Sustainability, Development & Economic Growth

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Ronan Lyons explores the themes of sustainability and intergenerational equity. The author examines the debate surrounding sustainability in economics, and argues that we need to apply the tools of economics in order to arrive at realistic policy proposals to counter environmental degradation. He concludes that we cannot continue to consume our natural resources without thought to the consequences, and therefore we should seek a more sustainable approach to growth if we wish to preserve generational equity.

'These are the days of the hungry man
Whose place is in the past
Hand in hand with ignorance
And legitimate excuses'.
George Michael, Praying for Time

Introduction

We live in the world of the "hungry man", a relic of the past who can conjure up enough excuses to justify using all his new found ability to sate his desires. The dangerous cocktail of ignorance, ability and appetite have had their backlash, however. Sustainable development and intergenerational equity are the main themes of a large portion of current economic debate. They are, therefore, the two main themes of the essay. I open with a discussion of sustainability and sustainable development as concepts. They are not easily defined, and even more difficult to understand as guidelines to help political decisions be consistent with intergenerational equity. To properly conceptualise sustainability, one must recognise the functions that the environment fulfils, as a provider of resources, an assimilator of waste and as a direct source of utility. Therefore I use a circular model of the economy, to help illustrate these functions. It is also important to understand the position that this debate about sustainability occupies in ecological economics. The third section discusses this concern, in particular the false Faustian logic of an anthropocentric *Weltanschauung*, and also considers many questions that the concept of intergenerational equity incorporates. The fourth section discusses the discount rate, which ranks future utility of less worth than current utility. Two possibilities of how to treat it are considered, in order to end this "discrimination". The fifth section examines the two extremes of sustainability, the so-called strong and weak approaches. The debate here concentrates on the substitutability of the

various types of capital. The penultimate part considers the limits to economic growth, by for example challenging the assumption of non-satiation. The seventh part returns to the main issue, namely how natural stocks of capital are to be managed. The possibility of consuming man-made capital is investigated. Finally, there follow my conclusions and recommendations.

Sustainability: the concept

Sustainability and sustainable development have been important terms in the language of economics since the UN's Brundtland Report, *Our Common Future* in 1987. As concepts, they are difficult to define (Jacob, 1996). Sustainable development refers to a process of development that meets each generation's needs without compromising the ability of future generations to do so. While seemingly simple to explain as a concept, there is little agreement as to what this means in terms of practical policy prescriptions (Faber *et al.*, 1996). Amidst general concern about the depletion of the ozone layer, the extinction of thousands of species and the so called greenhouse effect, one can identify two central concerns regarding the current form of economic development and growth. Firstly, there is the fear that natural resources are being depleted at such a rate that non-renewable resources such as fossil fuels will be exploited to extinction and that renewable resources are being extracted at rates higher than they can grow, i.e. that they too are being exhausted. This is George Michael's "hungry man" in the quotation. The second concern is that pollution from the production or consumption of goods is damaging the environment in an irreparable way (Faber *et al.*, 1996). There is the perception, then, that things are getting worse. Hence, many view current economic development as unsustainable.

To further understand these concerns, one must consider the functions of the environment in terms of a circular model of the economy (Pearce & Turner, 1990). Conventional economics views the process as linear:

Resources(R) $\Rightarrow$ Production (P) $\Rightarrow$ Consumption(C) [$\Rightarrow$Utility (U)]

To understand the three main functions that the environment contributes to the utility of society, one must view the process as circular. The first of these functions is as a *supplier of resources* (R), already accounted for in the linear model. These resources may be either *renewable* (RR) or *exhaustible* (ER). The second function is as a "waste sink". Waste (W) exists at each stage of the linear model, i.e.:

$W = W_R + W_P + W_C$.

The total amount of waste must equal the amount of natural resources used up, i.e. W=R, because of the first Law of Thermodynamics, which states that neither energy nor matter can be created or destroyed. All this waste is *recycled* (r) or goes back into the environment in various forms, often with time lags. Nonetheless, the environment must absorb this waste (W-r). This absorptive ability is the *assimilative capacity* of the environment (A). If (W-r)<A, the system will function. If (W-r)>A, this function becomes overloaded and permanently impaired. The ability of the environment to fulfil its first function, to provide R, is also harmed. The third function of the environment is as a direct *source of utility* (U), e.g. nice views, the enjoyment of a walk in the countryside, etc. Hence, environmental degradation means a decrease in the utility accruing to society, either directly, as the environment is a source of utility, or indirectly, through reduced resources needed in the production of utility-yielding goods.

Thus, a rational society will aim to leave the ability of the environment to perform its functions unharmed, so that each generation can maximise its utility. This is the central argument behind sustainable development. Nonetheless conventional economics seems to disregard the natural base upon which it operates. Hence, there have emerged the two main concerns mentioned earlier. It is firstly believed that the current harvest of resources is greater than the yield. This must always be true of ER, and if RR are also being exhausted at too high a rate, the resource endowment for future generations is being reduced. Secondly, pollution, a form of W, is adversely affecting the environment's assimilative capacity (A). This is how the environment's ability to fulfil its functions is being diminished.

Ecological Economics

Thus, the basis of the argument is that current generations are, through environmental degradation, putting future ones at a disadvantage, by leaving them with less resources with which to achieve the same or a higher standard of living. The full argument of ecological economics is concerned with more than just this aspect (Faber *et al.*, 1996). The first major moral issue concerns the many interactions between human activities and the ecosystem. The etymologies of the words 'ecology' and 'economy' are rooted in the Greek *oikos*, meaning house. Ecology means literally the structure (logos) of the house. Given its recent behaviour, it must be asked whether humankind believes that not only does it own the house, but that the house is for its use only. Everything in it is controllable and

the driving force is the will of humankind. This anthropocentric view of the world disregards the possibility of non-human species having rights. Furthermore, this Faustian logic assumes not only omnipotence but also omniscience (*ibid.*). Everything must be known in order to control it, but it is impossible to know everything that will ever happen. The Utopia described by the neo-classical economics paradigm assumes perfect knowledge. Although science and technology can increase the base of knowledge, humans can never be godlike in their attributes. Such a world could never exist, yet decisions seem to be taken on that very premise, for example the introduction of nuclear power (*ibid.*). At first, it was generally believed that it was safe. Now, knowledge has improved. Everyone knows better, but what has been the cost in the interim?

The second moral issue of ecological economics is the intergenerational issue mentioned above. The central problem is that future generations have nothing to offer in any market for their right to use resources (Faber *et al.*, 1996). If the current generation's utility function does not include their well-being, it is an externality. Why should future utility be valued less than current utility? On the other hand, what exactly is essential about our quality of life that means other generations must be afforded it? Which are essential, material goods or non-material ones, such as freedom, respect for nature, or both? How can we reach a trade-off between the utility of the definitely poor today, and the maybe-poor-maybe-rich of tomorrow? These are some of the issues surrounding the area of intergenerational justice.

The Discount Rate

Discounting is the process of attaching less weight to the utility of future generations than to that of the current one. As it discriminates against future generations, there are conflicts between the principle of discounting and those of sustainable development and intergenerational equity (Belratti *et al*, 1995). The main reason for this is that it affects the consumption of natural resources. Other issues are salient here too, e.g. the storing of radioactive waste is more likely to be permitted in a given decision, the higher the discount rate, *ceteris paribus*, as the costs are further in the future (Pearce & Turner, 1990). The higher the rate, the more likely a society is to deplete the stock of natural capital, thus affecting the chances of future generations. This section discusses the rationale behind discounting and whether it can be reconciled with the themes of this essay.

The most prominent form of the discount rate is the rate of interest. There are two main sources of such discount rates in society (*ibid.*). There is first of all, the social

time preference rate (STPR). This reflects people's impatience, or pure time preference, to enjoy utility now rather than later. Pigou (1960), among others, has referred to this as social myopism. Secondly, it also contains a social judgement, made by Tullock for example, that future generations will be richer. Hence, according to the Law of Diminishing Marginal Utility, the extra utility will be of greater benefit to the current generation. The second source of the discount rate is the social opportunity cost (SOC). This is the productivity of invested capital, expressed in percentage form, e.g. capital invested with expected productivity returns of 6% is the opportunity cost of that investment to society. Regardless of which of these is chosen as the discount rate, they are always positive (*ibid.*).

There are a number of criticisms of the reasoning behind discount rates. Firstly, there is no logical reasoning why people's impatience should be included. On the one hand, it may not be consistent with their own lifetime utility maximisation. On the other, public policy often overrules the wishes of individuals. There is no reason why it could not do so here, on such a crucial issue, particularly when governments are entrusted with the task of being guardians of future generations' interests. Furthermore, even on a level of wants and satisfaction, only tomorrow's utility matters, not today's assessment thereof. Secondly, the argument regarding diminishing marginal utility is flawed. Utility has no measure. If that is the case, how can the elasticity of the marginal utility of consumption function be measured (*ibid.*)? Also, the argument assumes that consumption will increase over time. While this may be the experience of so-called western countries recently, this may not always hold. This is particularly the case, if the discount rate is so high as to cause environmental degradation, which, as explained earlier, will adversely affect the consumption of future generations.

Then, there are general arguments against discount rates as a phenomenon. The higher rates are, the greater the discrimination against future generations. In the case of a high discount rate, a project is more likely to pass cost-benefit analysis, the further into the future the costs are pushed, and the closer to the present that benefits occur. High rates also discourage investment and can imply a reduced stock of capital to be inherited. Overlapping utility functions, i.e. where this generation cares about the welfare of future ones, still impose a present measure of future benefits. The theme of this essay is to allow future generations the same ability to achieve their desired standard of life, rather than impose something on them. There are two possibilities to improve the situation regarding the discount rate and the discrimination that it implies. The first is to abolish the discount rate, at least in terms of a societal rate. The second option is to leave it alone, and instead try to

understand the linkages between the two levels of environment and economy. Hopefully, a sustainability principle could then be employed in cost-benefit analysis, so that the stock of natural resources is kept constant over a portfolio of projects (*ibid.*).

Substitutability of Resources

Even the concept of sustainability as explained at the start leaves room for argument. This debate centres around the composition of capital endowed to future generations (Auty & Brown, 1997). If intergenerational equity is no more than ensuring that future generations are endowed with capital per capita that is greater than or equal to that of the current generation, nothing is said about the composition of that capital. It could be any combination of human capital, produced capital or natural capital. Whether this is so depends on the degree of substitutability of various kinds of capital. If perfect substitutability exists, this has implications regarding the preservation of natural exhaustible resources. If these do not have to be passed on, they can be exploited to their fullest in the present. There are two opposing views on the topic of substitutability and hence what we should leave to our descendants.

Firstly, there is the "strong sustainability" approach of ecological economics, which assumes non-substitutability of the various capitals (*ibid.*). Of all possible consumption bundles, some exist where the abuse of natural resources exists, i.e. use of ER, extraction of RR above their yield rate and pollution such that (W-r)>A. This continues until a critical point is reached where the environment cannot sustain this anymore. The ecosystem collapses, reducing to zero the stock of natural resources. Although the consumed natural resources were used to bring about "produced capital", such capital cannot replace natural capital. Many adherents to this approach believe that current uncontrolled economic growth will eventually bring about such a result. An alternative system of consumption involves a slowdown in the over-consumption of natural resources, so that the environment never reaches that critical point where the ecosystem collapses. Such a slowdown may be brought about through direct regulation or such market interventions as eco-taxes.

The second approach, the so-called "weak sustainability" approach, assumes that the composition of capital is relatively unimportant, i.e. a great degree of substitutability (O'Riordan, 1997). Thus, once natural capital is wisely invested in other forms of capital, the depletion of natural resources can not be viewed as a problem. A problem with this view is that it does not consider pollution, which reduces the assimilative capacity of the environment. This method is seen however as more

"human-friendly" than the strong sustainability approach, because its goal is the maximisation of human welfare, and not the environment itself (Auty & Brown, 1997). As with most competing views, there is much thought emphasising the middle ground between these two approaches. That is to say, the "ecological" standpoint highlights the importance of a basic level of sustainable natural resources. The "environmental" approach allows the use of cost-benefit analysis to assess possible eco-tax reform.

Limits to economic growth

Economists make certain assumptions regarding consumer behaviour that lead them to the conclusion that the greater the economic growth in a given period, the better. The whole argument rests on the assumption of non-satiation. Simply put, in the eyes of many economists, more is always better. Indeed, this assumption is assumed to be a basic trait of consumer behaviour. Nonetheless, arguments challenging this assumption have been around since the time of Aristotle (Faber *et al.*, 1996). The phenomenon of post-materialism seems to confirm that a point can be reached, the so-called bliss-point, after which other non-materialistic concerns take priority. Such a point, or level of income, may not be even that high. Even twenty-five years ago, a survey in Britain showed that nearly three-quarters valued non-materialistic aspects of their life as most important to their "quality of life" (Douthwaite, 1992). If non-satiation is an unrealistic assumption, perhaps then unlimited growth equally represents an undesired aim.

Even ignoring that problem, there exist two types of limit to growth (Daly, 2001). Biophysical limits to growth are limits that must exist because of the economy's existence as merely a subset of the ecosystem. This is closely related to the second Law of Thermodynamics, according to which entropy sets a physical boundary, to for example, growth or recycling (Pearce & Turner, 1990). Materials used in the economy are used entropically, and thus are dissipated within the economic system. Matter and energy escape through outlets back into the environment as pollution. 'The Club of Rome Report', for example, highlighted the unsustainability of current growth patterns, especially considering population growth, which in effect swamps out efficiency gains (Jacob, 1996).

Secondly, there are ethico-social limits to growth. These relate to the moral duty many humans feel regarding the prevention of the extinction of species, and indeed the obligation to future generations (Daly, 2001). As opposed to being a natural law, like biophysical limits, these reflect a duty. In order to be effective, this duty must be

expressed by the great majority of people, usually through politics, otherwise it cannot be enforced legitimately (Faber *et al.*, 1996). In these three ways, it can be seen that unlimited economic growth may not be a good thing. Growth of GNP is a means to an end, but not the end. Development, i.e. improving quality of life, is the end. Raw economic indicators tend to hide poverty and distribution, hence development needs more inclusive measures than merely economic growth.

Levels of Natural Capital

Returning to the main themes of the essay, what is to be done about natural capital stocks, in order to develop in a sustainable way, consistent with intergenerational equity? As highlighted earlier, there are two main areas under discussion, namely the depletion of natural resources and the problem of pollution. With reference to the first, it would seem that if the resource stock should be held constant over time, then non-exhaustible resources should not be used at all, assuming infinite generations in the future. A complication is that the yields of resources are not constant, therefore the harvest does not stay constant from generation to generation. The rules can be changed for exhaustible resources, however (Pearce & Turner, 1996). Firstly, any decrease in their stock can be compensated for by increases in renewable resources, i.e. substitutability between different types of capital. Secondly, due to increases in efficiency, a given standard of living could be achieved by a decreasing stock of exhaustible resources.

Having accepted this, modifications need to be made to the notion of holding renewable resources constant. These changes parallel those made for exhaustible resources. Firstly, stocks of renewable resources need to be increased to counteract reductions in exhaustible resource stocks. Secondly, the efficiency argument equally applies to all kinds of resources, i.e. increases in efficiency may mean a reduced need for renewable resources. To these opposite-working factors must be added the problem of population growth. Increased numbers of people on the earth mean the same resources have to be spread out over more people. Nonetheless, one cannot ignore the market mechanism and innovation, when considering the issue of depleting resources. One common criticism of sustainable development theories is that they often leave out these in their discussion (Smith, 2001). This argument holds that as resources become more scarce, their price will increase, reflecting reduced supply. This inspires the search for more deposits of a resource, more efficient methods of production or totally new substitutes to the good in question. For example, from the scarcity of wood and whale oil came coal, from coal to oil and later electricity. These could be replaced in the future by wind, water and solar-

powered energy, to which the recent vogue for giant wind-farms, yielding cheaper electricity testifies.

One must acknowledge, however, that a lack of perfect knowledge exists, regarding remaining stocks, and that long run trends are not predictable (Faber *et al.*, 1996). Nonetheless, there is a role for the market in the solution to the problem of depleting resources. The same cannot be said, however, of pollution and its effects on the natural environment as an assimilator of human waste. For this problem, ignorance is even more important, as too often unwelcome effects are unknown, and hence the costs to society, bearing in mind the circular model of the economy, are only known ex post. This can be easily seen in such phenomenon as the depletion of the ozone layer and acid rain. This makes internalising the cost more difficult. To further complicate the matter, the assimilative capacity of the environment (A) is not a constant (Pearce & Turner, 1990). Thus, particularly in the area of pollution, the idea of sustainable development means change from current behaviour.

One suggested possible source of the solution to the problems explained above lies in substituting from natural capital (K_N) to manmade capital (K_M). As the first Law of Thermodynamics reminds us, K_M is not independent of K_N, manmade capital can only be made on the foundations of natural capital (Boulding, 1980). Also, it is unlikely that manmade capital will fulfil the varied functions of natural capital, e.g. the environment in its capacity as a life support machine. However, given that, the idea of increasing the use of manmade capital, instead of natural capital may be worth considering in more detail, if it can be shown that the marginal productivity of K_M is greater than the value of K_N that went into its production. This argument for manmade capital is often accompanied by arguments regarding improved technology. Once again, one must be careful, as new technology may not necessarily be less polluting than what was used before. Also, technological progress, although occurring at a rapid rate in the last century, cannot be accurately predicted. All in all, natural capital should be protected, as according to the themes of this essay. Both more efficient methods of production and environmentally friendlier source of energy should be researched, in order to protect exhaustible natural resources. There should also be strong rules on an international level guarding such scarce resources.

Conclusion

'So you scream from behind the door
Say what's mine is mine and not yours...
And the wounded skies above say it's much too late

So maybe we should all be praying for time.'
George Michael, Praying for Time

Sustainability and intergenerational equity are attempts to eradicate the attitude that all capital can be privately owned and consumed without reference to the consequences, as seen in the quotation: 'what's mine is mine and not yours'. These concepts were discussed and explained in the second part of the essay. The three functions of the environment, i.e. as a provider of resources, an assimilator of waste and as a direct source of utility, should be considered and maintained, because any impairment of the environment's ability to fulfil these functions will affect the utility of all current and future generations. The dominant *Weltanschauung* should not be anthropocentric, as the third section explained, especially as we must remember that humanity does not own this "House Earth". Current forms of the discount rate amount to a discrimination against future generations and the societal rate should either be zero or should be used in conjunction with a principle of sustainability across a portfolio of projects, as was discussed in the fourth part. The two schools of thought in sustainability, the strong and weak approaches, differ in their assumptions as to the degree of substitutability between the various sorts of capital, but both offer important contributions regarding the base level of natural resources needed, and cost-benefit analysis. The sixth section considered the limits to economic growth, namely biophysical and ethico-social, and raised questions about the conventional assumption of non-satiation. The last part discussed how natural capital should be distributed between almost infinite generations. More efficient methods of production, sources of energy that are friendlier to the environment and strong international regulations are three ways through which each generation can live on the yields and not encroach into the level of resources.

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