cannot economically grow as it is impossible to expand forever into a finite space, and we cannot ignore future generations.

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