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WEAK AND STRONG CONDITIONS FOR SUSTAINABLE DEVELOPMENT: CLARIFICATION OF CONCEPTS AND THEIR POLICY APPLICATIONS

Abstract

As is well known there are a variety of concepts of sustainable development. This paper concentrates on the main economic concept of sustainable development and discusses weak and strong conditions for it, taking into account the scope for substituting different types of capital - man-made capital (physical and human) and natural resource or environmental capital. A simple diagrammatic approach is adopted which should help to clarify controversies in this area, and allow also for the views of ecocentric persons. The possibility is explored that the conditions for sustainable development may differ between countries - some are able to adopt weaker conditions than others. In addition, some of the implications of weak and strong sustainability for project evaluation are explored and a dilemma is raised about offset policies as a means for satisfying strong sustainability conditions.

1. Introduction

A variety of concepts and conditions for sustainable development have emerged, and for some people, this has created confusion (Tisdell, 1993, Ch. 9). Many writers have failed to distinguish between the normative and positive aspects of the issues involved and this has added to the confusion. It is in fact a strength that a variety of concepts of sustainable development have emerged but it is important to specify these concepts carefully and distinguish between them. In some writings it is not clear what the authors want to sustain and why they want to sustain it. Sometimes the focus is on a 'single' dimension such as the achievement of economic sustainability, social sustainability or biophysical sustainability and on other occasions, the focus is of a multi-dimensional nature requiring simultaneous satisfaction of conditions for economic, social and biophysical sustainability. The latter may be assumed to include ecological sustainability.

2. The Main Economic Goal of Sustainable Development and some of its Limitations

Here I shall concentrate on the principal economic concept of sustainable development, namely that it is development that ensures that income per head of future generations is no less than that of current generations (Tietenberg, 1988; Pearce et al., 1989). This may also be broadly interpreted to mean that the standard of living or economic welfare of future generations be not less than that of present generations, even though the way in which we should measure these variables is far from clear.

Note that the economic concept is purely an anthropocentric one– it is only generations of human beings which are to count. While this simplifies the issue, it does not avoid controversy. Controversy exists about whether this anthropocentric goal ought to be the goal of society and if it is the goal, how it can be achieved.

Those with an ecocentric bent find such an objective to be too limited. Many believe that other sentient beings should be taken into account in the welfare calculus (Blackorby and Donaldson, 1992), or that the survival of other species, irrespective of human wishes (Sagoff, 1988; Leopold, 1949), should form part of society's objective function. This implies that other sentient beings and species should not be regarded purely as instruments for the fulfilment of human satisfaction. I shall return to this point of view later.

In addition, there are those who are anthropocentric who are not convinced of the desirability of the objective that the income of future generations be not less than that of present generations. Beckerman (1994, 1996) is for example, anthropocentric but suggests that the above rule can give rise to poor social choices. For example, suppose that there are two alternative possible development paths. One ensures that the income of future generations is equal to that of present generations or increases very slightly. The other alternative ensures that the income of future generations except the last one, is much higher than that of present generations and the income of the last generation is marginally less than that of present generations. Application of the sustainability rule given above will result in choice of the former development path and rejection of the latter. However, the total utility obtained from the latter could be much higher than the former and on the face of it, it seems to be socially superior.

Total utility maximisation of the utility obtained by all generations taken together can result in quite different development choices to that of the above mentioned intergenerational equity objective, as can this type of utility maximisation subject to less restrictive intergenerational equity constraints.

Rawls' principle of justice (Rawls, 1971) is often used in support of the principle that the income of future generations should not be less than that of present generations. It is argued that every person could have been born at a different time and in the position of any other person. Therefore, not knowing what position and time individuals might occupy prior to birth, if a social agreement could be reached prior to birth, all would opt for equality of income unless inequality happened to be to the advantage of all. However as pointed out elsewhere (Tisdell, 1993, Ch. 9), Rawls' principle is not completely convincing.

It assumes, for example, that individuals can only be born as human beings and are only born once. It may be true, but not everyone believes it e.g., Hindus. Secondly, it does not consider the possibility that some individuals who could have been born, are not, due to birth control. The set of those to be born is taken as given whereas it may not be given in advance. All of these factors raise philosophical dilemmas for Rawls' approach. Apart from this however, it is doubtful whether individuals are as risk-averse as Rawls supposes. If they are not, then they may choose a development path for which the income of *some* future generations is below that of current generations.

Given a choice, each individual might for instance opt to maximise his/her expected utility subject to being assured some minimum standard of living. This implies that individuals are prepared to take some risks in order to improve their expected economic lot. As a result, individuals could rationally choose a development path for which the income of some future generations are below those at present but for which the income of most future generations is well above that of present generations.

Figure 1 illustrates the point. At the initial point, two alternative development paths are available to society (1) and (2). These give individuals the possibility of incomes shown by

line ABC or by curve ADE. The individual's exact income will depend upon when he or she is born, that is into which generation birth takes place. The horizon for human existence is t_n. The individual wishes to be assured of a minimum standard of living of OF. Given that the individual is equally likely to be born into any generation, his or her *expected* income[1] for development path (1) is BH and for development path (2) is in the neighbourhood of DJ. Both paths ensure that the individual's standard of living constraint is met. Thus the unsustainable development path (2) would rationally be chosen because it yields the highest expected income and satisfies the minimum income constraint, even though it is also a path for which the income of some future generations is below that of current generations. It therefore does not satisfy the economic criterion for sustainability, namely that the income of future generations be not less than that of present generations.

Note that the effect of the economic sustainability criterion depends on whether it is to be applied for each generation or only to the existing generations. If the criterion is repeatedly applied by every generation, then it implies that the only acceptable development paths are those that show *no* decline whatsoever in income levels. This would have the absurd result that a path like AKL in Figure 1 would be less preferred than path ABC, even though incomes of future generations are always greater for path AKL.

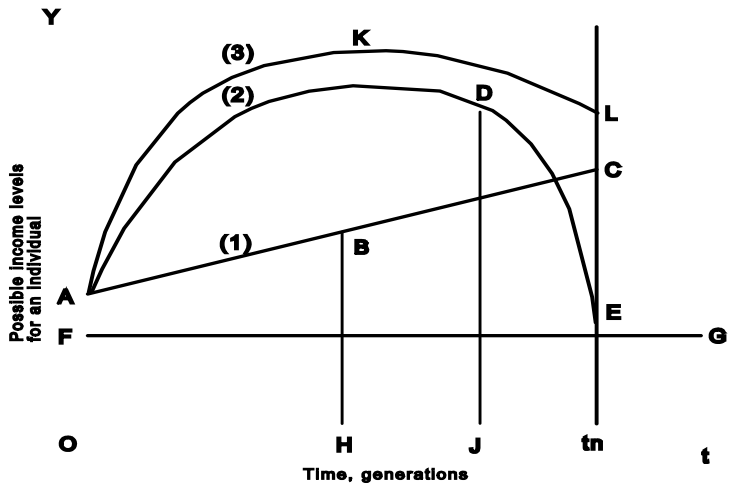

Figure1: The income achieved by an individual is liable to vary with the generation in which he/she is born.This figure shows some alternative possibilities. Path (1) is sustainable but the other two are not yet they may be socially preferable.

3. Capital Substitution and Sustainability

If the income of future generations is to be maintained or sustained, what assets should be made available to future generations? More generally, no matter what development path is chosen for future generations, what combination of assets is needed to achieve it? These questions have been the subject of considerable debate.

It is convenient to distinguish between man-made capital and natural resource/environmental capital (Cf. Pearce, 1993). Man-made capital consists of produced physical capital e.g., machines, human capital, the stock of knowledge and institutional/cultural capital. Natural resource/environmental capital consists of renewable resources, non-renewable resources and flow resources. All theses resources, together with labour, are determinates of economic production and welfare and their combinations affect the level of production and its sustainability.

The main debate that has emerged is the extent to which man-made capital can be substituted for natural resource capital and income be sustained or a desirable economic development path achieved. Substitution of man-made physical capital for natural resource capital has been the focus of particular concern but also substitution within these categories, where it is possible, is of interest.

Those economists who favour weak conditions for sustainability see the substitution of man-made capital for natural resource stock as a suitable means for sustaining the income of future generations or for achieving a desirable development path from an anthropocentric viewpoint. By contrast, those favouring strong conditions for sustainability fear that given the extent to which the natural resource stock has already been depleted for consumption purposes and for investment in man-made capital, further substitution is liable to imperil the income or welfare of future generations. It is argued that man-made physical capital is a wasting asset, natural resource stocks are essential to its production and environmental capital plays an important complementary role in production. Because of the latter aspect, high levels of man-made capital relative to the environmental stock, can result in falling production. The main issues can be illustrated by taking a simplified case.

Suppose just two forms of capital: K, man-made capital and N, natural resource/ environmental capital. Suppose that the income possibilities for future generations are a function of the ratio of man-made capital to natural resource and environmental stock, engineered by present generations and inherited from previous generations, that is a function of K/N - the initial ratio of man-made capital to natural resource stock. In a very underdeveloped economy, this may be close to zero, as it was in prehistoric times for all regions.

For each value of K/N, a large number of income possibilities for future generations exist. Select the preferred one for each value of K/N and suppose that all the preferred paths corresponding to each value of K/N can be ranked by preference so that a transitive and complete preference ordering exists. This can be used to generate an ordinal preference function such as ABCDF in Figure 2. There corresponds to each point on this curve an attainable income path (at least one) which gives the utility rank indicated. In some cases, the utility index may be of a von Neumann and Morgenstern type or cardinal in which case expected utilities could be calculated, but it is not necessary to assume this here. Given the curve ABF indicated in Figure 2, a ratio of man-made capital to natural resource stock of R_1 is optimal, that is maximises the objective or utility function under consideration.

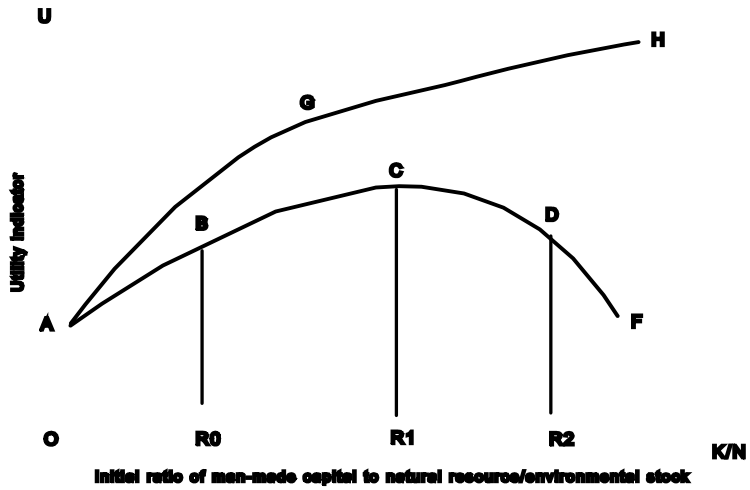

Figure 2: Diagram to explain anthropocentric reasons for imposing strong and weak conditions on substitution of capital.

This diagram may help to distinguish between reasons for support of weak

and strong conditions for sustainability. Those favouring weak conditions may believe that the economy is in the neighbourhood of B. If so, then $K/N = R_o$ is too low to achieve the desired income possibilities for the various generations. On the other hand, those favouring strong sustainability conditions may believe the economy to be in the neighbourhood of a point like D. If so, the ratio of man-made capital to natural resource stock is already too high and any further transformation will make the situation worse. Some members of this group may also believe that the economy is in the neighbourhood of C, in which case further transformation would be liable to lead to a suboptimal result.

The question of technological progress has not been mentioned. Ideally the type of relationships shown in Figure 2 should be drawn up allowing for future technological progress. In principle, this is possible but in practice, given fundamental uncertainty about future technological progress, it is only a theoretical possibility. After allowing for technological progress, a single peaked curve like ACF might still apply. However, superoptimists might consider a curve like AGH to be more relevant. If so, they would favour weak sustainability conditions strongly.

4. Further Observations on Weak and Strong Conditions for Capital Substitution

One possibility not specifically discussed above is the possibility of discontinuities in the curves shown in Figure 2. For example, at some ratio of K/N, curve ACF may decline abruptly. If this is so but the exact ratio at which it occurs is uncertain, one might rationally expect it to result in precautionary behaviour, that is making sure that K/N does not reach the threshold in question. Discontinuities in the curves raise new policy possibilities.

Those with an ecocentric-bent are likely to favour a lower value of K/N than would be chosen purely on anthropocentric grounds, given that the conversion of natural resource/environmental capital to man-made capital reduces biodiversity (Swanson, 1994). Thus given curve ACF in Figure 2, this group would be expected to prefer point B to C and certainly C to D. Such conservationists vigorously support the imposition of strong conditions on the substitution of man-made capital for natural resource stock on ethical grounds.

The question might also be raised of whether the *optimal* ratio of man-made capital to natural resource stock could differ between societies. This is indeed possible. For one thing, the natural resource endowment of countries differ. Hence, curves like the one shown by ACF in Figure 2 may differ between countries. Thus the optimal value of K/N may for example differ between China and Europe. The optimal value for China might be lower than for Europe. Nevertheless, the current K/N value for China may be less than its optimal whereas that for Europe might be in the neighbourhood of its optimum, given the different histories involved.

Those supporting strong conditions for sustainability often favour offset policies. This means that a development in one situation which destroys the natural environment, might be allowed if it is offset by an initiative elsewhere which improves the natural environment. For example, the destruction of a natural wetland for a housing development may be allowed if an artificial wetland is established elsewhere. However, if this artificial wetland is established in an existing natural environment, it will destroy it. In this case, the natural environment, rather than remaining constant, is changed in its composition and there is arguably some reduction in the natural resource stock. The question of what is a suitable environmental offset for deterioration of the natural environment in some respect can be contentious. In some cases there may be little contention, e.g., in cases where land degraded by economic use is restored to a more natural state, and used as an offset for use of a natural environment of little value elsewhere. However, the question of the suitability of environmental offsets needs more investigation for policy purposes.

5. Concluding Comments

There are rational reasons, even given that our goal should solely be to benefit humanity, for believing that the standard economic objective for sustainable development is not always socially desirable. This is so taking into account Rawls' principle of justice. Nevertheless, this is not at odds with account being taken of the welfare of future generations of human beings. It still may require strong conditions to be imposed on the substitution of man-made capital for natural resource/environmental capital. This has been illustrated diagrammatically and a diagram has been used to help clarify differences in views about

whether strong or weak conditions should be imposed on the substitution of man-made capital for natural resource/environmental stocks.

Endnote

1. Observe that the curve or path which has the maximum area under it will also yield the maximum expected value of income per unit of time or for each generation, if generations are equally spaced in time. The area under the curve being considered can be found by integration. If the time interval $0 \_ t \_ t_n$ is divided into *n* equal 'periods' each corresponding to a generation, then expected income for an individual as yet unborn can be found by dividing the area under the relevant curve by *n*. I am grateful to Christopher Tisdell for his suggestion about this mathematical point.

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