

# Alternative Indicators to GDP: Values behind Numbers Adjusted Net Savings in Question

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**ALTERNATIVE INDICATORS TO GDP: VALUES BEHIND NUMBERS**  
**ADJUSTED NET SAVINGS IN QUESTION\***

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**ABSTRACT**

After sixty years of predominance in the western countries, both the objective of economic growth and its core measure, the Gross Domestic Product (GDP), have been questioned. It no longer seems consistent to maintain growth as a societal goal and to keep GDP as the major reference for socioeconomic policies. Numerous alternative indicators have been suggested. These new indicators potentially constitute a great opportunity for change: it is now broadly accepted that *what we measure affects what we do*. We go a step further, claiming that *the way we measure it is just as crucial*: indicators intrinsically carry axiological and normative conceptions, embedded in the specific way they are built. As indicators are increasingly being used for shaping political ends, light should be shed on these underlying conceptions. Our analysis of the Adjusted Net Savings (ANS, the sustainability indicator proposed by the World Bank) attempts to illustrate these normative underpinnings, often obscured by technical concerns around the numbers. By systematically deconstructing the ANS, from its conceptual framework to its sub-dimensions, we shed light on the singular and debatable – productivist – conception of ‘sustainability’ (in its human and ecological aspects) encompassed in the ANS. This exercise aims to provide an insight into the societal values embedded in such indicators, which can strongly influence decision-making.

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For over sixty years, the objective of economic growth, quantitatively assessed by the Gross Domestic Product (GDP), has been pivotal within the elaboration of socioeconomic policies in capitalist economies. Created in the specific post-World War II context, national accounting systems – whose major indicator is GDP – were largely shaped to respond to the urgent need for reconstruction and for building a new image of national power (Fourquet, 1980). From then onwards, GDP has progressively become a central beacon in policy-making. Economic growth as a goal for socioeconomic policies was enhanced owing to a broad acceptance of the link between market production and social progress. Such a vision of progress was enrooted in social pacts ensuring a balanced share of the value produced between labour and capital.

Today however, the environmental and social impacts of a sixty-year economic growth have led to a historical turning point: it is no longer possible to maintain growth as an implicit societal goal. Nor is it consistent to keep GDP as the major reference for socioeconomic policies. GDP has been unable to tackle central issues related to the quality and sustainability of people and societies' ways of life. Nor has it been able to alert against the rise of many crises factors, such as demonstrated by the recent financial and economic crises.

Many debates have risen to discuss possible ways to go beyond this key indicator, gathering actors of various horizons: citizens, politics, economic institutions and academics<sup>1</sup>. From these debates, new alternatives and/or complements to GDP have emerged<sup>2</sup>. The growing interest in the research for new indicators, stepped up for now fifteen years, and the fact that it is taken into account more often by powerful institutions constitute significant phenomena: new indicators of “progress” are to play a growing role in the public sphere. On one hand, they constitute important beacons for leading policies. On the other hand, and more fundamentally, indicators of “progress” implicitly contribute to the definition of “progress”. The choice of an indicator (or set of indicators) carries much values and world visions.

Yet, the current debates on new indicators have the singularity of merging questions of finalities (what is a desirable society? what is progress?) and questions of methodology (how to measure progress?). While issues of finalities naturally require the legitimacy of a transparent debate, questions of method rather seem to constitute the traditional duty of experts. These two kinds of questions being uneasily distinguished, the risk is high to see the former being absorbed by the latter, leaving to experts the choice of a measure of “progress”, indirectly allowing them to decide

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<sup>1</sup> Among the main initiatives, let us point out the following :

- OECD 3<sup>rd</sup> World Forum, “Charting Progress, Building Visions, Improving lives”, October 2009, Busan, Korea;
- “Commission on the measurement of economic performance and social progress”;
- EU parliament international conference (in collaboration with OECD and WWF), “Beyond GDP”, November 2007, Brussels, Belgium.
- OECD 2<sup>nd</sup> World Forum, “Measuring and Fostering the Progress of Societies”, June 2007, Istanbul, Turkey.

<sup>2</sup> For a good overview of the main alternative indicators currently on the table, see Gadrey, J. and Jany-Catrice, F. (2007).

what “progress” is and/or should be. To avoid such a democratic deficiency to happen, it is crucial to clarify the normative foundations and implications of new indicators of “progress”, that is, to decrypt what values and visions of the world numbers implicitly carry.

There is a growing acceptance of the fact that the choice of a measure is intrinsically normative. “*What we measure affects what we do; and if our measurements are flawed, decisions may be distorted*” (Stiglitz *et al.*, 2009, p.7). Going a step further, we think that *the way we measure it* can suggest different insights on the direction(s) that should be taken in the pursuit of “progress”. Though, the growing influence of *what* we take into account and *how* we do it is too often occulted behind methodological concerns. This is what we shall illustrate in the paper, by deconstructing an indicator at each step of its elaboration (from its upriver theoretical/conceptual framework to its downriver sub-dimensions) to put into light the range of implicit values that underlie a quantitative measure, too often presented as being neutral<sup>3</sup>.

The indicator chosen here is the Adjusted Net Savings (ANS, also known as *Genuine Savings*). This indicator benefits from a very high visibility. It has been developed by the World Bank and estimated for more than 190 countries over the period 1970-2006<sup>4</sup>. Furthermore, it has been praised by many economists as being anchored in a coherent theoretical framework, being therefore a better indicator than many other composite “sustainability” indicators. What is more, the ANS has been assigned with a clear political role. The ANS “*seeks to provide national-level decision makers with a clear, relatively simple indicator of how sustainable their country’s investment policies are*” (Bolt *et al.*, 2002, p.4). It has also been suggested, in the – potentially influential – *Report of the Commission on the Measurement of Economic Performance and Social Progress*, as having to appear (conditionally to some modifications) in a restricted dashboard of indicators (Stiglitz *et al.* 2009). Furthermore, the United Nations Organization has been working on integrating ANS estimates into its official national guidelines (UNSD, 1993), which might enhance this indicator’s impact on global policy-making (Ferreira and Vincent, 2005). As this indicator is to influence policy conclusions, namely at the World Bank level, its potential impact on many countries deserves that transparency be made on its normative aspects. This transparency has been pointed out by the members of FAIR<sup>5</sup> as a necessary (but not sufficient) condition for the ANS to be legitimately adopted as a new policy tool.

The paper first recalls how ANS is elaborated. The next sections are dedicated to the implicit values and norms carried by theoretical and methodological choices. Section 2 approaches the normative implications of the theoretical framework underlying the ANS. Section 3 discusses the assumption of substitutability between capitals. Sections 4, 5 and 6 focus on three specific dimensions of the ANS. Firstly, the way human resources are accounted is questioned. Secondly,

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<sup>3</sup> Each of the normative issues presented here deserves a further analysis on its. But such an analysis goes beyond the scope of this paper, the aim of which being to draw a synthetic outline of the normative issues at stake in quantification processes.

<sup>4</sup> The ANS estimates can be downloaded from : <http://go.worldbank.org/VLJHBLZP71>

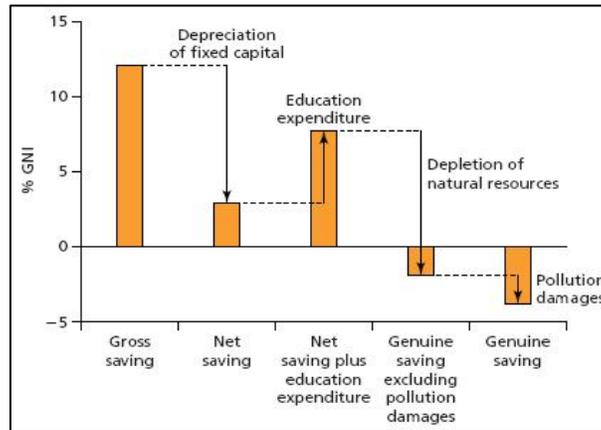
<sup>5</sup> FAIR, *Forum pour d’autres indicateurs de richesse*. We are particularly indebted to Jean Gadrey, Florence Jany-Catrice, Dominique Méda, Pascal Petit and Patrick Viveret for their enriching opinions on the ANS.

the estimation of natural resources depletion is examined as well as its imputation. Finally, the computation of the pollution damages is assessed. Section 7 concludes.

### 1 The Adjusted Net Savings: an Index of “Sustainability”

The ANS is an indicator of sustainability. It aims to give an account of the net creation or destruction of the national wealth, on a yearly basis. In the ANS, wealth is enlarged to include, besides produced assets, natural resources, environmental quality and human capital. Derived from standard national accounting measures of gross national savings, the ANS operates four types of adjustment (figure 1). First, estimates of the consumption of fixed capital are deducted to obtain net national savings. Second, current non-fixed capital expenditures on education are added to reflect the investment in human capital. Third, estimates of the depletion of different natural resources are subtracted to present the decline in asset values associated with their extraction and harvest. Eventually, global pollution damages from carbon dioxide emissions are deducted (Bolt *et al.*, 2002; Stiglitz *et al.*, 2009).

**Figure 1: Adjusted Net Savings (ANS)**



Source: World Bank, <http://web.worldbank.org/>

All these capitals variations are expressed in a common monetary unit, as a percentage of gross national income (GNI) and summed up:

$$ANS = \frac{GNS - D_h + CSE - \sum R_{n,i} - CD}{GNI}$$

where

*ANS* = Adjusted Net Savings Rate

*GNS* = Gross National Saving

*D<sub>h</sub>* = Depreciation of produced capital

*CSE* = Current (non-fixed-capital) expenditure on education

*R<sub>n,i</sub>* = Rent from depletion of natural capital *i*

*CD* = Damages from carbon dioxide emissions

*GNI* = Gross National Income at Market Prices

As the ANS represents the variation of wealth, a negative value of this indicator sends the message that it will not be possible to maintain current consumption levels over the future.

## **2 The Neoclassical Conceptual Framework of the ANS**

The conceptual framework in which an indicator is anchored is worthwhile considering for it encompasses, within its axiomatic, normative elements that are *per se* debatable. Upstream of any technical choice, the theoretical frameworks from which indicators derive carry a singular world vision that deserves being highlighted as soon as indicators are to be used or understood in terms of societal finalities. This section explores the conception of sustainability underlying the ANS (2.1.) and then critically discusses the implications of such a conception (2.2.).

### **2.1 The Conception of “Sustainability” Underlying the ANS**

The very first formulations of the ANS (gross savings adjusted for the loss of various assets), as a measure improving the traditional measures of savings, appear in Pearce and Atkinson (1993), Hamilton (1993) and Hamilton (1994) and Hamilton, Pearce and Atkinson (1997). A more formal basis to the ANS is to be found in Hamilton and Clemens (1999), where the authors more rigorously present the adjustments to be done to savings measures to come to a more comprehensive indicator. All these contributions, enrooted in the theoretical green accounting and social welfare literature<sup>6</sup>, provide suggestions for an indicator of sustainability: a measure that would account for the value of living and non-living natural resources depletion, environmental degradation and for the investment in human capital (Pearce and Atkinson, 1993). This new type of measure was perceived and justified as contributing to enrich national accounting, enabling along the way a better conceptualization of “sustainable development”.

Whatever the different modalities of net savings measures across the new green accounting literature, the ANS is commonly built, following Hartwick (1990), on the basis of an intertemporal optimization problem. Wealth is defined as the present value of welfare, (understood as the utility of a representative agent), the latter depending on both consumption and environmental services<sup>7</sup>. Wealth should be maximized subject to a constraint of production function that combines produced, environmental and human assets<sup>8</sup>. Production yields a composite good and leads to pollution emissions, which may be abated by some input of the composite good (Hamilton, Atkinson, Pearce, 1997).

The ANS results from solving this optimization problem. It is identified as the investment (in produced and human capital, from which the value of depletion of natural resources and accumulated pollutants is deducted) that sustains intertemporal welfare maximization. This

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<sup>6</sup> Weitzman (1976), Dasgupta and Heal (1979), Hartwick (1990) and Mäler (1991) constitute seminal contributions in this field.

<sup>7</sup> These “services” have to be understood as positively affecting utility in the case of natural resources (as, for instance, green spaces and forests) while negatively affecting utility in the case of pollutants.

<sup>8</sup> In the very first models, utility had to be maximized on the optimal path (Hamilton, Clemens, 1999), but non optimal models have been developed afterwards (namely Dasgupta, Mäler (2000) and Asheim, Weitzman (2001)).

conception of sustainability is thus in line with Pezzey (1989) who defines sustainability as a non declining value of utility. A negative ANS at a point in time means that future utility is unavoidably be less than current utility over some period and indicates that the economy is on an unsustainable path (Hamilton and Clemens, 1999). In other words, the economy does not invest enough with regard to the optimization objective.

## **2.2 The Normative Implications of the ANS Conceptual Framework**

The above-mentioned conception of sustainability, which intrinsically associates utility and assets, raises four concerns.

First, devoting to the representative agent a central place, it is anchored in a methodological individualism that prevents from grasping the evolution of collective welfare as such. Yet, the World Bank considers that intangible capital, including human capital and the quality of formal and informal institutions, is preponderant in an enlarged conception of wealth: “*Intangible assets (...) includes social capital, that is, the trust among people in a society and their ability to work together for a common purpose*” (World Bank, 2006, p. 18). While such a theoretical conception of intangible capital might include collective elements, the fact that ANS is conceived as an aggregate measure leaves little space for thinking of the collective nature of social or institutional capitals. Alternative approaches, as in the Index of Social Health (Miringoff and Miringoff, 1995) for instance, have shown their better ability to grasp the impact of social context and interactions on the evolution of intangible wealth. More fundamentally, such an individualistic framework does not allow for thinking of distributional concerns, like income inequalities, as affecting sustainability (defined as the maximization of welfare overtime). Does it mean that inequalities play no role in the sustainability of a society? As soon as it is known that different types of inequalities may be reinforcing, one might believe that they constitute an important factor of sustainability: “... *certain inequalities may be mutually reinforcing. Gender disparities (...) are typically much larger for households with lower socio-economic status: in many developing countries, the combined effect of gender and socio-economic status is often to exclude young women in poor households from attending school and getting rewarding jobs, denying them possibilities of self-expression and political voice, and exposing them to hazards that put their health at risk*” (Stiglitz *et al.*, 2009, p. 55)<sup>9</sup>. Alternative measures, whose conceptual framework does not deeply diverge from the ANS one, suggest weighting negatively the degree of income inequality in the measure of sustainability. This is the case, among others, of the Index of Sustainable Economic Welfare (ISEW, Daly and Cobb, 1989) and of the Genuine Progress Indicator (GPI, Talberth, Cobb, Slattery, 2006).

Second, linking of welfare to the maximization of the present value of a utility function that namely depends on consumption illustrates a productivist/consumerist vision of sustainability. This prevents from thinking of sustainability and welfare across time without maintaining or increasing the level of consumption, whatever its nature. Such a conception does not leave any space for thinking of *prosperity without growth* (Jackson, 2009). Even if wealth is enlarged to

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<sup>9</sup> Many other studies have shown how inequalities affect welfare. See, for instance, Wilkinson, R.G. (2005).

environmental, social and personal dimensions, as soon as wealth is understood as the discounted value of future consumptions, it cannot be seen out of a consumerist perspective. Such a drift is well illustrated in what follows: “*having a high level of schooling, being in good health or benefiting from a large social network are also some forms of current wealth that enlarge one’s perspectives of earning money, consuming and/or enjoying life at later periods*” (Fleurbaey, 2008 in Stiglitz *et al.*, 2009, p.251).

Third, in a theoretical framework where the environment is only grasped by the utility function of a representative agent, nature is only considered through the goods and services that can be extracted from it (assimilation capacity, life-support function, production and consumption goods). From this framework, the “existence value” of resources is excluded, that is, the value people place on the existence of assets regardless of their consumption (Everett and Wilks, 1997; Falconi, 1999). This perception of sustainability carries an instrumental vision of the relationship between mankind and nature. Theoretically, this instrumental conception, underlying the idea of mankind mastering nature, should not be problematic since, though it implies a risk of spoiling nature, it also suggests the possibility for mankind to contribute to nature’s emancipation. However, the ANS framework renders this instrumental relationship between mankind and nature questionable from a normative perspective as soon as it assumes a rate of time preference, discounting the future with regard to the present. This leaves the ground to short-term logics (instrumentalizing nature in production and consumption), at the cost of long-term ones (rather acting in favour of nature preservation), the former generally going against the latter. If the preference of the short-run on the long-run reflects empirical individual behaviours, such a conceptual framework, taking act of this preference and being based on it, does not fully exploit the power of an indicator to shape a new reality, by not theoretically constituting any incentive for attitudinal changes.

This leads to a fourth more fundamental concern lying in the vagueness of what sustainability eventually is. If time preferences are such that the short-run is preferable than the long-run, one might imagine that the implicit weight of consumption in the utility function becomes far higher than the weight of environmental services. In such a case, a sustained utility would not necessarily coincide with a sustained level of long-term investment in enlarged assets. This relationship should be questioned further. This is currently not the case in the green accounting literature, where a conceptual fuzziness remains, as we have shown above: sustainability is sometimes defined as the non declining value of utility (Pezzey, 1989), implying that sustainability is first and foremost a “subjective” matter (mediated by the representative agent) and sometimes as the non-declining value of all assets (Hamilton, Atkinson, Pearce, 1997), sustainability being then purely “technical”. Of course, the link between net measures (such as net national product and adjusted net savings) and social well-being or welfare has been questioned in the literature. Hamilton and Ruta (2009) raise the question: “*How much social welfare has changed when a natural resource is extracted?*”. Dasgupta and Mäler (2000) theoretically establish the linkage between net savings, social welfare and sustainable development for the enlarged context of non optimal economies. Asheim and Weitzman (2001) show that an appropriate consumption price index implies that the growth in net national product indicates a change in social welfare. But these works do not fundamentally question the implications of

associating utility (whatever the way it is designed) and investment in assets (whatever assets it includes) on the definition of sustainability as a desirable societal objective. Questioning this apparent inextricability between utility and assets investment should highlight the determinants and finalities of sustainability as a political target as well as better define the limits and orientations of the relationships between mankind and nature.

To sum up, while the ANS is praised by many economists for its theoretical anchorage in a consistent conceptual framework, no explicit consideration is made on the normative conceptions and consequences such a framework entails. Though we have seen that the neoclassical framework underlying the ANS already shapes a singular conception of sustainability : it is anchored in a methodological individualism impeding to think of the collective determinants of welfare overtime and to integrate distributional issues; it maintains sustainability in a consumerist perspective where economic growth remains central; it carries an anthropocentric vision of the mankind-nature relationship; and eventually it leaves a heavy imprecision on the nature of sustainability as targeting utility or assets.

Going from the conceptual framework to the technical construction of the ANS, one observes that such a neoclassical conception is enhanced, encompassing a highly normative span. This is developed in sections 3, 4, 5 and 6.

### **3 Substitutability: “Weak Sustainability”**

By gathering heterogeneous types of capital in a same unit and summing them up, the ANS assumes, to a certain degree, their substitutability. Such an assumption constitutes a “weak sustainability” approach. Following this approach, if Brazil destroys all Amazonian forests and invests the sales proceeds in education expenditures, the ANS will remain unchanged or might even increase. Accordingly, Brazil would be on a “sustainable” path (Pillarissetti and van den Bergh 2008).

From a normative perspective, such a “weak” conception has been widely contested. Some authors argue that it reflects the pervasive impact of increasingly using an economic register to approach nature. For a long time, the impact of human economic activity on nature was recognized, but not as something with which economic activity should concern itself. Holland (1999) observes, however, that the rise of ecological economics, fuelled by increasing concern at both the degree and kind of human impact upon the natural world, signals the fact that many economists no longer regard this attitude as acceptable. This recent awareness has given rise to many researches on ways of registering environmental impacts in economic terms.

In this line, the ANS aims to enlarge the conceptions inherent to standard national accounting. It registers nature as a specific “capital” among others, all of them being summed up. To that respect, the substitutability assumption that allows for describing the net creation/destruction of enlarged wealth has a *performative* effect: as soon as the impact of mankind on nature receives an

economic “weight”, it becomes possible at the same time to *offset* the adverse environmental impacts against “beneficial” development elsewhere (Holland , 1999). Such an economist vision has been depicted by the tenant of deep ecology as being source of misrepresentations as well as of some kind of arrogance. In such types of measure, human response to nature is misrepresented because it is overestimated. Arrogance towards nature appears in the recurrent confusion between the world and the *human* world. Such misrepresentations and arrogance are challenged by the tenants of a “strong” sustainability, where ecological limitations are central and therefore substitutability between assets of different types is not allowed.

Yet, Hamilton, Atkinson and Pearce (1997) have considered the issue of strong sustainability, following the idea that there is some amount of critical natural capital that must be preserved if welfare is to be maintained – there are essentially no substitutes for certain natural assets (Pearce *et al.*, 1989). These authors consider two generic types of natural capital to be maintained: the assimilative capacity of environment (which dissipates pollutants that are ultimately life-threatening) and the critical stock of living natural resources that provide life-support functions. With respect to the latter capital, considering that “*what constitutes an ‘excess’ is very much a matter of preferences*” (Hamilton, Atkinson, Pearce, 1997, p. 19), the authors compare two optimization problems: the optimal exploitation of rainforest when only local preferences prevail and the optimal exploitation of rainforest when both local and global preferences come into play. It is assumed that a country with rainforest resources has preferences only for consumption of this resource, whatever the benefits there are to rainforest preservation, since these benefits are a global externality. The authors come to the conclusion that taking the world preferences into account, through global willingness to pay, leads to critical rainforest levels being preserved because externalities of preservation are internalized.

If this conclusion theoretically holds and supports a perspective where ecological limitations matter, it raises a major concern on the empirical level. The authors recognize it themselves, assessing the global willingness to pay assumes that the externalities of deforestation are consciously perceived and evaluable in monetary terms though in fact it is far from being the case. The theoretical possibility of including strong sustainability issue seems to disappear as soon as it is concretely integrated in the ANS.

A second empirical concern should be added here, which does not allow the ANS to be an indicator of strong sustainability. To the criticism of substitutability between capitals, one can answer that appropriate prices could reduce the degree of substitutability. Theoretically indeed, prices should reflect the scarcity of resources, implying that prices of resources tend to infinity over time as long as they are excessively extracted and contribute to resources depletion. But this is not the case empirically. As we shall see it in parts 5 and 6, natural resources and environmental damages are often underestimated, impeding the limitation of their substitutability with produced or human capitals.

Both the concerns of difficult evaluation of willingness to pay and concrete obstacles to reduce substitutability through accurate price systems question the consistency of a monetary indicator for quantifying (or at least getting closer to) strong sustainability. To that end, physical

accounting indicator such as the Ecological Footprint (EF) seems more appropriate. The EF strongly stands against weak sustainability assumptions. No role is given to savings and capital accumulation: “*any positive ecological surplus (biocapacity that exceeds the ecological footprint) does not entail an increase in some natural capital stock, and hence an improvement in future productive capacity. A fortiori, saving and accumulating manufactured or human capital does not help sustainability*” (Stiglitz *et al.*, 2009, p. 71). Following the “strong” approach, each capital must be maintained at levels at least equal to those necessary for basic-life support functions and even higher in order to keep reasonable levels of environmental resilience, that is, the capacity of ecosystems to regenerate after a shock (Stiglitz *et al.*, 2009).

The same “sustainability” streamer thus encompasses very different visions of the world and conceptions of the link between mankind and nature. In terms of policy implications, this has far-reaching consequences on the constraints a society should impose to itself in order to be “sustainable”.

#### **4 Human Wealth: Restricted to Human Capital and Measured through Education Inputs Rather than Outcomes**

The way the “human” dimension of the ANS has been theoretically conceived and quantified entails two concerns. First, human wealth appears to be restricted to human productive potential (4.1). Second, grasping human capital through education expenditures is questionable: focusing on education expenditures does not enable grasping the outcomes of the educational system (4.2.).

##### ***4.1 Human Wealth Reduced to its Productive Potential***

In a conception of extended wealth, the “human capital” dimension of the ANS aims at broadening the traditional definition of what constitutes an asset. “*There exist additional stocks (...), whose contribution to production is difficult to deny yet which are not considered assets (...) perhaps the most important of these is the knowledge, experience and skills embodied in a nation’s populace, its so-called human capital*”(Bolt *et al.*, 2002, p.7).

However, contrasting with this claimed objective, the ANS theoretical framework conceives human capital as one of the various capitals composing a production function. Upstream of the construction of the ANS, this entails a productivist perspective of what human wealth is. Reducing human wealth to its productive capacities, the ANS conceptual framework leaves little space to a more comprehensive vision of human nature; a vision that would enlarge the scope of the human wealth to be transmitted to the future generations to many other dimensions, such as, among many others, social cohesion, respect, altruism and culture. In terms of normative prescriptions, the productivist perspective of the ANS could lead to restrictive propositions, as the following EU parliament suggestion well illustrates it: “*As human capital investments are included in the Genuine Savings, this indicator could support the Lisbon Agenda of the EU of*

*creating a competitive 'knowledge based economy'* ” (EU parliament, 2007, p.37). In such a perspective, one might wonder whether philosophy or literature would be considered as contributing to the “competitiveness” of a knowledge based economy, and whether it would in turn benefit from any investment.

Conceiving human capital through its productive potential tends to shape the conception of sustainability as a transmission of productive human resources rather than the transmission of a larger cultural patrimony which is though highlighted by UNESCO as “*a mainspring of our cultural diversity*”, its maintenance being “*a guarantee for continuing creativity*”<sup>10</sup>.

#### **4.2 Measuring Education through Inputs Rather than Outcomes**

Considering that human capital depends for a large part on the educational system, the authors of the ANS evaluate this dimension by expenditures on education<sup>11</sup>. It is assumed that a dollar of educational expenditure translates into a dollar increase in human capital (Ferreira and Vincent, 2005), the latter thus being accounted from the cost. Besides the fact that this assumption has been proved poor (Jorgenson and Fraumeni, 1992, Schultz, 1988, in Ferreira and Vincent, 2005), it raises a major concern: considering education through its expenditure does not allow for evaluating the outcomes of the educational system. Expenditures on education give no information on the nature and the impacts of education on the members of a society and on the way they live together. For instance, higher expenditures on computers at school might enhance the technological breakage between pupils who have a computer at home and those who don't. Expenditures on education do not inform either, as the ANS theoretical framework would yet require, on the ability of education to enhance productivity.

Other indicators adopt a far different approach to assess education. The Human Development Index (HDI), for instance, encompasses school enrolment and alphabetisation. What are targeted here are the outcomes rather than the inputs. This indicator – in line with the capabilities approach – targets the ability of educated people to get access to sources of self-emancipation individually and collectively (Sen , 1999). This brings us back to the question raised in section 4.1. on the scope of human wealth : by implicitly assuming that education has an intrinsic value in providing individuals with the key for accessing informed and conscious lives, the HDI broadens the scope of what should be transmitted to future generations from productive potential to human flourishing.

The fact of focusing on the inputs rather than on the outcomes has an important normative scope. According as expenditures are invested in an educational system favouring competitiveness or in a system rather fostering capabilities and sources of human flourishing, the nature of the human wealth to be transmitted in a ‘sustainable’ society in the future deeply differs.

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<sup>10</sup> UNESCO: <http://www.unesco.org/culture/ich/index.php?pg=00002>

<sup>11</sup> More precisely, human capital variation is accounted as non-fixed capital expenditures on education, the fixed-capital (as school buildings for example) being already accounted as *investment* in national accounting. The ANS estimate of investment in human capital is a purely gross measure, which makes no allowance for losses in human capital (Ferreira and Vincent, 2005).

## Natural Resources Depletion: Contestable Pricing of Nature and Allocation of Responsibilities

The ANS embraces changes in natural wealth through two dimensions: “natural resources depletion” (treated in this section) and pollution damages (see section 6). Natural resources depletion is by far the most discussed dimension in green accounting and ecological literatures. Two main issues are at stake: the way nature is priced is contestable (5.1.) and the way resource extraction is imputed enhances inequalities between developing and developed countries (5.2.).

### 4.3 Contestable Pricing of Nature

The renewable and non-renewable natural resources accounted in the ANS include natural gas, hard coal, lignite/soft coal/brown coal, oil, metals and minerals (bauxite, copper, gold, iron, lead, nickel, phosphate, silver, tin, zinc) and forests (Bolt *et al.*, 2002)<sup>12</sup>. The way these resources are priced is questionable. Natural resources depletion is obtained by subtracting the rent of natural resources from the standard savings in national accounts. The rent is measured as the market value of extracted material minus the average extraction cost. In the specific case of forests (the only renewable resource included in the ANS) rent is calculated as the rent on the amount of extraction which exceeds the natural increment in wood volume (Neumayer, 2000, Bolt *et al.*, 2002). Formally, the resources rents to be deducted are computed as follows:

$$(P - AC).R$$

where  $P$  is the resource price,  $AC$  is the average cost and  $R$  is the quantity of resources extracted. The rents of these assets are valued at the so-called Hotelling-rent, which is the maximum rent that could be obtained overtime while emptying the stock of resources. In the ANS, the more readily available average costs are used as a proxy for the theoretically correct marginal costs (Neumayer, 2000)<sup>13</sup>. According to the Hotelling rule, in an efficient exploitation of non-renewable resources, the percentage change in net-price per unit of time should equal the discount rate in order to maximize the actualized value of resource. In other words, the price of an exhaustible resource is expected to increase autonomously over time.

The ANS uses the *current prices* of resources in order to evaluate natural resources. This monetization of nature’s value brings up three issues.

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<sup>12</sup> Empirically, the adjustment for natural resource depletion in the ANS proves to improve significantly the relation between estimates of the ANS and subsequent changes in consumption (Ferreira, Hamilton, Vincent, 2008).

<sup>13</sup> Hamilton and Clemens (1999, p. 339) mention a methodological problem implied by the use of *average* rather than *marginal* cost of extraction : from a theoretical point of view, depletion estimates depend on scarcity rents which should be measured as price minus marginal cost, while in practice, data on marginal production cost are almost never available. This implies the use of average extraction costs which tends to overstate calculated resource rents and hence to understate genuine savings.

First, if market prices can be used to evaluate stocks and flows on a perfectly competitive market (implying perfect information), it is not the case as soon as we consider nature, which encompasses many externalities and imperfect information. Theoretically, the ANS values produced assets and the changes in the various stocks of natural resources and pollutants at the shadow prices<sup>14</sup> supporting the optimal path – scarcity rents in the case of natural resources, marginal damages in the case of pollutants. However, as Ferreira and Vincent (2005) discuss, in real-world economies, market prices surely diverge from the shadow-price estimates required for the theoretical ANS to reflect sustainability. To which extent is it then consistent to rely on market prices? Theoretically, prices should reflect the scarcity of resources, implying that prices of exhaustible resources tend to infinity over time. But in reality, in the context of imperfect competition, prices are not increasing at the rate of resources depletion, and therefore do not constitute a good resource allocation signal anymore. As a response to the non accuracy of market prices to signal resources allocation, theory would suggest to create “accounting prices”. This would require modeling the long-term consequences of given changes in environmental capital and how they impact future well-being (Stiglitz *et al.*, 2009). Such pricing leaves much space for speculations about future developments, which enhances the sources of disagreements and renders any practical implementation difficult today.

Second, the way the rent is computed strongly determines which countries are on a “sustainable” path and which are not. Some authors have shown how computing rents another way around could lead to dramatically different results. This is the case of Davis and Moore (2000) who have shown that valuing resource assets at the current rental rate may provide biased estimates of asset values. Neumayer (2000) explores two competing methods for computing natural resources rents. The first one, method of Repetto, includes resources discoveries in the formula. Resource rent is computed as follows:

$$(P - AC).(R - D)$$

In such a computation, the correction term in the ANS can be positive if  $D > R$ , the rate of discovery being higher than the rate of depletion.

The next method, the ‘El Serafy’-method, is computed as follows:

$$(P - AC).R.\left[\frac{1}{(1 + r)^{n+1}}\right]$$

where  $r$  is the discount rate and  $n$  is the number of remaining years of the resource stock if production was the same in the future as in the base year. More soon as  $r > 0$  and  $n > 0$ , this computation gives a smaller deduction term than with the ANS method. Such a computation is

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<sup>14</sup> The shadow-price is to be understood as the cost of strengthening the constraint of the optimization problem. In our case, the constraint namely encompasses limited natural resources and pollutants. In this line, *strengthening* the constraint means decreasing the amount of limited natural resources, increasing the pollution associated to the production, etc. The value of the shadow price is determined by solving the optimization problem.

derived from the idea that receipts from non-renewable resource extraction should not fully count as ‘sustainable income’ since resource extraction decreases the resource stock and thus brings with it an element of depreciation of the resource capital stock (Neumayer, 2000). For Neumayer, the ‘El Serafy’-method is superior. Following the current computation of the rents in the ANS, a country that would be completely dependent on resources exploitation, like Saudi-Arabia for instance, could never have a positive ANS, as all resources rents are counted as capital depreciation and could therefore never be sustainable. This would not be the case with the alternative ‘El Serafy’-method<sup>15</sup>.

A third reason why the pricing of nature is questionable relates to the impact of the market structures on the value of depletion. Going back to the seminal principles of classical political economy, we know that the long-term equilibrium of the firm in perfect competition gives rise to a higher quantity exchanged and to a lower rent than in monopoly. This would imply that the depletion evaluated through the rent would appear lower in the competitive case than in the monopolistic one, while in fact, the depletion would have been higher. This question should lead to further investigations.

#### **4.4 Resources Depletion: Imputation of the Costs**

Following the methodology of the ANS, the depletion of non-renewable resources is imputed to countries that extract natural resources, mostly resources-exporting developing countries. This means that the image conveyed by the indicator puts into light the unsustainable path of exporting countries rather than questioning the consumption patterns of importing countries<sup>16</sup>. *“One may feel uneasy in front of the message conveyed by the ANS regarding resources (e.g. oil) exporting countries. In such exporting countries, unsustainability only comes from an insufficient rate of reinvestment of the rents generated by the exploitation of the natural resource, and “over-consumption” by importing countries is not an issue at all. Developed countries, generally less endowed in natural resources but richer in human and physical capital than developing ones, would then unduly appear sustainable”*(Stiglitz *et al.*, 2009, p. 283). To this regard, the World Disaster Report 2001 notes that contrary to what the ANS would suggest, many advanced

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<sup>15</sup> Both Repetto and El Serafy methods belong to the literature on exhaustible resource accounting. To that respect, Hamilton and Ruta (2009) shed light on the contrast that distinguishes this empirical literature, which implicitly accounts for resource depletion as a change in the *total* asset value, from the theoretical literature on wealth accounting and social welfare, which considers the change in *real* asset value. While the former is the sum of produced capital and the value of natural resource stock given by the present value of total rents, the change in real wealth theoretically values depletion at the marginal rental rate (owing to optimality). Looking at practical asset accounting, the authors come to the conclusion that in all cases the change in total wealth (including capital or holding gains) is greater than the change in real wealth: *“for a typical situation with a 25 year reserve life and a social discount rate of 4%, the value of depletion using the change in real asset value is about 70% larger than that suggested by the El Serafy formula”* (Hamilton and Ruta (2009), p. 62). This distinction in exhaustible resources accounting, the authors argue, has far-reaching consequences: the change in total wealth overstates the impact of saving on social welfare.

<sup>16</sup> Everett and Wilks (1999), Pillarisetti (2005), Falconi (1999). This imputation to producers is also the case for ISEW and GPI.

economies are operating at unsustainable levels with large ecological footprints and amassing substantial ecological debt<sup>17</sup>.

The problem is worsened by the fact that the changes in the terms-of-trade between resource importers and exporters are not grasped through the pricing system of the ANS. As aforementioned, the Hotelling rule is assumed: resource rents are supposed to rise over time, thus providing the resource exporter with improving terms-of-trade. Yet, the resource importer which faces a future deterioration of its terms-of-trade should make an extra-adjustment for the increasing scarcity of resources. But the ANS does not accurately reflect this future increase in price. As a consequence, an exporter of non-renewable resources which would not have reinvested the entirety of the income currently derived from a resource sale could have negative ANS while still ensuring weak sustainability (van der Ploeg, 2010). Reversely, a resource importer could display a positive ANS while not doing the necessary endeavours in order to be weakly sustainable: “(...) when prices are non competitive, the importing country is able to pay its imports less than would be required for efficiency, it will have a responsibility in global non-sustainability that is not captured by the money-value of its imports. Low prices allow this country to over-consume and to transfer the long-term costs of this over-consumption to the exporting country” (Stiglitz *et al.*, 2009, p.78).

Such an asymmetric representation of the environmental burden has far-reaching consequences as soon as this indicator is used for addressing policy conclusions, as in Atkinson and Hamilton (1996) and Hamilton *et al.* (1997). These authors tentatively suggested making aid conditional for developing countries who fail to pass the test of weak sustainability, that is, for countries having a negative ANS.

As a consequence, a case has been made by some authors for imputing consumption of exhaustible resources to their final consumers, i.e. the importing countries. This is done in the Ecological Footprint, which measures the net consumption of bio-productive earth resources. This type of measure, computed as “national production – exports + imports”, better takes into account the gap, in certain countries, between consumption and production. (Boutaud and Gondran, 2008).

## 5 Pollution damages

The last item to be deducted from net savings consists in the global damages from carbon dioxide emissions. The data is published in the World Bank Development Indicators and the source is the Carbon Dioxide Analysis Centre. “*The global marginal social cost of a metric ton of carbon emitted is assumed to \$20 in 1995 (...) This is deflated for other years using the USA GDP deflator*” (Bolt *et al.*, 2002, p.19)<sup>18</sup>.

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<sup>17</sup> International Federation of Red Cross and Red Crescent Societies 2001, in Pillarissetti (2005).

<sup>18</sup> Estimates of air pollution damages for the last 5 years are to be found in World Bank (2009).

The monetary estimation of CO<sub>2</sub> damages raises the same concerns of uncertainty and arbitrariness as for the natural resources depletion. “*It is debatable whether valuing CO<sub>2</sub> emissions with 20US\$ per tonne of carbon is sufficient to account for damage caused by greenhouse gases*” (Neumayer, 2000, p. 273). This pricing is moreover questionable in its anthropocentric roots: the CO<sub>2</sub> price is determined on a CO<sub>2</sub> market, only depending on human supply and demand for it. The difficulty of pricing CO<sub>2</sub> is the object of a huge literature which will not be reviewed here. Our specific insight is related to the fact that CO<sub>2</sub> damages, as calculated in the ANS, implicitly raise the critical issue of ecological responsibilities, at least in two respects.

First, the way CO<sub>2</sub> is priced, and thus implicitly weighted with regard to the other dimensions of the ANS, almost erases CO<sub>2</sub> damages from the indicator: “*Under the current state of the art, the prices used to value carbon emissions in existing estimates of ANS are not able to give it any significant role in the global assessment of sustainability, and this casts doubts on the usefulness of the indicator as a guide for policy*” (Stiglitz *et al.*, 2009). If the ANS is to signal the risk that a country is on an unsustainable path, the relative weight of CO<sub>2</sub> damages as currently computed prevents this indicator from pointing out the global ecological responsibility of the highest carbon-emitting countries.

Second, the way the world share of CO<sub>2</sub> emissions are imputed globally is very questionable in terms of responsibilities. In line with the Kyoto agreement, CO<sub>2</sub> emissions are imputed to the production: if production is intensively devoted to exports, the responsibility of CO<sub>2</sub> emissions of the exporting countries is over-estimated, while the responsibility of the importing countries is underestimated. This constitutes an important bias in favor of the over-emitting countries<sup>19</sup>.

More fundamentally, one can wonder why the environmental degradation is only grasped through the CO<sub>2</sub> emissions damages. “*One major shortcoming of the ANS (...) is the fact that the adjustment for environmental degradation is limited to global pollution damages from carbon dioxide emissions*” (Stiglitz *et al.*, 2009, p.278). This observation leads us to enlarge the scope of the argument to both pollution damages and resources depletion: some crucial ecological aspects are missing in the ANS, their absence being justified by a lack of available data. Their authors recognize this lack: “*the calculations are not comprehensive in that they do not include some important sources of environmental degradation such as underground water depletion, unsustainable fisheries, and soil degradation*” (World Bank, 2006, p.154). Nonetheless, as soon as this indicator is presented as assessing sustainability, such a lack should be at least broadly mentioned and at best filled in.

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<sup>19</sup> Pillarisetti (2005) adds to these two concerns of responsibility in CO<sub>2</sub> emissions a very interesting perspective on the misleading interpretations of CO<sub>2</sub>/GDP ratio of the ANS.

## 6 Conclusion

The ANS certainly constitutes a considerable step in the search for new political tools. The fact that this indicator, which tackles a global issue, emanates from a global institution enhances its potential influence on the coordination, at the international level, of national sustainability policies. More fundamentally, it aims at enlarging the conception of “wealth”, offering more space to intangible wealth and to the environment in the decision-making.

However, even though such imperative issues are taken into account by the ANS, *the way* they are computed dramatically narrows the scope of what is considered. From the conceptual framework of the ANS, one observes that natural resources, environmental quality and human capital are only conceived in their productive dimension. As soon as we consider that indicators are not only a passive reflect of a reality but do *shape* this reality, one might feel uncomfortable to observe that the ANS is wedged in a productivist approach. Such a perspective leaves very little space for considering the systemic reasons why societies are today on a globally unsustainable path. Nor does it allow for thinking of a conception of sustainability which would not be anchored in a dynamic of sustained production/consumption. If the creation of the ANS illustrates the intention of opening the scope of traditional conceptions of wealth and of enhancing this enlarged wealth notion’s influence in the decision-making spheres, its computation however narrows this scope by implicitly carrying an *a priori* singular – productivist – approach of what sustainability is and, inextricably, should be.

These upriver normative foundations, on which we have shed light here above, are crystallized in the methodological choices on which the ANS has been built. The assumption of substitutability between capitals restricts the possibility for ecological limits to be considered as having to constrain societies’ ways of life. From the ANS perspective, as long as the level of investment in human or produced capital is sufficient enough to compensate for non-renewable resources depletion, the economy remains on a sustainable path. What is more, considering human *capital* rather than human *wealth* restricts human beings to their productivity, leaving no space for “economically unproductive” sources of human wealth (institutions ensuring democratic functioning of societies, altruism, social cohesion, respect, etc.). In addition, grasping “human capital” through expenditures on education does not allow for judging on the outcomes of such expenditures. As far as natural resources are concerned, evaluating them on a monetary basis has been justified by practical reasons. These motives have surreptitiously avoided more fundamental questions: to what extent are market prices a good resource allocation signal? Are they able to reflect the life-support function of nature and its value independently of serving production? Do market prices give a consistent weighting of the different dimensions of the ANS? Moreover, the fact that resources extraction costs are imputed to resources extractors has far-reaching consequences. It puts the burden of resources depletion on the producing countries (most of them being poor), rather than on the consuming countries (mostly rich), whose over-consumption is not denounced. Such a methodological choice could prove to be crucial, would the ANS become a criterion for accessing to financial aid.

The decomposition of the ANS has illustrated how a measure that uninformed people could consider as “neutral”, implicitly carries values and world visions. The latter are to influence the reality reflected by the indicator and the decision made on its basis. Such a normative span is inherent to any indicator. That is why such a critical reading of indicators is pivotal today, at a moment where a singularly large amount of alternative measures to GDP is being broadly discussed. If there is an increasing awareness that *what we count influences what we do*, we have highlighted that *the way we count it* is just as crucial. Indicators are to be increasingly used as a tool in the decision-making. Their role is even more essential: they shape the societal objectives to be reached. In this sense, the critical exercise developed here above should be applied for any other indicator. Not clarifying the implicit values carried by a measure while discussing it would dupe citizens on the democratic aspect of the debate to which they take part.

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