Frequently Asked Questions on Hueting's SNI concept

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1 General critics:

QUESTION 1a Statics versus dynamics

The concept of strong sustainability does not fit to the real world, because the real world especially nature is not in a static equilibrium, at best in an dynamic one. We do not know if for e.g. the climate change is more induced by human behavior or by the evolution of the Earth, because the change of climate does not necessarily depend on additional CO2 emissions caused by production.

Answer 1

With respect to the first part of this question the following *answer (1)* can be made . In the article Sustainability is an objective concept by Roefie Hueting and Lucas Reijnders in Ecological Economics 27 (1998) is stated on page 140, left column that vital environmental functions have to stay available in a *dynamic* equilibrium. This is described on p. 139 as an equilibrium between activities by humans (especially production and consumption) and their natural resources. We most probably agree (1) that the earth since its origin, around five billion years ago, has been changing continuously and *drastically* and that this process will continue on a geological timescale and (2) that humans since their origin, roughly hundred to two hundred thousand years ago, have been constantly busy, in particular with adding value to the non-human made physical surroundings: producing. Hueting and Reijnders therefore state in the article that in these dynamic processes the vital possible uses of those surroundings have to stay available on penalty of a collapse of the production to far below a sustainable level now (because this is already happening in some places, see: Hueting and Reijnders, Broad sustainability contra sustainability: the proper construction of sustainability indicators, in Ecological Economics 50, 2004) and in the future (precautionary principle for the sake of generations to come).

Answer 2

With respect to the second part of this question the remark can be made that according to climatologists the plausibility that climate change is caused by human activities is much greater than that is not caused by man. Furthermore: the precautionary principle is underlying the concept of environmental sustainability, which in turn is underlying the SNI.

QUESTION 1.b Direction of evolution

The concept of strong sustainability contradicts the concept of evolution, but we do not know in which direction the evolution will evolve the Earth.

Answer 3

The SNI is not based on strong sustainability. In Hueting and De Boer, Environmental valuation and SNI according to Hueting, in Economic Growth and Valuation of the Environmnent, a Debate, E. van Ierland et al.(eds), Edward Elgar, Cheltenham, 2001, the following remarks are made about strong and weak sustainability.

The figures thus found can be no more than rough estimates, of course.
In the context of non-renewable natural resources, though, this is an approach that does justice to the principle of sustainability, which is the point of departure of our estimates.

Our approach would be comparable with that of Solow (1974), Hartwick (1977, 1978) and others, if the latter were to exclude unfeasible substitution of renewable resources by other resources and by capital (see below), that is if they were to abandon their faith in the extreme areas of formal production functions.

When using the concept of environmental function, the only thing that matters in the context of sustainability is that vital functions remain available. What does the conservation of vital functions imply for the distinction between renewable and non-renewable resources and for the distinction between strong and weak sustainability?

As for renewable resources, functions remain available as long as their regenerative capacity remains intact. Regeneration in relation to current use of 'non-renewable' resources such as crude oil and copper that are formed by slow geological processes is close to zero. 'Regeneration' then takes the form of efficiency improvement, recycling and, in the final instance, developing substitutes. The possibilities for this are hopeful (Reijnders, 1996; Brown et al., 1998). So, economically speaking, there seems to be no essential difference between the two types of resource: sustainability is attained if their functions remain available.

Advocates of 'weak sustainability' take the line that all elements of the environment can ultimately be substituted by man-made alternatives, implying that restoration of lost elements can be postponed in anticipation of cheaper substitutes provided by future technologies. However, the life support systems[1] of our planet, on which a number of vital functions depend, are not substitutable at all (Lovelock, 1979; Roberts, 1988; Reijnders, 1996).[2] Consequently, there can be no such thing as 'weak sustainability' for the functions of these systems.

Advocates of 'strong sustainability' hold it to be impossible for humanity to substitute many of the elements of the natural environment. In its strictest form, however, this implies that stocks of non-renewable resources should remain fully intact, an unrealistic aim, as already discussed. Consequently, strong sustainability for non-renewable resources seems to be impossible.

In conclusion, there seems to be only one kind of sustainability, whereby non-renewable resources must gradually be substituted by other elements of our physical surroundings in order to guarantee the availability of functions, and substitution of a large class of renewable resources is impossible, particularly life support systems, including

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[1] Life support systems are understood as the processes that maintain the conditions necessary for life on earth. This comes down to maintaining equilibria within narrow margins. The processes may be of a biological or physico-chemical nature, or a combination thereof. Examples of biological processes include the carbon and nutrient cycles, involving the extraction of such substances as carbon dioxide, water and minerals from the abiotic environment during biomass creation, and the return of these substances to the abiotic environment during biomass decomposition. Examples of physico-chemical processes include the water cycle and regulation of the thickness of the stratospheric ozone layer. As the examples show, there is interaction between the processes, with the possibility of equilibrium being disturbed. The water cycle, for example, may be disturbed by large-scale deforestation.

[2] The same holds for most of the functions of natural ecosystems, especially in the long term (see, for example, the remark on the function of 'gene pool' in Section 4 of R. Hueting and B. de Boer (2001), Environmental valuation and sustainable national income according to Hueting in: *Economic growth and valuation of the environment, A debate*, E.C. van Ierland, J. van der Straaten, H. Vollebergh (eds), Edward Elgar, Cheltenham, UK – Northhampton, MA, USA, pp. 27-33.

ecosystems.

Answer 4

As for the uncertainty about direction the evolution will evolve the Earth, this question boils down to the question "Can the term at which vital functions have to remain available objectively be determined?" The *answer (4)* is: yes, this is possible, but only with great uncertainties. First of all, to clarify the problem: if, as a result of reaching sustainability standards, possible uses have been made available and unthreatened, and they have to remain so in the future, then these sustainability standards have to be respected in the future from generation to generation, over and over again for generations to come (this is the basic assumption of the SNI: predominant preferences for maintaining environmental functions which are for humans; of course the resulting reallocation sacrifice for maintaining the standards can decrease by improved technology). So the point is whether the length of the period during which sustainability standards have to be maintained can be objectively determined.

Partly this period is restricted by the term of life of the object in question: Homo sapiens. The geological history learns that the family of species to which humans belong (the primates) are characterized by a term of life per species in the order of 100.000s to around one million years. The longest term of life of a mammal is in the order of tens of millions of years. There isn't a single reason to suppose that humans as a species will persevere on earth for five billion years, when the sun comes to its end. Long before mammals will have disappeared from the earth (in particular because of a too high temperature). When humans disappear so does the concept of sustainability.

For another part the period is limited by earth's geophysical processes. Further to the above remarks on maintaining vital functions in the dynamic processes of the earth and human activities (the definition of environmental sustainability), the following statement is made in the afore mentioned article by Hueting and De Boer, Edward Elgar book p. 59 under 6.6 (in connection with previous pages). In order to prevent a collapse of production, vital functions have to stay available in the future on a therefore required level. In theory the future is infinite, but in practice we limit this to the time span "in which the influence of geophysical processes on the environment is unlikely to exceed human influence, say several millennia or longer". Besides geophysical processes also biogeochemical processes have to be considered. That period is, put succinctly, equal to now up to the moment upon which the effect of environmental pressure on functions is neutralised c.q. overruled by geophysical or biogeophysical processes. This time span can by rough estimate be objectively determined by natural scientists. For example it has been estimated that in about 40.000 years there will be a new ice age. Generations to come have to take measures to eliminate the effect of extra greenhouse gases on functions to keep them available only up to the turning point. Thereafter, then living humans can decide to survive in the cold. (The necessary measures the n are obviously not costs but value added, because the cold is not caused by humans).

So it is stated that environmental sustainability cannot be determined for ever (a difficult concept just as infinite) and that when the sun is burned-up the concept of environmental sustainability doesn't exist anymore because humans then, and probably earlier, don't exist any longer.

Herewith environmental sustainability is determined as remaining available of vital environmental functions, a situation that can be objectively determined (while the preferences for whether or not wanting to reach this situation are subjective).

2. Specific critics:

QUESTION 2a Technological change

It is assumed that the technological change is zero while calculating the SNI of a specific year. It could be that an important invention could be made to reduce the abatement costs to protect of the environment is much cheaper in the future. Then it would be efficient to restore environmental damages in the future in stead of today.

Answer 5

The SNI is not a policy for how to restore functions as efficicient as possible, but an instrument that provides information about the question whether society is drifting further away from envronmental sustainability or approaching environmental sustainability, formulated as the situation in which vital possible uses of human's physical surroundings remain available for future generations with the technology in the year of investigation. In the first case (drifting away) the gap between SNI and standard NI becomes greater, in the second case (approaching) this gap becomes smaller. Thus, to give an example, in the Netherlands this gap has increased by about 10 billion euro in the period 1990-2000. If, as has been included in question 2a, in some year x in the future an important invention is made that reduces the abatement costs, then this helps to reduce the distance between SNI and NI (the gap) in that year x and consequently helps to bring society closer to environmental sustainability in year x.

QUESTION 2a' Time frame

Additionally, to what extent are SNI's of different years comparable?

Answer 6

SNI's of different years are compatible in the same way as standard NI's of different years, because they are estimated according to the same rules, and therefore SNI's and NI's in the same year are compatible too. However, the uncertainty of the SNI estimates is of course much greater than the uncertainty of the NI estimates.

QUESTION 2b Zero cost of extinct species

Assume the following: A specific species has died out, that means that this species cannot be protected anymore, which would decrease ceteris paribus the costs of protecting the environment and consequently enhance the the SNI. This would be a paradox.

Answer 7

Hueting has often published that no elimination costs can be computed for irreversible, unrepairable losses, so his 'demand and supply of functions' method fails in these cases. This is because, if in between the estimates of two SNI's species become extinct, no measures can be formulated so no costs can computed to bring them back on Earth. So yes, this could lead to an overestimation of SNI in the second year. It is a good question and as soon as there are subsidies for tackling the biodiversity, one of the three or four areas that are not yet covered in the Dutch SNI's, this should be mentioned as a sort of PM item. When mentioning this problem in his publications Hueting always adds the remark that no other method can solve this problem. So this could be an answer to the question asked, although it is a not sastisfying answer.

3. Practical problems

QUESTION 3 Shape of abatement cost curves

Do we really know the shape of the abatement cost curves?

Answer 8

Yes, by and large we do. Elimination cost curves (elimination is defined as eliminating the burdening of functions at the source, see New Scarcity) are constructed by arranging the five kind of elimination measures (technical, alternatives, direct shifts, reduction of activities and reduction of population- as ultimum remedium) by increasing annual costs per unit of function(s) regained (expressed as a physical parameter, e.g. 1000 tons CO2). So you get a number of dots in the diagram with money on the y-axis and the function in

physical units on the x-axis and then draw a line between the dots which is the elimination cost curve using the technology in the year of investigation.

QUESTION 3b Cans or bottles

How should the following problem be handeled: Assuming we could only choose between cans and bottles for Coke, what is then preferable? On the one hand it would be possible to reduce the consumption of bauxit to produce cans, on the other hand we would increase the quantity of water to clean bottles and it much less energy consuming to transport one liter Coke in a can than in a bottle. How shall this problem or trade-off be solved?

Answer 9

Referring to *answers 4 and 5*, the following remarks can be made. The purpose of SNI is to estimate a burdening of vital functions that can be sustained from generation to generation in such a way that these functions remain over and over again available for the next generation (see *answer 4*). So as for the non renewable bauxit, water and fossil energy carriers we deal with the costs of recycling and with the costs of developing and bringing into practice alternatives. For how to deal with non renewables see the solution given by Tinbergen/Hueting/Bosch, mentioned at pages 67 (at the bottom), 68 and 69 in Economic Growth etc. etc., Edard Elgar, Cheltenham UK, 2001. The costs of the measures resulting from this solution will increase the prices of bauxit, water and energy. Depending on the relative rises in prices of these non-renewables the prices of cans and bottles will be affected and depending of the relative rises in the prices of cans and bottles the choice between cans and bottles will be made. As you will understand, the above is a primitive and incomplete description of what is happening in the model, in which more factors play a roll. Again, the question shows that the colleage who asked the question has a wrong idea about what the SNI is: it is not a policy tool for special cases but a macro approach for giving information about a sustainable production level that can be attained by a sustainable burdening of the possible uses of the non human-made physical surroundings, as an indispensable supplement to the standard NI. However, the new price relationships in the estimated environmentallly sustainable situation will give some indication of what can be espected if society is approaching this goal.

QUESTION 3c SNI requires too many assumptions

Too many assumptions are needed to calulate a the SNI, especially on the behavior of foreign countries, consumer behavior, production functions etc.

Answer 10

It is quite usual to have this number and types of assumptions in economic modelling. As for foreign countries, without the assumption that other countries proceed simultaniously to environmental sustainability according to the definition given, you get a result that is complete nonsense, because then 'pollution' is exported; this assumption is self-evident, logical and inescapable. As for consumer behaviour, empirical long term demand elasticities for changes in prices are available to start off, but elasticities for great changes are uncertain indeed. But one has to realize that they are dictated by the requirement that a sustainable production level must be attained; so they *must* be estimated even if they are uncertain. The same holds true for production functions. In conclusion, uncertainties are inescapable. However, the greatest uncertainty by far is to make no estimate of SNI's. SNI's cannot be replaced by any other approach, including the ecological footprint or the natural step.