United Nations University

WIDER

World Institute for Development Economics Research

Research Paper No. 2004/XX

# Sustainability and Well-being Indicators

Eric Neumayer

March 2004

**Abstract**

This paper provides a review and critical discussion of indicators, which attempt to combine the measurement of sustainability with that of well-being. It starts with some commonly agreed definitions of sustainability, showing how most well-being indicators tell us little if anything at all about this issue. Sustainability is most commonly defined in economics as non-declining utility or well-being over time. Yet, due to its future orientation, most indicators of sustainability such as Genuine Savings (GS) have merely focused on the capacity to provide utility in the future, but have not included the measurement of current well-being. Indicators of well-being such as the Human Development Index (HDI), on the other hand, have typically failed to account for sustainability in their measurement of current well-being. The paper then critically reviews the Index of Sustainable Economic Welfare (ISEW) and the Genuine Progress Indicator (GPI), which are the most prominent examples of an indicator, which …/…

Keywords: environment, sustainable, measurement

JEL classification: I32, Q51



* Lecturer in Environment and Development, Department of Geography and Environment, London School of Economics and Political Science, UK; e.neumayer@lse.ac.uk.

This study has been prepared within the UNU-WIDER project on Social Development Indicators (Measuring Human Well-being) directed Professor Mark McGillivray.

UNU-WIDER acknowledges the financial contributions to the 2002-2003 research programme by the governments of Denmark (Royal Ministry of Foreign Affairs), Finland (Ministry for Foreign Affairs), Norway (Royal Ministry of Foreign Affairs), Sweden (Swedish International Development Cooperation Agency—Sida) and the United Kingdom (Department for International Development).

ISSN 1810-2611 ISBN 92-9190-_ _ _-_ (internet version)

attempts to fully integrate the measurement of welfare with that of sustainability into one single indicator. Such an integration, whilst seemingly attractive, is rendered difficult by the fact that what contributes to current well-being need not contribute at all or in the same way to sustainability and vice versa. We also review various proposals of extending a welfare indicator, namely the HDI, with sustainability considerations without full integration of both concepts. All of these proposals suffer from a range of fundamental conceptual problems. As one possible alternative, we propose a combination of the HDI and GS, which holds great promise for an assessment of well-being and its sustainability, particularly in developing countries.

**Acknowledgements**

I would like to thank Mark McGillivray, G. Srinivasan as well as various participants at the project meeting for their constructive comments.



UNU World Institute for Development Economics Research (UNU-WIDER)
Katajanokanlaituri 6 B, 00160 Helsinki, Finland

Camera-ready typescript prepared by Adam Swallow at UNU-WIDER
Printed at UNU-WIDER, Helsinki

## 1 Introduction

Most indicators of well-being ignore sustainability and most indicators of sustainability ignore (current) well-being. A prominent example for the former is the United Nations Development Programme's Human Development Index (HDI), whereas the World Bank's Genuine Savings (GS) is characteristic of the latter. This paper provides a critical assessment of those efforts, which have tried to integrate both concepts into one single indicator or have combined the measurement of both without full integration. Before addressing these measures, let us define what we mean by well-being and sustainability. Well-being often comes under the name welfare or utility and we will use all three terms interchangeably here. In spite of its common use in economics and other social sciences, it is not easily defined in a concrete sense. We will simply understand well-being, welfare or utility as the satisfaction of human preferences. The better human preferences are satisfied the greater is well-being. From our definition it becomes clear that income is by far not the only relevant item creating well-being. Even if we exclude very personal determinants of well-being such as friendship, love and the like, which policy cannot influence, we end up with a great variety of welfare-relevant factors. Health, education, freedom, autonomy, recreation, experience of nature, to mention but a few, are all examples of items that promote welfare. What contributes to welfare and by how much is of course to some extent open to subjective judgement.

Sustainability is sometimes narrowly defined in physical terms as environmental sustainability, where it refers to the maintenance of certain environmental functions. Economists, however, prefer a broader definition that is not confined to environmental sustainability. Definitions slightly differ, but the most common one sees sustainability as the requirement to maintain the capacity to provide non-declining well-being over time. Contrary to well-being itself, which has an orientation towards the presence, sustainability is therefore a future-oriented concept. To make the notion of maintaining the capacity to provide non-declining well-being over time operational, economists have resorted to the idea of maintaining the value of total capital intact, which usually comprises manufactured capital, human capital, natural capital and sometimes social capital. Manufactured capital consists of factories, machineries, infrastructure and the like. Human capital refers to human skills and knowledge. Natural capital encompasses everything in nature that provides human beings with well-being, from natural resources to the pollution absorptive capacity of the environment. Social capital is difficult to define. It refers to things like the amount of trust, the extent of social networks, the willingness of individuals to co-operate with each other and their 'civic engagement' in social groups such as churches and unions (Putnam 1993). Even with this definition of sustainability, there are different conceptual paradigms of the conditions for achieving sustainability; specifically *weak* sustainability holds that natural capital is substitutable with other forms of capital, whereas *strong* sustainability rejects such substitutability and therefore focuses on environmental sustainability (Neumayer 2003).

The pursuit of well-being of the current generation is easily justifiable, notwithstanding the fact that in reality many policy makers pursue other and often contrary objectives. The pursuit of sustainability can be justified by a universalist ethic in the Kantian (1785) and Rawlsian (1972) tradition, which treats all human beings equally independent of their position in time (Neumayer 2003, Anand and Sen 2000). In addition, it can also be justified under the notion of 'usufruct rights', where each generation has the right to enjoy the fruits of accumulated capital without depleting it (Anand and Sen 2000: 2035).

Section 2 provides a critical discussion of the Index of Sustainable Economic Welfare (ISEW), which is the most prominent current example of an attempt to fully integrate the measurement of well-being and sustainability into one single indicator. Another indicator falling in this category is Osberg and Sharpe's (2002*a*, 2002*b*) Index of Economic Well-Being. Such attempts encounter formidable conceptual problems, which render it questionable whether well-being and sustainability should or even could be measured with one single fully integrated indicator. Section 3 assesses various proposals to combine sustainability with the measurement of well-being without full integration. For no clear reason all these proposals have focused on adding sustainability considerations to the Human Development Index (HDI). None of these proposals is entirely convincing either because they do not really tackle the sustainability issue or because they conflate the conceptually different measurement of human development with that of sustainability similar to the fully integrated indicators. As an alternative, section 4 therefore proposes to use so-called Genuine Savings (GS) as a sustainability check for well-being indicators. We discuss the proposal in the context of the HDI, but stress that our proposal can be applied to any well-being indicator. Section 5 concludes.

## 2 Fully integrated indicators of well-being and sustainability

Gross national product (GNP) or gross domestic product (GDP) were originally created as indicators of total economic output for macroeconomic stabilization policy and were therefore not meant to be indicators of well-being.[1] On the other hand, it is certainly true that policy makers, the media and the public alike seem to equate GNP/GDP with well-being. In international comparison as well, we tend to think of the countries with a high GNP/GDP as not only the rich, but also the well-off countries. However, because income is just one of the components of well-being, GNP/GDP have long since been criticized as misleading and deficient indicators of well-being. Consequently, there have been many attempts at constructing better indicators. Since our objective is to review and critically assess indicators, which have combined the measurement of well-being with that of sustainability, we cannot discuss these efforts here. For an overview and references, see Hagerty *et al*. (2001) as well as the other papers arising from the UNU-WIDER project on Social Development Indicators (Measuring Human Well-Being).

Let us start with indicators, which have tried to fully integrate the measurement of sustainability into that of well-being. The Index of Sustainable Economic Welfare (ISEW), also known under the name Genuine Progress Indicator (GPI), is the most prominent example. It stands in the tradition of earlier attempts to include sustainability aspects into a well-being indicator—see, for example, Nordhaus and Tobin's (1972) Measure of Economic Welfare (MEW), Zolotas' (1981) Economic Aspects of Welfare (EAW) and Eisner's (1990) Total Incomes System of Accounts (TISA).[2] The MEW and the EAW take environmental aspects into account, but only rudimentarily so. The MEW adjusts the welfare measure for 'disamenities of urban life' such as 'pollution, litter,

1 The revised United Nations system of national accounts makes this very clear: 'Neither gross nor net domestic product is a measure of welfare. Domestic product is an indicator of overall production activity' (Commission of the European Communities—Eurostat *et al*. 1993: 41).

2 See Eisner (1990) for an overview.

congestion, noise' based on hedonic valuation studies.[3] The EAW subtracts air pollution damage costs together with half of the estimated control costs for air and water pollution and the full control costs for solid wastes from the welfare measure. The TISA on the other hand does not include any environmental aspects into its measurement, but like the MEW and the EAW seeks to broaden the concept of capital and investment accounted for.

Because of space limitations, we will concentrate on the ISEW/GPI, which takes a more comprehensive set of environmental factors into account than either the MEW or the EAW does. Also, these older indicators are somewhat outdated now. An ISEW/GPI has been constructed for Australia (Hamilton 1999), Austria (Stockhammer *et al*. 1997), Chile (Castañeda 1999), Germany (Diefenbacher 1994), Italy (Guenno and Tiezzi 1998), the Netherlands (Rosenberg, Oegema, and Bovy 1995), Scotland (Moffatt and Wilson 1994), Sweden (Jackson and Stymne 1996), Thailand (Clarke and Islam 2003), the UK (Jackson *et al*. 1997) and the US (Redefining Progress 2001). The methodology differs slightly from study to study, but all follow the same basic concept, which is well captured by the example of the GPI for the US. It starts by adjusting personal consumption expenditures for unequal income distribution and subtracts net foreign lending or borrowing as well as the cost of consumer durables. It then subtracts a whole range of so-called social costs such as the costs of crime, traffic accidents, commuting, divorce, underemployment and loss of leisure time. The next group of deductions refers to the costs of environmental pollution such as air, water and noise pollution, environmental degradation such as loss of wetlands, farmlands and old-growth forests, and resource depletion. Two of these are by far the most important ones in this group. First, the costs of replacing non-renewable resource use with renewable resources under the assumption that the per unit costs of replacement rise by 3 per cent per annum. Second, the future or long-term damage costs due to carbon dioxide ($CO_2$) emissions, which are accumulated from year to year. Finally, a number of welfare-enhancing items are added such as the value of housework and volunteer work, the service value of consumer durables, public infrastructure and net capital investment.

All studies, which have computed an ISEW/GPI come to the same basic conclusion: starting from around the 1970s or early 1980s, depending on the country, the ISEW/GPI no longer rises very much or even falls, whereas GNP/GDP continues to rise. As an explanation for this widening gap between ISEW/GPI and GNP/GDP, Max-Neef (1995: 117) has put forward the so-called 'threshold hypothesis': 'for every society there seems to be a period in which economic growth (as conventionally measured) brings about an improvement in the quality of life, but only up to a point—the threshold point—beyond which, if there is more economic growth, quality of life may begin to deteriorate'. This 'threshold hypothesis' is referred to in almost every recent ISEW/GPI study and Max-Neef (1995: 117) himself regarded the evidence from these studies 'a fine illustration of the Threshold Hypothesis'.

The ISEW/GPI has been criticized on many accounts—see, for example, Nordhaus (1992), several authors in Cobb and Cobb (1994), Crafts (2002), Neumayer (1999, 2000, 2003, 2004). The two components, which have encountered the greatest critique, are resource depletion and long-term environmental damage. On resources, critics have

3 Such studies derive the value from environmental disamenities in comparing, for example, house prices from real estate, which is similar in all respects but the environmental disamenity.

argued that the replacement method overestimates the true loss of resource value with a bias that grows bigger over time due to the erroneous assumption of increasing per unit costs of replacing non-renewable resources. If anything, the costs of renewable resources such as wind and solar energy are falling rather than rising over time. In addition, the implicit assumption that the full amount of current non-renewable resource use needs to be replaced by renewable resources is also questionable given that there is no imminent danger of a running out of most non-renewable resources. On long-term environmental damage costs, its accumulation over time has been contested as flawed due to multiple counting. The damage costs for carbon dioxide emissions already cover the full future damage cost discounted to present-value terms such that accumulation would count the same damage over and over again—see Neumayer (2000*a*, 2003, 2004) for details.

Some of the problems of the ISEW/GPI are avoided in Osberg and Sharpe's (2002*a*, 2002*b*) Index of Economic Well-Being. For example, they include a value for increases in life expectancy over time, which is ignored in ISEW/GPI (Crafts 2002). They also value leisure time and do not count human capital investment as regrettable or defensive expenditures as the ISEW/GPI does for 50 per cent of education expenditures. They do not commit the fallacy of multiple counting of long-term environmental damage in the form of carbon dioxide emissions. On the other hand, their environmental component is rather weak with resource consumption not included at all and carbon dioxide is the only pollutant accounted for.

As fully integrated indicators of well-being and sustainability both the ISEW/GPI and Osberg and Sharpe's Index of Economic Well-Being encounter another fundamental problem, on which we will concentrate here. The problem is that for measurement purposes one should not attempt to fully integrate well-being and sustainability into one single indicator. This is because what affects current well-being need not affect sustainability and vice versa—either not at all or at least not in the same way. This seems counter-intuitive given the conceptual links between well-being and sustainability. However, current well-being is affected by the way in which current total capital is used. Sustainability is only affected if the total capital stock itself is affected.

Take the depletion of non-renewable resources and long-term environmental damage from carbon dioxide emissions as examples. They affect sustainability as, all other things equal, they diminish the value of the total capital stock available to future generations. They rightly form a component of a sustainability indicator. But neither resource depletion nor long-term environmental damage negatively affect current welfare. They affect future, but not current welfare. One could therefore argue that they should be excluded from an indicator of current welfare. Against this reasoning, one might argue with Osborne and Sharpe (2002*a*: 300) that 'if individuals alive today care about the well-being of future generations, measurement of trends in current well-being should include considerations of changes in the well-being of generations yet unborn'. This is a good argument, but it depends on the assumption that changes to future well-being really do affect the current generation's welfare. More importantly, the argument cannot hold in the other direction as future generations cannot care for the welfare of the current generation. Hence, what affects the current generation's welfare should not be included in an indicator of sustainability. There are items in the ISEW/GPI and in Osborne and Sharpe's Index of Economic Well-Being, which affect current welfare, but are only loosely connected to sustainability, if at all. A good example for this is income inequality. The indicators fall if income inequality increases. Many would agree that the

current welfare of society is negatively affected by a more unequal distribution of incomes. A society with a more unequal distribution of income generates less current welfare out the available stock of capital than another one with the same capital stock, but a more equal distribution of income. Not necessarily so with sustainability, however. A more unequal distribution of present incomes does not in itself diminish the value of the total capital stock available to future generations. There could be indirect effects as the distribution of income can affect savings and therefore investment decisions, which then affects sustainability. The available evidence is not unambiguous (Schmidt-Hebbel and Servén 2000), but if anything evidence seems to suggest that a more unequal distribution of income can be in the interest of the future because rich people have a higher marginal propensity to save than poor people (Smith 2001).[4] Hence, more income inequality can lower current welfare, but enhance sustainability.

The co-existence of factors within one integrated indicator of welfare and sustainability, which affect one, but not the other (or only weakly and ambiguously so), means that as the indicator rises or falls we do not know what rises or falls. A rising indicator could mean rising welfare and sustainability, rising welfare and a decline in sustainability (that is less in value terms than the rise in welfare) or falling welfare and a rise in sustainability (that is more in value terms than the fall in welfare). Which one is not clear. The lesson is that one needs two separate indicators to trace two distinct concepts.

## 3 Indicators combining well-being and sustainability without full integration

Let us therefore turn to efforts at combining the measurement of well-being with that of sustainability without trying to integrate both into one single indicator. These efforts have concentrated on the United Nations Development Programme's (UNDP) Human Development Index (HDI), first published in 1990, which is also the perhaps most prominent and best known indicator of well-being. The exact methodology of the HDI has changed somewhat throughout time. Without going into detail, the HDI is currently computed as follows: It is made up of three equally weighted components, the income, the education and the health/longevity component. For the first two components a transformed variable is derived from basic data. For the income component a log transformation is applied, in effect discounting higher incomes due to supposed diminishing marginal utility. For the educational component the transformed variable consists of two thirds of the percentage rate of literate adults among all adults and one third of the combined first-, second- and third-level educational gross enrollment ratio in percentage. The health/longevity component is directly measured by life expectancy at birth in years. For each variable a maximum and a minimum is defined. An index is then calculated as follows:

4 Anand and Sen (2000: 2038) also point out that redistribution to the poor in the form of better nutrition, health and education rather than income is likely to contribute to sustainability unambiguously. We agree, but the mere re-distribution of income need not be sustainability promoting.

$$\text{X\_index} = \frac{(\text{actual value} - \text{minimum value})}{(\text{maximum value} - \text{minimum value})},$$

X = (Income, Longevity, Education)

This index is calculated for each variable. A country's HDI is then simply the arithmetic average of its three indexes:

$$\text{HDI} = \frac{1}{3} \times (\text{Income\_index} + \text{Longevity\_index} + \text{Education\_index})$$

The validity of the HDI as an indicator of well-being has been disputed in many respects—see, for example, McGillivray (1993), Hicks (1997), Noorbaksh (1998*a*, 1998b), Sagar and Najam (1998). We will not discuss the criticism it has encountered as other papers in the UNU-WIDER project pursue this task. Instead, we will concentrate on our major objective, which is to examine how indicators of well-being and sustainability have been combined with each other.

### 3.1 Sustainability extensions to the HDI

There have been many proposals on how the HDI could be amended to take environmental aspects or sustainability into account. First, Desai (1995) has developed an 'index of intensity of environmental exploitation', which ranks countries similar to the HDI methodology according to a composite index comprising greenhouse gas emissions per capita, water withdrawal as per cent of annual internal renewable water resources and energy consumption per unit of GNP. Desai does not, however, attempt to integrate this index into the HDI itself.

Second, Dahme *et al*. (1998) have proposed to rank countries according to their total material requirements and to use this data to construct an extension to the United Nations Development Programme's Human Development Index (HDI), called 'Sustainable Human Development Index' (SHDI). Total material requirement refers to the sum of all material inputs required to produce a country's national economic output. All material inputs are grouped into abiotic raw materials (mineral and energy resources), biotic raw materials, moved soil (agriculture and forestry), water and air and are aggregated in weight terms.

Third, Sagar and Najam (1996: 14) suggest that an increase in income per capita 'above a selected threshold—selected to represent a point that allows a reasonably high standard of living but beyond which consumption pressures on the environment start becoming excessive—the standard-of-living index should reflect this unsustainable lifestyle through a penalization on the index'. The resulting 'index of sustainable living' would go some way towards a SHDI according to its proponents.

Fourth, De la Vega and Urrutia (2001) have proposed to adjust the HDI's income component to reflect the environmental damage caused in generating the income. Their proposal focuses on carbon dioxide since it is the only pollutant for which comprehensive cross-country and over time data exist. Setting 60 tonnes of carbon dioxide emitted per capita as the maximum and zero as the minimum, they compute an 'environmental behaviour indicator' (EBI) according to the formula $\text{EBI} = 1 - CO_2/60$.

The harmonic mean of the EBI and the HDI's income component forms the so-called pollution-sensitive income component. This pollution-sensitive income component is then used in the usual way as one of the three unweighted components together with the longevity and education component to create a so-called pollution-sensitive HDI.

The fifth proposal by Ramanathan (1999) is close to the HDI methodology in setting maximum and minimum values for an index of deforestation, an index of the number of rare, endangered or threatened species, a greenhouse gas emissions and a chlorofluorocarbon emissions index, which are combined to an overall environment endangerment index (EEI). This aggregate EEI is then used to calculate a so-called Environment Sensitive HDI as the product of the HDI and the EEI. He does not, however, attempt to compute such an Environment Sensitive HDI.

## 3.2 A critical assessment of the proposed extensions

All these proposals encounter substantial problems and criticism. Desai's (1995) proposal refers to rather incomplete and partly irrelevant aspects of environmental pollution. For example, how much water a country withdraws as a per cent of annual internal renewable water resources is substantially determined by geological and climatic conditions and a higher percentage of use is not necessarily worse than a low percentage. Similarly, energy consumption per unit of GNP is just an efficiency measure. Carbon dioxide emissions are certainly relevant, but they capture just one aspect of environmental pollution. Also, to rank countries according to their carbon dioxide emissions does not tell us anything about the actual environmental damage caused or its unsustainability. Furthermore, Qizilbash (2001) demonstrates that the ranking of countries is very sensitive to the choice of environmental factors looked at. If other environmental factors are included such as commercial and traditional fuel consumption per capita (instead of per unit of GNP), water resource consumption per capita (instead of as a percentage of annual internal reserves) and forest and woodland change, then the ranking is quite different from the one arrived at by Desai (1995).

De la Vega and Urrutia's (2001) pollution-sensitive HDI is similar to Desai's proposal in focusing on carbon dioxide emissions, but it attempts to integrate the pollution index into the income component. Again, no attempt at valuation is undertaken. Their proposal suffers from a major setback, however. Countries with very high per capita emissions such as some of the Middle East oil producing countries, Luxembourg, Australia, Norway and the US move down in the pollution-sensitive HDI ranking and vice versa for countries with very low emissions. This would erroneously suggest that the achieved human development of these countries is lower than the original HDI indicated. However, this is not the case. Instead, very high per capita carbon dioxide emissions merely signal that the high human development of these countries is bought at the expense of carbon dioxide emissions that would be unsustainable on a global scale as it would cause drastic climate change. Never mind that this is no new information, but something we knew all the time. More importantly, given that this is the true information content, the HDI itself should be unaffected since human development is unaffected. Again, as with the case of the ISEW/GPI and Osberg and Sharpe's (2002*a*, 2002*b*) Index of Economic Well-Being, the conflation of factors relevant for current well-being with those of sustainability leads to a flawed overall indicator that can no longer measure correctly either current well-being or sustainability. Ramanathan's (1999) proposal encounters the very same critique.

Dahme *et al.*'s (1998) proposal is very removed from actual environmental damage. From an environmental point of view, two forms of material flows with differing environmental damage impacts cannot be added together just because one can express both in weight terms. Without further analysis of what the material flows consist of and what are its environmental implications, it is pointless to simply rank countries according to the size of their material flows (for a more detailed critique of material flows as a measure of sustainability, see Neumayer (2003, 2004)).

More fundamentally, neither of these proposals directly addresses the sustainability problem. A ranking of countries according to environmental factors or material flows does not tell us anything about their sustainability, not even if we focus on environmental sustainability only. Sagar and Najam's (1996) proposal is also too simplistic. There does not exist a threshold of income, after which further income increases are unsustainable due to 'excessive consumption'. Without further knowledge about the environmental impact of the consumption level, one cannot infer whether it is sustainable or not. Also, none of the proposals discussed so far deals seriously with resource depletion, even though resource depletion forms an important component of the depreciation of the natural capital stock.

## 4 An alternative proposal: assessing the sustainability of well-being with Genuine Savings

As an alternative to fully integrated indicators of sustainability and well-being and as an alternative to the suggested extensions to the HDI discussed in the last section, Neumayer (2000*a*) has proposed to combine the HDI with a measurement of sustainability that can signal if the achieved level of human development can be maintained into the future. The measurement of sustainability is that of so-called Genuine Savings (GS), which measures the total investment in all forms of capital minus the total depreciation of all forms of capital. In simple terms, if GS is negative, then the value of the total capital stock available to future generations is smaller than the one available to the current generation—a clear indication of unsustainability (Pezzey and Toman 2002). Hence, Neumayer (2000*a*) proposes to qualify a country's HDI as unsustainable if the country's GS rate is below zero. Note, however, that the proposal can in principle be applied to any indicator of well-being, not just the HDI.

Genuine Savings has been pioneered by Hamilton (1994, 1996) with the World Bank's Environment Department. The World Bank publishes GS data in its annual statistical compendium World Development Indicators under the name 'adjusted savings'.[5] Within its GS computations, the World Bank takes depletion of the following natural resources into account in computing natural capital stock depreciation: oil, natural gas, hard coal, brown coal, bauxite, copper, iron, lead, nickel, zinc, phosphate, tin, gold, silver, and forests. As can be seen, the measure is strong on non-renewable resources since for these marketed resources the necessary data for valuation are not too difficult to get hold of. The harvesting of forests is the only renewable resource taken into account so far, others such as water depletion, fish catch, biodiversity loss, soil erosion

5 Like Dasgupta (2001*a*, 2001*b*) I prefer the term genuine investment as investment is really what GS refers to. However, Genuine Savings has now become the established nomenclature.

and the like encounter formidable data problems. The same is true for environmental pollution, for which carbon dioxide is currently the only pollutant included.

The World Bank counts current education expenditures as a proxy for investment into human capital. This is certainly rather crude, but it is difficult to see how investment in human capital could be estimated otherwise for so many countries over such a long time horizon.[6] Dasgupta (2001*b*: C9f.) argues that it is an overestimate since human capital is lost when people die. Against this one might object that part of the human capital might have been passed on so that the human capital is not really lost once individuals die or, to be precise, leave the workforce. In any case, such correction would be difficult to undertake.

Table 1 lists the HDI of countries in five-year steps from 1975 to 2000 and qualifies the achieved level of human development as potentially unsustainable if the country's GS was negative in or around that year. Note that for a number of technical reasons the qualification is one of *potential* unsustainability rather than outright unsustainability. First, given the sometimes shaky quality of the data one must be cautious about making strong assertions. Second, the World Bank counts the full value of resource depletion as natural capital depreciation ([price – average cost] * quantity of resource extracted or harvested). As argued in detail in Neumayer (2000*a*, 2003) the World Bank's computation of the full value of natural resource extraction might overestimate natural capital depreciation. What has become known as the El Serafy method (El Serafy 1981, 1989) corrects this upward bias, but it requires information about reserve stocks, which are not available for many countries for many resources for many years. Our computations therefore by necessity apply the World Bank method.

Table 1. HDI with Genuine Savings qualification

| Rank | Country | 1975 | 1980 | 1985 | 1990 | 1995 | 2000 |
|---|---|---|---|---|---|---|---|
| *High human development* | | | | | | | |
| 1 | Norway | 0.859 | 0.877 | 0.888 | 0.901 | 0.925 | 0.942 |
| 2 | Sweden | 0.863 | 0.872 | 0.883 | 0.894 | 0.925 | 0.941 |
| 3 | Canada | 0.868 | 0.883 | 0.906 | 0.926 | 0.932 | 0.940 |
| 4 | Belgium | 0.844 | 0.861 | 0.875 | 0.896 | 0.927 | 0.939 |
| 5 | Australia | 0.844 | 0.861 | 0.873 | 0.888 | 0.927 | 0.939 |
| 6 | United States | 0.863 | 0.884 | 0.898 | 0.914 | 0.925 | 0.939 |
| 7 | Iceland | 0.863 | 0.885 | 0.894 | 0.913 | 0.918 | 0.936 |
| 8 | Netherlands | 0.861 | 0.873 | 0.888 | 0.902 | 0.922 | 0.935 |
| 9 | Japan | 0.854 | 0.878 | 0.893 | 0.909 | 0.923 | 0.933 |
| 10 | Finland | 0.836 | 0.856 | 0.873 | 0.896 | 0.908 | 0.930 |
| 11 | Switzerland | 0.874 | 0.886 | 0.892 | 0.905 | 0.914 | 0.928 |
| 12 | France | 0.848 | 0.863 | 0.875 | 0.897 | 0.914 | 0.928 |
| 13 | United Kingdom | 0.841 | 0.848 | 0.858 | 0.878 | 0.916 | 0.928 |
| 14 | Denmark | 0.868 | 0.876 | 0.883 | 0.891 | 0.907 | 0.926 |

6 Note that in the traditional national accounts capital expenditures on education are already counted towards investment in man-made capital.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 15 | Austria | 0.840 | 0.854 | 0.867 | 0.890 | 0.909 | 0.926 |
| 16 | Luxembourg | 0.831 | 0.846 | 0.860 | 0.884 | 0.912 | 0.925 |
| 17 | Germany | n.a. | 0.859 | 0.868 | 0.885 | 0.907 | 0.925 |
| 18 | Ireland | 0.818 | 0.831 | 0.846 | 0.870 | 0.894 | 0.925 |
| 19 | New Zealand | 0.849 | 0.855 | 0.866 | 0.875 | 0.902 | 0.917 |
| 20 | Italy | 0.828 | 0.846 | 0.856 | 0.879 | 0.897 | 0.913 |
| 21 | Spain | 0.819 | 0.838 | 0.855 | 0.876 | 0.895 | 0.913 |
| 22 | Israel | **0.790** | 0.814 | 0.836 | 0.855 | 0.877 | 0.896 |
| 23 | Hong Kong, China (SAR) | 0.756 | 0.795 | 0.823 | 0.859 | 0.877 | 0.888 |
| 24 | Greece | 0.808 | 0.829 | 0.845 | 0.859 | 0.868 | 0.885 |
| 25 | Singapore | 0.722 | 0.755 | 0.782 | 0.818 | 0.857 | 0.885 |
| 26 | Cyprus | n.a. | 0.801 | 0.821 | 0.845 | 0.866 | 0.883 |
| 27 | Korea, Rep. of | 0.691 | 0.732 | 0.774 | 0.815 | 0.852 | 0.882 |
| 28 | Portugal | 0.737 | 0.760 | 0.787 | 0.819 | 0.855 | 0.880 |
| 29 | Slovenia | n.a. | n.a. | n.a. | 0.845 | 0.852 | 0.879 |
| 30 | Malta | 0.731 | 0.766 | 0.793 | 0.826 | 0.850 | 0.875 |
| 31 | Barbados | n.a. | n.a. | n.a. | n.a. | n.a. | 0.871 |
| 32 | Brunei Darussalam | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| 33 | Czech Republic | n.a. | n.a. | n.a. | n.a. | 0.843 | 0.849 |
| 34 | Argentina | 0.785 | 0.799 | 0.805 | 0.808 | 0.830 | 0.844 |
| 35 | Hungary | 0.777 | 0.793 | 0.805 | 0.804 | 0.809 | 0.835 |
| 36 | Slovakia | n.a. | n.a. | 0.813 | 0.820 | 0.817 | 0.835 |
| 37 | Poland | n.a. | n.a. | n.a. | 0.792 | 0.808 | 0.833 |
| 38 | Chile | **0.702** | **0.737** | **0.754** | 0.782 | 0.811 | 0.831 |
| 39 | Bahrain | n.a. | n.a. | n.a. | n.a. | n.a. | 0.831 |
| 40 | Uruguay | 0.757 | 0.777 | 0.781 | 0.801 | 0.815 | 0.831 |
| 41 | Bahamas | n.a. | 0.805 | 0.817 | n.a. | n.a. | n.a. |
| 42 | Estonia | n.a. | n.a. | n.a. | n.a. | n.a. | 0.826 |
| 43 | Costa Rica | 0.745 | 0.769 | 0.770 | 0.787 | 0.805 | 0.820 |
| 44 | Saint Kitts and Nevis | n.a. | n.a. | n.a. | n.a. | n.a. | 0.814 |
| 45 | Kuwait | **0.753** | **0.773** | **0.777** | n.a. | **0.812** | **0.813** |
| 46 | United Arab Emirates | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| 47 | Seychelles | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| 48 | Croatia | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| 49 | Lithuania | n.a. | n.a. | n.a. | 0.816 | 0.781 | 0.808 |
| 50 | Trinidad and Tobago | 0.722 | **0.755** | **0.774** | **0.781** | **0.787** | **0.805** |
| 51 | Qatar | n.a. | n.a. | n.a. | n.a. | n.a. | 0.803 |
| 52 | Antigua and Barbuda | n.a. | n.a. | n.a. | n.a. | n.a. | 0.800 |
| 53 | Latvia | n.a. | n.a. | n.a. | 0.804 | 0.763 | 0.800 |
| *Medium human development* | | | | | | | |
| 54 | Mexico | n.a. | 0.734 | **0.752** | 0.761 | 0.774 | 0.796 |
| 55 | Cuba | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| 56 | Belarus | n.a. | n.a. | n.a. | 0.809 | 0.776 | 0.788 |
| 57 | Panama | n.a. | 0.731 | 0.745 | 0.747 | 0.770 | 0.787 |
| 58 | Belize | n.a. | 0.710 | 0.718 | 0.750 | 0.772 | 0.784 |
| 59 | Malaysia | 0.616 | 0.659 | 0.693 | 0.722 | 0.760 | 0.782 |
| 60 | Russian Federation | n.a. | n.a. | n.a. | n.a. | 0.779 | **0.781** |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 61 | Dominica | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| 62 | Bulgaria | n.a. | 0.763 | 0.784 | 0.786 | 0.778 | 0.779 |
| 63 | Romania | n.a. | n.a. | n.a. | 0.777 | 0.772 | 0.775 |
| 64 | Libyan Arab Jamahiriya | n.a. | n.a. | n.a. | n.a. | n.a. | 0.773 |
| 65 | Macedonia, TFYR | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| 66 | Saint Lucia | n.a. | n.a. | n.a. | n.a. | n.a. | 0.772 |
| 67 | Mauritius | 0.630 | 0.656 | 0.686 | 0.723 | 0.746 | 0.772 |
| 68 | Colombia | 0.660 | 0.690 | 0.704 | 0.724 | 0.750 | 0.772 |
| 69 | Venezuela | 0.716 | **0.731** | **0.738** | **0.757** | **0.766** | **0.770** |
| 70 | Thailand | 0.604 | 0.645 | 0.676 | 0.713 | 0.749 | 0.762 |
| 71 | Saudi Arabia | **0.587** | **0.646** | **0.670** | **0.706** | **0.737** | **0.759** |
| 72 | Fiji | 0.660 | 0.683 | 0.697 | 0.723 | 0.743 | 0.758 |
| 73 | Brazil | 0.644 | 0.679 | 0.692 | 0.713 | 0.737 | 0.757 |
| 74 | Suriname | n.a. | n.a. | n.a. | n.a. | n.a. | **0.756** |
| 75 | Lebanon | n.a. | n.a. | n.a. | 0.680 | **0.730** | 0.755 |
| 76 | Armenia | n.a. | n.a. | n.a. | n.a. | n.a. | **0.754** |
| 77 | Philippines | n.a. | 0.684 | 0.688 | 0.716 | 0.733 | 0.754 |
| 78 | Oman | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| 79 | Kazakhstan | n.a. | n.a. | n.a. | n.a. | n.a. | **0.750** |
| 80 | Ukraine | n.a. | n.a. | n.a. | n.a. | n.a. | **0.748** |
| 81 | Georgia | n.a. | n.a. | n.a. | n.a. | n.a. | **0.748** |
| 82 | Peru | n.a. | 0.669 | 0.692 | 0.704 | 0.730 | 0.747 |
| 83 | Grenada | n.a. | n.a. | n.a. | n.a. | n.a. | 0.747 |
| 84 | Maldives | n.a. | n.a. | n.a. | n.a. | 0.707 | 0.743 |
| 85 | Turkey | 0.593 | 0.617 | 0.654 | 0.686 | 0.717 | 0.742 |
| 86 | Jamaica | **0.687** | **0.690** | **0.692** | 0.720 | 0.736 | 0.742 |
| 87 | Turkmenistan | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| 88 | Azerbaijan | n.a. | n.a. | n.a. | n.a. | n.a. | 0.741 |
| 89 | Sri Lanka | 0.616 | 0.650 | 0.676 | 0.697 | 0.719 | 0.741 |
| 90 | Paraguay | 0.665 | 0.699 | 0.705 | 0.717 | 0.735 | 0.740 |
| 91 | Saint Vincent and the Grenadines | n.a. | n.a. | n.a. | n.a. | n.a. | 0.733 |
| 92 | Albania | n.a. | n.a. | n.a. | n.a. | 0.702 | 0.733 |
| 93 | Ecuador | n.a. | **0.673** | **0.694** | **0.705** | **0.719** | **0.732** |
| 94 | Dominican Republic | 0.617 | 0.646 | 0.667 | 0.677 | 0.698 | 0.727 |
| 95 | Uzbekistan | n.a. | n.a. | n.a. | n.a. | **0.714** | **0.727** |
| 96 | China | n.a. | n.a. | 0.591 | 0.625 | 0.681 | 0.726 |
| 97 | Tunisia | 0.514 | 0.566 | 0.613 | 0.646 | 0.682 | 0.722 |
| 98 | Iran, Islamic Rep. of | **0.556** | 0.563 | **0.607** | **0.645** | **0.688** | **0.721** |
| 99 | Jordan | n.a. | 0.636 | 0.658 | 0.677 | 0.703 | 0.717 |
| 100 | Cape Verde | n.a. | n.a. | 0.587 | 0.626 | 0.678 | 0.715 |
| 101 | Samoa (Western) | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| 102 | Kyrgyzstan | n.a. | n.a. | n.a. | n.a. | n.a. | 0.712 |
| 103 | Guyana | n.a. | **0.679** | **0.671** | n.a. | 0.703 | n.a. |
| 104 | El Salvador | 0.586 | 0.586 | 0.606 | 0.644 | 0.682 | 0.706 |
| 105 | Moldova, Rep. of | n.a. | 0.720 | 0.741 | 0.759 | 0.704 | 0.701 |
| 106 | Algeria | n.a. | **0.550** | 0.600 | 0.639 | n.a. | n.a. |
| 107 | South Africa | n.a. | 0.663 | **0.683** | **0.714** | 0.724 | 0.695 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 108 | Syrian Arab Republic | 0.538 | 0.580 | 0.614 | **0.634** | **0.665** | **0.691** |
| 109 | Viet Nam | n.a. | n.a. | n.a. | 0.605 | 0.649 | 0.688 |
| 110 | Indonesia | n.a. | n.a. | 0.582 | 0.623 | 0.664 | 0.684 |
| 111 | Equatorial Guinea | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| 112 | Tajikistan | n.a. | n.a. | n.a. | n.a. | 0.669 | 0.667 |
| 113 | Mongolia | n.a. | n.a. | 0.650 | 0.657 | 0.636 | 0.655 |
| 114 | Bolivia | n.a. | **0.548** | **0.573** | **0.597** | 0.630 | 0.653 |
| 115 | Egypt | 0.435 | 0.482 | 0.532 | 0.574 | 0.605 | 0.642 |
| 116 | Honduras | 0.518 | 0.566 | 0.597 | 0.615 | 0.628 | 0.638 |
| 117 | Gabon | n.a. | n.a. | n.a. | n.a. | n.a. | **0.637** |
| 118 | Nicaragua | n.a. | **0.576** | 0.584 | 0.592 | **0.615** | 0.635 |
| 119 | Sao Tome and Principe | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| 120 | Guatemala | 0.506 | 0.543 | 0.555 | 0.579 | 0.609 | 0.631 |
| 121 | Solomon Islands | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| 122 | Namibia | n.a. | n.a. | n.a. | n.a. | n.a. | 0.610 |
| 123 | Morocco | 0.429 | 0.474 | 0.508 | 0.540 | 0.569 | 0.602 |
| 124 | India | 0.407 | 0.434 | 0.473 | 0.511 | 0.545 | 0.577 |
| 125 | Swaziland | 0.512 | 0.543 | 0.569 | 0.615 | 0.620 | 0.577 |
| 126 | Botswana | 0.494 | 0.556 | 0.613 | 0.653 | 0.620 | 0.572 |
| 127 | Myanmar | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| 128 | Zimbabwe | n.a. | 0.572 | 0.621 | 0.597 | 0.563 | n.a. |
| 129 | Ghana | 0.438 | **0.468** | 0.481 | 0.506 | 0.525 | 0.548 |
| 130 | Cambodia | n.a. | n.a. | n.a. | n.a. | 0.531 | 0.543 |
| 131 | Vanuatu | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| 132 | Lesotho | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| 133 | Papua New Guinea | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| 134 | Kenya | 0.443 | 0.489 | 0.512 | 0.533 | 0.523 | 0.513 |
| 135 | Cameroon | 0.410 | **0.455** | 0.505 | 0.513 | 0.499 | **0.512** |
| 136 | Congo | 0.417 | **0.467** | **0.517** | **0.510** | **0.511** | n.a. |
| 137 | Comoros | n.a. | 0.480 | 0.498 | 0.502 | 0.506 | n.a. |
| *Low human development* | | | | | | | |
| 138 | Pakistan | **0.345** | 0.372 | 0.404 | 0.442 | 0.473 | 0.499 |
| 139 | Sudan | **0.346** | **0.374** | n.a. | n.a. | **0.462** | **0.499** |
| 140 | Bhutan | n.a. | n.a. | n.a. | n.a. | n.a. | 0.494 |
| 141 | Togo | 0.394 | 0.443 | 0.440 | 0.465 | 0.476 | 0.493 |
| 142 | Nepal | 0.289 | 0.328 | 0.370 | 0.416 | 0.453 | 0.490 |
| 143 | Lao People's Dem. Rep. | n.a. | n.a. | n.a. | n.a. | n.a. | 0.485 |
| 144 | Yemen | n.a. | n.a. | n.a. | **0.399** | **0.439** | **0.479** |
| 145 | Bangladesh | **0.335** | **0.353** | 0.386 | 0.416 | 0.445 | 0.478 |
| 146 | Haiti | n.a. | 0.430 | 0.445 | 0.447 | 0.457 | **0.471** |
| 147 | Madagascar | **0.399** | **0.433** | **0.427** | 0.434 | **0.441** | 0.469 |
| 148 | Nigeria | 0.328 | **0.388** | **0.403** | **0.425** | **0.448** | **0.462** |
| 149 | Djibouti | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| 150 | Uganda | n.a. | n.a. | 0.386 | **0.388** | 0.404 | 0.444 |
| 151 | Tanzania, U. Rep. of | n.a. | n.a. | n.a. | 0.422 | 0.427 | 0.440 |
| 152 | Mauritania | **0.337** | **0.360** | **0.379** | **0.390** | **0.418** | 0.438 |
| 153 | Zambia | n.a. | **0.463** | **0.480** | **0.468** | n.a. | n.a. |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 154 | Senegal | 0.313 | **0.330** | **0.356** | 0.380 | 0.400 | 0.431 |
| 155 | Congo, Dem. Rep. of the | n.a. | n.a. | n.a. | n.a. | n.a. | **0.431** |
| 156 | Côte d'Ivoire | 0.369 | 0.403 | 0.412 | **0.415** | 0.416 | 0.428 |
| 157 | Eritrea | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |
| 158 | Benin | 0.288 | 0.324 | **0.350** | **0.358** | 0.388 | 0.420 |
| 159 | Guinea | n.a. | n.a. | n.a. | n.a. | n.a. | 0.414 |
| 160 | Gambia | **0.272** | n.a. | n.a. | n.a. | 0.375 | 0.405 |
| 161 | Angola | n.a. | n.a. | n.a. | n.a. | n.a. | **0.403** |
| 162 | Rwanda | 0.336 | 0.380 | 0.396 | 0.346 | 0.335 | 0.403 |
| 163 | Malawi | 0.316 | 0.341 | 0.354 | 0.362 | 0.403 | 0.400 |
| 164 | Mali | 0.252 | 0.279 | **0.292** | 0.312 | 0.346 | 0.386 |
| 165 | Central African Republic | n.a. | **0.351** | 0.371 | 0.372 | **0.369** | 0.375 |
| 166 | Chad | n.a. | n.a. | **0.298** | 0.322 | 0.335 | **0.365** |
| 167 | Guinea-Bissau | n.a. | n.a. | 0.283 | 0.304 | 0.331 | 0.349 |
| 168 | Ethiopia | n.a. | n.a. | 0.275 | 0.297 | 0.308 | **0.327** |
| 169 | Burkina Faso | 0.232 | 0.259 | 0.282 | 0.290 | 0.300 | 0.325 |
| 170 | Mozambique | n.a. | **0.302** | **0.290** | **0.310** | 0.313 | 0.322 |
| 171 | Burundi | n.a. | n.a. | 0.338 | 0.344 | 0.316 | **0.313** |
| 172 | Niger | 0.234 | 0.254 | 0.246 | **0.256** | **0.262** | 0.277 |
| 173 | Sierra Leone | n.a. | n.a. | n.a. | n.a. | n.a. | n.a. |

*Note*: Numbers in bold represent negative GS rates.
n.a. means that either the HDI or GS is not available.
*Source*: UNDP (2002) and World Bank (2002).

Table 1 shows that most countries with high human development are not detected as weakly unsustainable. This is because investments into human and man-made capital far outweigh depreciation of capital. It is only such countries as Kuwait and Trinidad and Tobago with a strong dependence on natural resource extraction, which have negative GS rates. Most countries whose human development achievement needs to be qualified due to negative GS rates are those with low human development or in the lower part of medium human development. Another observation following from Table 1 is that unsustainability is persistent in the sense that often countries with negative GS in one year have similarly negative rates in other years as well. Unsustainability is not inescapable, however, as such examples as Chile and Jamaica show, which started off with negative GS, but turned these into positive rates in the 1990s. In the case of Sub-Saharan Africa, from which many countries with signs of unsustainability come from, a more detailed analysis shows that even their net savings, that is before natural capital depreciation, is often already negative such that their economies are on a weakly unsustainable path quite independently of depreciation due to natural resource exploitation (Neumayer 2004).

One of the problems of the existing published GS data is that it does not take into account population growth. One might think that this is easy to achieve in looking at GS per capita instead of GS. However, the correct accounting for population growth depends on whether population growth is assumed to be exponential and whether social welfare only depends on per capita utility or also on population size (see Hamilton 2002, Asheim 2002, Arrow, Dasgupta, and Mäler 2003). If one were to take GS per capita as a first approximation, then many more developing countries with fast growing

populations would run into problems with weak sustainability. Dasgupta (2001*a*: 158) computes that Bangladesh, India, Nepal, Pakistan and the Sub-Saharan African region as a whole have all had net *per capita* depreciation of their total capital stock over the period 1970 to 1993. China, the only other country looked at by Dasgupta, has just so escaped this fate. Note, however, that technological progress is a force in the opposite direction. If it is at least partly exogenous in the sense that it is not fully captured by total capital (Weitzman 1997), then even negative GS rates at any moment of time need not imply weak unsustainability. The same is true for what Dasgupta (2001*a*: 149) calls 'costless accumulation of public knowledge'. We cannot resolve these difficult issues and simply take existing published GS data as a first approximation.

What are the policy implications of our analysis? Countries with negative GS rates need to invest more and consume less to achieve sustainability. There is a fundamental problem with this policy implication, however. We saw already that developing countries with low and lower medium human development form the majority of countries with unsustainable human development. To demand from these poor countries to save more and consume less is likely to impose the burden of sustainability achievement on the shoulders of poor, powerless and vulnerable people. This, however, would contradict the universalist foundation of sustainability, as Anand and Sen (2000: 2030) make clear:

> universalism also requires that in our anxiety to protect the future generations, we must not overlook the pressing claims of the less privileged today. A universalist approach cannot ignore the deprived people today in trying to prevent deprivation in the future.

Without help from the intra-generationally rich (i.e. the developed countries), these countries will not only be unable to improve their welfare, but they also risk losing the little welfare they have since even this low level is unsustainable. Such help in the form of aid, trade or investment can be justified partly with recourse to the fact that development in rich countries has partly been achieved via imposing a negative externality in the form of greenhouse gas emissions, the costs of which are mainly borne by future developing countries (Neumayer 2000*b*).

## 5 Conclusion

We have argued that besides methodological flaws that are specific to the ISEW/GPI, fully integrated indicators of well-being and sustainability encounter a fundamental conceptual problem: What affects current well-being need not affect sustainability at all or not in the same way, and vice versa. Fully integrated indicators therefore tend to conflate the measurement of two items that should be kept conceptually different. Whereas well-being refers to the current use of the available capital stock in terms of preference satisfaction, sustainability refers to sustaining the value of the total capital stock for the future. The inclusion of sustainability in a measure of current well-being can be justified if one assumes that the current generation's welfare fully takes the welfare of future generations into account. However, no similar justification exists for a measure of sustainability, which should be free of items that affect only current well-being as future generations cannot care for current welfare.

As we have seen, even some proposals combining the measurement of well-being with that of sustainability without full integration at times fall into this trap. We have therefore developed a proposal, which combines the measurement of well-being with that of sustainability that avoids the trap. Well-being is measured in the conventional way, but the sustainability of the achieved level of well-being is checked with a GS test. Where GS is below zero, there is a danger that the achieved level of well-being is bought at the expense of liquidating the total capital available to a country, which cannot be sustainable. We have illustrated our proposal with reference to the HDI, but hasten to add that it is a general proposal in that the GS test can be added to any indicator of well-being.

Of course, our proposal to combine the HDI with a sustainability check according to the GS rule is not without its problems and limitations either. Currently, GS is not computed for all countries for which UNDP calculates a HDI, but using GS as a sustainability qualification only makes sense if it is available for all relevant countries. Coverage is also a problem with respect to the extent to which natural capital is fully taken into account. Ideally more renewable resource depletion such as water, soil and fish should be included. The same goes for pollutants such as sulphur and nitrogen dioxides, particulate matter, volatile organic compounds and many more. That developed countries are not regarded as unsustainable according to GS is partly due to their high investment into manufactured and human capital. However, if more pollutants could be taken into account their sustainability position would no longer be as favourable as it currently is. This is because as UNDP (1998: 66) correctly points out: 'It is the rich who pollute more … who generate more waste and put more stress on nature's sink'. Of course, it is doubtful whether we will ever have such data available for all countries. However, for the developed countries better and more comprehensive data exist and there is no reason why a more comprehensive GS measure could not be estimated for this group of countries.

The main reason why developed countries are not detected as unsustainable by GS has to do with the concept of sustainability underlying the measure, however. This concept is one of weak sustainability, which, as pointed out in the introduction, assumes substitutability of natural capital through other forms of capital. The competing concept of strong sustainability rejects such substitutability. It requires to keep pollution within the absorptive capacity of nature and to replace depleted non-renewable resources with a functionally equivalent stock of renewable resources or non-depletable resources (such as solar and wind energy) (Neumayer 2003). Why not combine the HDI with a measure of strong sustainability then? The reason is that there are likely to be very few, if any, countries that achieve strong sustainability. Most developed countries emit more greenhouse gases than the atmosphere can cope with. Those developing countries that do not exceed the natural absorptive capacity of the global atmosphere with their greenhouse gas emissions still often deplete their non-renewable resource stock without adequate replacement investments into renewable or non-depletable resources or degrade their local environment. The information content of such a measure would therefore be minimal. The lesson is to take GS as a first step into the right direction. A country, which is not weakly sustainable cannot be strongly sustainable either and since there are so many poor weakly unsustainable countries in the developing world, making them weakly sustainable is what we should concentrate on.

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