An Assessment of the Growth Debate: A Comparison of Perspectives

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Abstract

The debate on growth versus environment, including the more recent literature on sustainable development, is systematically evaluated in a stylized framework. Diffent perspectives on the conflict and relation between the economy, growth and the natural environment, have created a situation where people do not talk the same language. A conceptual framework is developed which allows to explain main diffences between alternative perspectives. Five categories are distinguished, labelled as: "the immaterialist", "the pessimist", "the technocrat", "carpe diem" and "the optimist". Both the conceptual framework and a set of characteristics (time horizon, ideology, prediction and policy implication) are used to compare these perspectives. Primarily the choice of a time horizon and the subjective evaluation of technical potential, the flexibility of social preferences and institutions, and the stability and resilience of natural systems, explain differences between the perspectives. Such a systematic confrontation is hoped to contribute to more consensus and understanding between supporters of alternative perspectives.

1. Introduction

The relationship between growth and environment has been controversial for a long time. Some economists have argued that a rise in Gross Domestic Product (GDP) will doubtlessly harm natural environments (see Daly in this book for an anti-growth perspective). Indeed, during the last few decades economic growth has gone along with a substantial increase in energy use, congestion and transformation of land cover. Other economists have maintained that the economy can grow forever without harming the quality of the environment. Technical progress is then considered as a critical factor for reconciling growth and environment (see Beckerman in this book for a pro-growth perspective).

These different views on growth and the environment often give rise to unfruitful debates between advocates and opponents of growth. The aim of this chapter is to provide some clarification about this debate, and in particular to assess the economic (contra-)arguments. The standard economics perspective is essentially welfare-based, or even more restricted, namely GDP-based, where environmental destruction is only regarded as a problem in sofar as it affects the present value of market exchange (or welfare in welfare/externality theory). Alternative non-anthropocentric (ecocentric or biocentric) views exist, such as based on intrinsic values in nature (see Glasser in this book), and these can explain some of the perspectives on growth versus environment discussed in Section 4 (notably the first one).

We pay attention to both the old "growth debate" and the recent literature. Indeed, the introduction of the concept "sustainable development" can to some extent be regarded as a re-opening of the growth debate (see Pezzey, 1993; and van den Bergh, 1996). Reference to the wide literature on sustainable development will be minimized, however, as this is addressed in particular in other contributions in this book. Although the various publications on the conflict between economic growth and environmental conservation together offer a range of perspectives, a systematic comparison of these is usually lacking. Here such a comparison is aimed for, based on a general framework and carefully chosen criteria.

2. A static view on economy and environment

Standard economic theory distinguishes the following exogenous factors that characterize a market economy at each moment in time:

(b1) Institutions and conventions
(b2) Population
(b3) Preferences
(b4) Technology and knowledge
(b5) The stock of man-made capital

Note that not only the market mechanism, but also the social cohesion and community structure, and public policies and institutions are included under (b1). Environmental economists usually distinguish two important links as to the interaction between the economy and the ecological system. First, the environment serves as a factor of production, in terms of natural resource supply, availability of space, provision of production conditions for agriculture, forestry and fishery, supply of basic human needs such as fresh air and fertile soil, and storage and assimilation of waste. Second, the

environment is a consumption good in terms of its direct impact on the well-being of people. In both respects, the environment amounts to a basic economic factor. Consequently, we add it as a sixth element to the set of basic factors:

(b6) The stock of environmental capital

The market mechanism is an institution (b1) which generates prices for goods and factors that reflect relative scarcities in the economy. Scarcity of some good is determined by household preferences (b3) and technology (b4). Together with the stocks (b5) and (b6) and the size of the population (b2), these determine the *scale* on which economic activity takes place. However, also the *composition* of economic activities is the result of market behaviour. This composition can be characterized by the following three structures:

(r1) The input mix of production, i.e. the use of labour, capital, energy, virgin materials, recycled materials and abatement technology;
(r2) The composition of demand, i.e. commodities, services, environmental goods, leisure;
(r3) The output mix of production, i.e. commodities, services, pollution.

The basic factors (b1) - (b6), that underlie the economic framework, and the resulting economic structure defined by (r1) - (r3) describe, in a nutshell, the basic context in which the relationship between economic growth and environmental preservation can be discussed.

3. Growth and the environment

Section 2 provides a static view on the relation between the economy and the environment. Economic growth, however, is a dynamic concept. It is generally defined as the increase in the total value-added of marketable, man-made goods and services in the economy. In our model, dynamics can be introduced by exploring changes in the basic factors (b1) - (b6). In particular, developments in factors (b1) - (b3) are usually considered to be more or less exogenous to the market economy. These factors depend, for instance, on cultural change (b3) and public policy (b1). The latter is important in the present context as it allows for studying the influence of environmental regulation on the relationship between growth and environment. Of course, if policy is regarded as an endogenous process, this means also (b1) will have to be endogenized. For a long time, economists have treated technical change (b4) also as an exogenous trend. However, since the development of endogenous growth theory, technology is generally considered to be an endogenous factor which depends on economic decisions such as education and R&D activities. The stock of physical capital increases in time through investments. We consider knowledge as a factor determining technical change. Alternatively, it may be considered as a human capital good, similar to physical capital (see, e.g., Smulders, 1994). Note that economists do generally not take the impact of technological change on behaviour and preferences into account. The stock of environmental capital is linked to economic activity in such a way that it deteriorates due to extraction of natural resources and emissions from production and consumption processes. However, nature has some regenerative and assimilative capacity through which the stock of environmental capital may recover.

Traditionally, an important question for economists is how development with respect to basic factors affects, on the one hand, the value-added of marketable goods and services as measured by (real) GDP and, on the other hand, the quality of the natural environment as measured by the physical stock of environmental capital? The difference between *economic value* terms which relate to economic activity and *physical* measures associated with the environment is crucial here. If development implies a continuous increase in value-added, the crucial issue is whether this can be reconciled with an environmental sustainability constraint, such as a constant or non-decreasing stock of environmental capital. It shoul, however, be noted that the economic valuation, based on individual preferences - either via prices, indirect market-based assessment or stated preference - has been much criticized (see, Bromley, 1995; and Gowdy, 1997).

A second important note to the above conceptual framework is that it is not meant to imply only an equilibrium perspective on growth. Of course, standard growth theory has devoted most attention to growth in equilibrium. Ayres (1997) regards this as an oxymoron, because all incentives to individual agents to buy, to sell, to invest, to invent or to innovate, arise only and directly as result of some equilibrium. One might even conjecture that the further away from equilibrium, the stronger these incentives will push agents to react in a destructive or constructive way. As opposed to traditional and modern neoclassical growth theories, alternative models of technological progress and economic evolution focus attention on disequilibrium conditions as essential for, and inherently linked to economic and technological change. Gowdy (this book) gives a broad entrance to this literature. Van den Bergh and Hofkes (this book) offer a survey of models supporting the various perspectives on growth and environment. The discussion here will focus attention on assumptions, interpretations and implications of alternative perspectives, in the context of the above sketched framework, and skip further reference to formal models.

4. Five perspectives on growth and environment

Below, we consider five different views on the potential for reconciling growth and environmental preservation, and relate these to the above discussion of changes in basic factors (Δb1) - (Δb6), as well as changes in economic structure as represented by (Δr1) - (Δr3). In addition, we pursue an explicit treatment of the interdependence between environmental quality and long-run growth. This distinguishes our classification from other ethical or basic views on environment and nature, often presented in introductions to environmental science and ecological economics (see, e.g., van den Bergh, 1996). In particular, the taxonomy 'technocratic' ('cornucopian' and 'accommodating') and 'ecocentric' ('communalist' and 'deep ecology') is often used (see Turner *et al*. 1994, p. 31). Here we are more focused on the *long run*, both in terms of economic and environmental time scales. Clearly, any view on the relation between these will affect ones perspective on growth and environment. For instance, some people believe that the market, if appropriately guided by environmental policies - notably price-oriented - can take long-run goals and values in account. Other are more pessimistic, pointing at myopic behaviour on the part of both economic agents and policy-makers or politicians.

The first perspective questions mainly the desirability of growth. The other four perspectives deal with the technical ability (perspectives (ii) and (iii)), the socio-economic endogenous resolution potential (perspectives (iv) and (v)), and the capability of nature itself (perspective (ii)), to harmonize economic growth and environmental conservation and preservation.

(i) The immaterialist: Growth is undesirable

The first perspective addresses the issue of whether economic growth is desirable or, in other words, whether growth contributes to the goals we strive for as individuals or communities. Several authors have pointed out that economic growth in general does not coincide with a rise in welfare or well-being. In contrast, if economic growth is associated with degradation of the natural environment we should evade growth (see e.g. Mishan, 1967 and 1977; Schumacher, 1973; and Daly, 1991. An overview is given in Daly and Townsend, 1993, and an unequivocal dismissal by Beckerman, 1976 and 1995; see also the previous two chapters).

Some of these authors indicate that there is a distinction between limited absolute needs - like food, clothing, shelter, clean water, health care - and relative desires - i.e. relative to the perceptible (material) welfare or consumption of other individuals in the community (see Daly, 1991, p. 40). For the first category boundless growth is not required. For the second category it cannot give rise to continuing improvements in individual welfare for everyone. From completely different angle, a non-anthropocentric ethic based on intrinsic values in nature (Deep Ecology) can also provides strong support for this perspective.

(ii) The pessimist: growth is impossible in the long run

The pessimist states that economic growth will inevitably lead to an irrevocable depletion of natural resources and to an irreversable degradation or destruction of natural and environmental constituents. Hence, perspective (ii) is pessimistic about the technological potential ($\Delta b4$) to prevent further environmental damage at continuing economic expansion. As the economy requires a minimal availability of environmental quality and resources, there are limits to growth. This perspective has been elaborated in studies by the Club van Rome (see Meadows *et al.*, 1972 and 1992. Reactions on the first report are summarized in Lecomber, 1975; on the second report, see Nordhaus, 1992). A recent study by Duchin and Lange (1994) used an extended an updated version of the well-known Leontief multiregion multisector input-output world model to test the Brundtland commission's statement that growth and sustainability can go together. Their conclusion is strongly negative, and they argue that we should rethink how to integrate development of rich and poor countries with environmental sustainability.

An important element for perspective (ii) is the second law of thermodynamics. This law states that, in order to sustain or develop a system, low-entropy materials and energy should be imported, while high-entropy materials and energy should be exported (see Boulding, 1966; and Georgescu-Roegen, 1971). The traditional economic approach is incomplete here because it examines relative scarcity and optimal allocation based on relative prices. No price-system can reflect absolute scarcity. A related critique is that economists only deal with allocation, and not with (optimal) scale and size of an economy (Daly, 1991). A shift in the use of energy and materials in production and consumption can thus be regarded as a way to relax the limits to growth until the point is reached where all thermodynamic potential improvements have been exhausted. Georgescu-Roegen (1971) has demonstrated that a distinction between actors ("funds") and material and energy inputs ("flows") is of the utmost importance to perform a correct calculation of substitution options. Substitution among different types of materials should be regarded in terms of "replacement" (e.g., metal by plastics), and is different from substitution between labour (or capital) and materials which

can be characterized by "saving" of materials or energy (see e.g. Ruth, 1993, and in this book; and Smulders, 1995).

A second reason why economic growth in the long run is impossible is that it exerts a negative impact on *living* organisms and systems. Once the carrying capacity to life on earth is severely degradaded, economic growth and perhaps even survival of mankind are jeopardized (see Clark and Munn, 1986). Concrete focal points are the greenhouse effect, tropical deforestation and loss of habitats and biodiversity around the world (see e.g. Arrow *et al.*, 1995 and *Ecological Economics*, 1995). Worrying in this context is the often mentioned approximate figure of 40% of the natural products of photosynthesis that humans have presently appropriated (Vitousek *et al.*, 1986). Furthermore, ecologists worry about the stability of ecosystems on a larger scale, including systems not directly used by humans, and wider life-support functions. In the context of this particular reasoning, one may regard the debate as mainly one between concerned biologists and optimistic economists, with the first group tending to focus on precautionary and the second on optimization strategies.

(iii) The technocrat: growth and environmental quality are compatible

The technocrat argues that it is not possible to uniquely relate economic growth, in the sense of an increasing valuation of man-made goods and services, and an expansion of the physical size of production and consumption, in the sense of use of materials and energy ("throughput" in the terminology of Daly, 1991). Indeed, we not only add value to products and services by means of physical flows, but also via labour, knowledge and technology. In other words, just like a labour theory of value, a materials or energy theory of value will be incomplete. Therefore, the question should be whether an economy can realize an ever growing value added on the basis of a finite amount of natural resources and environmental capacity for storage and assimilation of waste.

The technocrat shows a positive attitude to this issue, as opposed to the pessimist of perspective (ii). According to the technocrat there are options to permanently relax the limits to growth via three channels. First, there are substitution options replacing non-renewable resources or polluting factors in production by renewable capital (Δb5) and cleaner factors. Substitution will be encouraged if the environment as a production factor becomes scarcer. In that case, prices of resources increase, other prices will rise, and producers and consumers will search for inputs, goods and services that are less environmentally damaging or less resource intensive. Second, investments (Δr1) and technological progress (Δb4) may imply a same level of production with less resource use and environmental damage. Third, recycling of materials and re-use of products (Δr1) can give rise to a lower level of environmental pressure. All three mechanisms emphasize the significance of "environmental technology" for harmonization of growth and environment (see Dasgupta and Heal, 1979; Simon and Kahn, 1984).

(iv) Carpe diem: growth and environmental degradation are inevitable

Suppose technical possibilities can reconcile growth and environment: Will mankind be capable of turning economic development in a way that is sustainable? The answer depends on one's confidence in the adaptive capacity of people, society, government and policy. The fourth perspective shows little of such confidence, and also states that the economic development path can hardly be

influenced. Both the rate and the direction of growth are the result of economic decisions by households and firms at the micro level, largely beyond the control of any planner. Besides, the aspirations of governments regarding economic and social stability nowadays are restricted by international relations and institutions. The evolution of the natural environment is in this perspective not open to discussion: it merely depends on individual actions and public support for environmental policy. According to perspective (iv) preferences will not adequately affect (Δb4), so that economic development will be disastrous for the environment. Just like individuals do not have eternal life, mankind may become extinct some day (see, e.g., Aalbers, 1995).

(v) The optimist: growth is necessary for environmental conservation

Changes in preferences (Δb3) and institutions (Δb1) are important for environment and economy. When people care more about the environment -- for example, because specific environmental problems become pressing, or more information becomes available -- the demand for polluting goods may drop (Δr2). Furthermore, the consumer may behave more consciously regarding environmental impacts of her actions, and become more supportive of stricter environmental policies. This can lead to a changed, "cleaner" structure of production activity (Δr3) and consumption.

Optimists have a positive attitude towards such changes in preferences. Some optimists even think that these, as well as institutional transformations, occur in response to economic growth. In other words, optimists highlight the luxurious-good character of the natural environment: growth is an imperative for environmental preservation as it enforces the public support as well as financial means for stringent environmental policy.

5. Evaluation

The five perspectives are summarized and systematically compared in Tables 1 and 2. The first table shows which elements from the theoretical framework of Section 2 are emphasized in the various perspectives. It is clear that this table implies that each perspective can be regarded in terms of a specific weighting of the various factors, and changes therein, as outlined in Section 2 and 3. This may give an indication of the completeness of the models that are implicitly underlying the perspectives. Table 2 contains a summary of the previous section. The perspectives are seen to mainly differ in the following ways: they (implicitly) adopt distinct time horizons; they evaluate different technical capacity to harmonize growth and environmental quality; and they start from different views on mankind.

-- insert Tables 1 and 2 --

An evident question is whether it is possible to indicate which perspective receives most support from facts? The immaterialist perspective (i) may be considered as the most critical on the conventional economic analysis of growth. It fundamentally criticizes the assumptions and implications of the standard (neoclassical) economic theory. In a concrete sense, it argues that it is certainly incorrect to think that we increase our welfare as long as the GDP rises, even if environmental quality remains unchanged.

The pessimist perspective (ii) directs the attention mainly onto the physical and biological-ecological dimension of the economy. Most economists nowadays admit that there are physical limits

to the size of production, and infinite physical growth is thus not possible. In addition to this, there is much uncertainty about the natural resilience and stabilizing capacity of the biosphere, among other things, with respect to the increase of greenhouse gases in the atmosphere. The main problem in applying these insights, however, is that the physical scale of the economy is still increasing, both in terms of materials and energy use. The dilemma of perspective (ii) is that there is no straightforward and universal relationship between the value added, and the physical requirements for production and consumption. In principle, the economy can grow without physical growth. Service sectors may have a large growth potential, although physical capital, materials and energy are required. For the moment, however, efficiency seems to be increasing, especially due to modern information technology. In response to this, many supporters of perspective (ii) emphasize that complementarity prevails over substitution as a relationship between, on the one hand, environmental capital - provision of production and consumption conditions and goods - and material/energy use, and, on the other hand, production factors like labour and man-made capital. To support this, differential characteristics of environmental capital are often stressed, notably uniqueness, irreversibility and multifunctionality. In other words, perspective (ii) adheres to the concept of strong sustainability, i.e. limited substitution of environmental by economic capital (see Daly and Cobb, 1989; and Pearce *et al.*, 1990).

The "carpe diem" perspective (iv) is rather cynical and leaves us little hope and room for discussion. To counter it, some authors note the fact that "economic growth has been a relatively episodic phenomenon in human history" (Ayres, 1997, p2). Furthermore, some confidence in mankind is necessary to be able to find solutions to pressing economic-environmental conflicts. Both the technocrat and the optimist show such confidence. Both believe that growth is certainly feasible without further degradation of environmental capital. In the past, mankind has shown many times that she has plenty of ingenuity and flexibility to react adequately to large scale environmental transformation and threatening resource scarcity. Perspectives (iii) and (v) are therefore optimistic regarding technological options, adaptive preferences, and changes in behaviour and institutions. Perspective (iii) contrasts mostly with the thermodynamically motivated perspective (ii). However, it is difficult to come up with an absolute limit to the economic output in value terms that can be obtained from a given material/exergy resource input (Ayres, 1997, p.28). Optimists go one step further, and believe that the environment has many characteristics of a luxurious good. Hence, economic growth is considered as necessary for increasing consciousness regarding nature and environment. Indeed, empirical research indicates that for a specific class of environmental problems the relationship between income and the level of environmental pressure shows an inverted-U curve (see de Bruyn and Heintz in this book). This curve indicates that if the income level is low people care little about the environment. Beyond a certain turning point, however, economic growth does no longer go along with further environmental degradation. Growth even may motivate such an increase of environmentally supportive and enhancing activities so that it becomes compatible with an improvement of environmental quality. The conclusions of these empirical studies can, however, be criticized on several grounds. First, results obtained from cross-section data (various countries) cannot be simply translated to (future) time series for specific countries. Second, the existence of international trade and reallocation of activities generate problems of interpretation because a complete account of interactions between the spatial distribution of economic activities causing high environmental pressure is missing. Finally, empirical studies only focus on particular aspects of

environmental pressure that are not representative for categories of environmental problems that are related to the carrying capacity and natural resilience of ecosystems (see Arrow *et al.*, 1995; and Ayres, 1995).

6. Conclusion

In general, it is difficult to conclude unequivocally about the reconciliation of environmental conservation and preservation and growth objectives. Moderate optimism characterizes many individuals and policy documents, largely based on facts which argue that we have solved similar problems in the past. An important objection against optimism is that one cannot simply extrapolate historical trends, certainly not in the long run. Instead, trends should be questioned, based on theoretical and empirical approaches covering all relevant issues related to ecosystem resilience and destruction, unique and scarce resources and serious pollution and health risks.

Different perspectives have created a situation where people do not talk the same language. This can be rather confusing. Our framework offers some insights to explain differences and place different perspectives in a consistent framework. Primarily the choice of a time horizon and the subjective evaluation of technical potential, the flexibility of social preferences and institutions, and the stability and resilience of natural systems explain differences between the perspectives. Confrontation between disciples of the different perspectives, as well as between social and natural sciences may perhaps provide more consensus some day.

PERSPECTIVE	basic factors	outcomes	changes
(i) Immaterialist	b3:preferences	r2:composition demand	Δb3, volume material welfare
(ii) Pessimist	b4:technology b5:capital b6:environment	r1:input mix r3:sector structure	material/energy use, depletion
(iii) Technocrat	b4:technology b5:capital	r1:input mix r3:sector structure	Δb4, Δr1, Δr3, appraisal of 'man-made goods'
(iv) Carpe diem	b1:institutions b3:preferences	r2:composition demand r3:sector structure	Δb2, Δb3, volume economy, depletion, pollution
(v) Optimist	b1:institutions b3:preferences	r2:composition demand r3:sector structure	Δb3, Δb4, Δr2, Δr3, environment as luxurious good

Table 1. A comparison of the five perspectives based on the framework

PERSPECTIVE	time horizon	ideology	prediction	policy implication
(i) Immaterialist	short-long	ethical-psychological	happiness via non-material items	reconsider goals
(ii) Pessimist	long	physical-material-biological	lower material welfare	(selective) contraction
(iii) Technocrat	short-medium term	technological-human-ingenuity	hyper-technological world	encourage technological progress
(iv) Carpe diem	short - long	international-social-political	catastrophe-scenario	present more important than future
(v) Optimist	short	market-welfare-financing	responsible man, transition to other vision	support of market and democracy

Table 2. Characteristics of the five perspectives.

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