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## **The Inclusive Wealth Index. A Sustainability Indicator, Really?**

Géraldine Thiry & Philippe Roman

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Among recent high-profile propositions to revise national accounts and to provide new indicators of sustainability and well-being, the Inclusive Wealth Framework and the related Inclusive Wealth Index (thereafter IWI), first released during the “Rio+20” Conference, undoubtedly stand out as the most promising endeavour. Built up at the confluence of welfare, development and sustainability economics, the indicator is supposed to bring information about the wealth of nations and their sustainability, in a comprehensive way. The inclusive wealth framework is nevertheless fraught with limitations, due to questionable theoretical assumptions and gaps in data availability. We propose a critical appraisal of the index and its underlying framework. Our conclusion is that these limitations undermine its capacity to reach the goals it was given, and to fulfill the requirements of a satisfactory sustainability indicator.

**Working Papers Series**

# The Inclusive Wealth Index. A Sustainability Indicator, Really?

Géraldine Thiry, Philippe Roman

June 2014

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## The text

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## Abstract

Among recent high-profile propositions to revise national accounts and to provide new indicators of sustainability and well-being, the Inclusive Wealth Framework and the related Inclusive Wealth Index (thereafter IWI), first released during the “Rio+20” Conference, undoubtedly stand out as the most promising endeavour. Built up at the confluence of welfare, development and sustainability economics, the indicator is supposed to bring information about the wealth of nations and their sustainability, in a comprehensive way. The inclusive wealth framework is nevertheless fraught with limitations, due to questionable theoretical assumptions and gaps in data availability. We propose a critical appraisal of the index and its underlying framework. Our conclusion is that these limitations undermine its capacity to reach the goals it was given, and to fulfill the requirements of a satisfactory sustainability indicator. Special emphasis is put on the misleading pretension of (neoclassical) economics to handle highly complex, uncertain and manifold issues, even on theoretical bases renovated by dropping some optimality assumptions. We briefly sketch alternative research avenues, that appear more conducive to the endorsement of strong sustainability, and less prone to economism. Alleged theoretical consistency and elegance should not beguile us when choosing indicators for sustainable and prosperous societies.

## Keywords

inclusive wealth, sustainability, well-being, indicators, green accounting

## L’Indice de Richesse Inclusive, un indicateur de soutenabilité?

### Résumé

Dans le paysage des propositions de comptabilité nationale rénovée et de nouveaux indicateurs de bien-être et de soutenabilité, l’approche de la Richesse Inclusive (Inclusive Wealth Framework) et l’Indicateur de Richesse Inclusive qui lui est associé, lancés en juin 2012 pendant le sommet «Rio + 20», sont particulièrement en vue. Construit à la confluence de l’économie du bien-être, de l’économie du développement et de l’économie de la soutenabilité, l’indicateur est supposé informer, de manière exhaustive (inclusive), sur la richesse des nations et leur soutenabilité. Mais le cadre d’analyse de la Richesse Inclusive présente de nombreux problèmes liés à ses hypothèses et à des insuffisances dans la disponibilité des données. Nous montrons que ces problèmes empêchent l’IWI d’atteindre les objectifs de ses auteurs. Plus fondamentalement, l’IWI ne satisfait pas les conditions d’un bon indicateur de soutenabilité. Nous mettons en question les prétentions de l’économie (néoclassique) à pouvoir traiter des enjeux complexes, incertains et variés, notamment à l’aide d’hypothèses de non-optimalité. Nous évoquons ensuite des pistes de recherche alternatives, dont les fondements nous semblent plus à même de développer une approche forte de la soutenabilité dans une perspective moins economiciste. Le choix de nouveaux indicateurs de prospérité ne doit pas reposer sur des critères d’élégance formelle ou de prétendue cohérence théorique.

## Mots-clefs

richesse inclusive, soutenabilité, bien-être, indicateurs, comptabilité verte

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“There is now cause to revise the orthodox view of economic life in both the small and the large.” Dasgupta (2013)

“Our scientific contribution has been misleading because our models are structurally incapable of addressing major concerns. (...) The contribution from theory, through the sustainability paradigm of non-decreasing welfare, has turned out ineffective.” Gerlagh and Sterner (2013)

## 1 Introduction

The search for new indicators of prosperity is increasingly recognised as crucial for reorienting societies toward well-being and sustainability, as made apparent by the broad interest in “beyond GDP” initiatives (Cassiers et al., 2014; Gadrey and Jany-Catrice, 2006; IHDP, 2014). The recent 2012 United Nations Conference on Sustainable Development (Rio+20) brought the issue of selecting a set of sustainability indicators to the fore. Discussions are currently running on the selection of a set of Sustainable Development Goals (SDGs) to follow up the Millennium Development Goals (MDGs) by 2015.

In parallel with issue-specific indicators, all-encompassing initiatives have been proposed, which aim at accounting for the many dimensions of sustainable development. Among those, the Inclusive Wealth Index (IWI) was released in 2012 during the Rio+20 Conference. It is a joint initiative of the United Nations University-International Human Dimensions Programme (UNU-IHDP) and the United Nations Environmental Programme (UNEP) in collaboration with the UN-Water Decade Programme on Capacity Development (UNW-DPC) and the Natural Capital Project of Stanford University. This sustainability indicator, presented in the Inclusive Wealth Report 2012 (IWR), is aimed at responding to the need for “new indicators that tell us if we are destroying the productive base that supports our well-being” (UNU-IHDP and UNEP, 2012:xv). It therefore explicitly targets an audience of decision makers<sup>1</sup>. According to its authors, “the [Inclusive Wealth Report] represents a crucial first

<sup>1</sup>“The primary audience of the Inclusive Wealth Report will be governments. More broadly, the report will be of use

step in transforming the global economic paradigm, by ensuring that we have the correct information with which to assess our economic development and well-being — and to reassess our needs and goals” (UNU-IHDP and UNEP, 2012:xv). The ambition is to renovate national accounting.

The IWI has entailed broad enthusiasm. During the Trondheim Conference on Biodiversity (May 2013), it was praised as a promising tool to integrate biodiversity and ecosystem services into national accounting. Mooney (2013:180) asserts that “the IWR 2012 is a major achievement and one that can be made richer and more comprehensive in the years ahead. Since it provides an index of a nation’s path to the attainment of sustainability it is of a major importance to all of us”. The OECD acclaims the IWI for being a potentially helpful tool “in reorienting and monitoring macroeconomic policies to make them more sustainable” (OECD - DAC, 2012:5). The IWR’s authors themselves explicitly state that “countries should mainstream the Inclusive Wealth Index within their planning and development ministries” (UNU-IHDP and UNEP, 2012:xxxii).

Theoretically speaking, the IWI is at the confluence of welfare economics, sustainability economics, and wealth accounting. Sustainability is thus directly linked to the maintenance of a broad set of capital assets whose relative weights reflect their imputed social values.

Though the IWI is a close relative to the Adjusted Net Savings (ANS)<sup>2</sup>, its authors pretend to go a step further (Arrow et al., 2012), notably by getting rid of optimality assumptions. Nonetheless, as does the ANS, the IWI still carries a series of theoretical, methodological and normative problems that lead us to question its relevance as a benchmark for sustainability. Is the IWI the most appropriate tool in order to reach the purpose it has been given?

to development practitioners as well as researchers and the wider development community. (...) The report will also be useful for national economic planning agencies when considering macroeconomic fiscal policies. Changes in the various capital assets and their contribution towards the inclusive wealth of a country can provide information on where future investments should be targeted to get the best returns for increasing the productive base of the country” (UNU-IHDP and UNEP, 2012 :7).

<sup>2</sup>The ANS is a synthetic sustainability indicator developed by the World Bank over the last two decades (Pearce and Atkinson 1993; World Bank, 2011). It is also called “Genuine savings”(GS).



The paper is structured as follows. Section 2 presents the vision, the theory and the methodology underlying the IWI. Section 3 critically assesses the IWI. Section 4 concludes.

## 2 The IWI : Presentation

Apprehending the IWI requires figuring out the fundamental reasons why it was created (the vision), understanding the theoretical and conceptual grounds upon which it relies (the framework) and grasping the way its elements are organised and computed (the indicator).

### 2.1 Underlying Vision

The elaboration of the IWI results from a long research journey and from dissatisfaction with recent development initiatives and indicators. One of the main architects of the IWI, Partha Dasgupta, is critical of the iconic HDI. While he recognises that “UNDP (1990) made a step toward including health and education as aspects of human well-being”, he laments that “UNDP has offered no ethical justification for the relative weights they attach to the three components of HDI, nor for why the state of the environment should be missing from it” (Dasgupta, 2009:5)<sup>3</sup>. Dasgupta considers that the HDI mismanages intertemporal issues badly, “because no depreciation is taken into account. (...) It is possible for a country’s HDI to increase even while its overall productive base shrinks” (ibid.:6)<sup>4</sup>. He further questions the relevance of democratically debating alternative development paths “if the basis on which citizens deliberate is innocent of the role a degraded nature plays at the poverty, population, and environment nexus?” (Dasgupta 2013:40) Hence the importance in his view of shedding light on the broad productive base of societies.

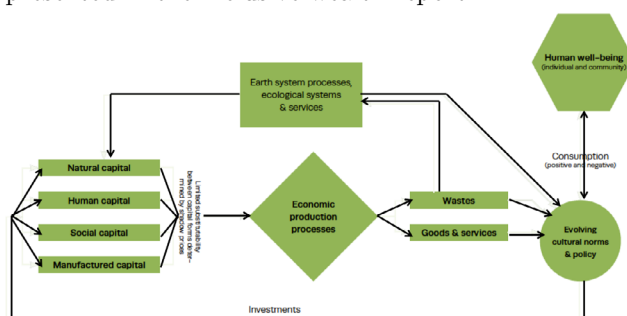
<sup>3</sup>Since the onset of the HDI, UNDP officials have attempted to green the human development framework. Recent reports have extensively addressed environmental issues. The HDI has nevertheless not been “greened” so far, in spite of recent efforts in this direction (see, e.g., Togtokh, 2011).

<sup>4</sup>Contrary to what Dasgupta seems to imply, mixing current welfare and sustainability preoccupations can be misleading, according to the Stiglitz-Sen-Fitoussi Report: “The assessment of sustainability is complementary to the question of current well-being or economic performance, and must be examined separately. This may sound trivial and yet it deserves emphasis, because some existing approaches fail to adopt this principle, leading to potentially confusing messages”(Stiglitz et al., 2009:17)

Echoing Dasgupta’s critique, Neskakis et al. (2013), in the IHDP magazine, want to “get away from arbitrarily assigning weights to [capital assets], and instead capture the values individuals place on these capitals.” Regarding the shortcomings of MDGs and SDGs in accounting for interdependence of the goals, context specificity and value pluralism, they argue “it might (...) be a fruitless exercise to attempt to define a universal set of goals acceptable to all communities across the world, or to try to reach an agreement on a set of constituents of well-being that are highly subjective across different populations” (Neskakis et al. 2013).

In the IWI authors’ own words, the index should be “able to capture overall well-being, be objective and quantifiable; able to include an overview of trade-offs and synergies across the various constituents and determinants of well-being; and able to indicate the sustainability of the well-being of nations and their citizens”<sup>5</sup>. To the best of our knowledge, no other synthetic indicator is granted such a broad set of objectives. The inclusive wealth framework is thus supposed to follow value pluralism (in a liberal bottom-up approach) and to be well-being oriented. As far as sustainability is at stake, the focus is put on the determinants of well-being (i.e. the objective factors assumed to cause well-being) as a proxy to its constituents (i.e. what well-being is phenomenologically made of), as illustrated in figure 1.

Figure 1: Productive base and human well-being as presented in the inclusive wealth report



Source : Inclusive Wealth Report 2012, p.46

Following the typology of sustainability indicators proposed by Gasparatos and Scolobig (2012:3), the

<sup>5</sup><http://www.ihdp.unu.edu/article/read/engagement-workshop-on-inclusive-wealth-report-iwr>

IWI relies upon a vision that fits within the “neoclassical monetary valuation/aggregation” category, which implies a “subjective theory of value, receiver system of valuation”<sup>6</sup>. However, the preanalytic vision<sup>7</sup> underlying the IWI relates to a concept of value closer to the “biophysical tools” category, that is, “cost of production theory of value, donor system valuation”. Indeed, sustainability is viewed as the maintenance of the productive base. One of the main limitations but also supposed forces of the IWI is probably the fact that it mixes those two visions.

## 2.2 Inclusive Wealth Framework

### 2.2.1 Normative Theoretical Basis

The cornerstone of the inclusive wealth framework (as presented in the IWR 2012) is an “equivalence theorem whereby the authors are able to move from the constituents of wellbeing to their determinants: the various capital assets a country is able to accumulate” (Duraiappah and Muñoz, 2012:364). We briefly remind here the fundamentals of the model, presented in Arrow et al. (2012).

Intergenerational well-being at time  $t$  is denoted  $V(t)$  and is assumed to be:

$$V(t) = \int_t^{\infty} [U(\underline{C}(s))e^{\delta(s-t)}] ds, \delta \geq 0 \quad (1)$$

where  $\delta$  is the felicity discount rate and  $\underline{C}(s)$  denotes a vector of consumption flows at time  $s$ . Intergenerational well-being is the discounted flow of the felicities of current and future generations. Economic development is sustained if  $dV(t)/dt \geq 0$ . “We note that, even though the sustainability requirement (...) is defined at a particular moment in time, the element  $V$  requires a forecast of the economy’s future beyond  $t$ . That future depends on

<sup>6</sup>Gasparatos and Scolobig (2012) distinguish between three sustainability categories of assessment tools: the biophysical (eco-centric, based on physical indicators), monetary (anthropocentric, neoclassical monetary valuation), and indicator-based (aggregation without an a priori value theory).

<sup>7</sup>Following Schumpeter’s description of scientific process, Spash (2012) stresses the importance of clearly defining one’s ontological presuppositions and “preanalytic vision”, answering a series of questions: “what do we understand as being the reality with which we are engaging, what are its key features and how do the various elements then fit together, what are their properties?” (Spash, 2012:42)

the economy’s stock of assets at  $t$ ; it also depends on the evolving structure of technology, people’s values and preferences, and institutions beyond  $t$ . The stock of assets at any moment  $s$  in the future would be determined by the stocks at the ‘previous’ date” (Arrow et al., 2012:6). Hence, given  $\underline{K}(t)$  (the vector of capital stocks at time  $t$ ), one can determine  $\underline{K}(s)$ ,  $\underline{C}(s)$  and thereby  $U(\underline{C}(s))$  for all  $s \geq t$ . Therefore,  $V(t)$  can also be written:

$$V(t) = V(\underline{K}(t), t) \quad (2)$$

Intergenerational well-being is expressed as a function of capital assets and time<sup>8</sup>. The assumption is made that  $V(t)$  is differentiable in  $\underline{K}$ . Differentiating  $V(t)$  with respect to  $t$  in equation (2) and imposing  $dV(t)/dt \geq 0$  yields a criterion for sustainable development at time  $t$ :

$$dV(t)/dt = \partial V/\partial t + \sum_i [(\partial V(t)/\partial K_i(t))(dK_i(t)/dt)] \geq 0. \quad (3)$$

The authors relate this sustainability criterion to prices and investments through shadow prices, defined as follows:

$$p_i(t) \equiv \partial V(t)/\partial K_i(t), \forall i \quad (4)$$

The variable  $p_i(t)$  is the contribution made by  $K_i(t)$  to  $V(t)$ , both indirectly (through the goods and services it helps produce) and directly (through the direct enjoyment of the stocks themselves). It is worth noting that “at any date an asset’s shadow price is a function of the stocks of all assets” (Arrow et al., 2012:7), and that “the price today depends not only on the economy today, but on the entire future of the economy” (ibid.). This implies that future scarcities in any type of capital asset in the future are supposed to be reflected in current shadow prices of all goods and services: “That means that shadow prices are functions of the degree to which various assets are substitutable for one another, not only at the date in question, but at subsequent dates as well”(ibid.). The influence of future well-being on current shadow prices depends on the value of the discount rate. A positive  $\delta$  allows the future not to

<sup>8</sup>The fact that  $V$  directly depends on  $t$  reflects the accounting of the impact of time-varying factors that are treated as exogenous.



bear on the present, which is debatable for obvious ethical reasons (Chichilnisky, 1996; Cairns, 2013)<sup>9</sup>.

Given the sustainability criterion (equation (3)) and the definition of shadow prices (equation (4)), “the ratios of shadow prices are marginal social rates of substitution among the various capital assets” (Arrow et al. 2012:7).

The authors define comprehensive wealth<sup>10</sup> of an economy as the shadow value of all its capital assets, that is<sup>11</sup>:

$$W(t) = r(t)t + \sum p_i(t)K_i(t)$$

From this definition, the authors define comprehensive investment as:

$$\Delta V(t) = r(t)\Delta t + \sum p_i(t)I_i(t)\Delta t \quad (5)$$

where  $I_i(t) = \Delta K_i(t)/\Delta t$  and  $\Delta$  denotes a small perturbation.

Then, the authors’ proposition is the following: “A small perturbation to an economy increases (resp., decreases) intergenerational wellbeing at  $t$  if and only if the shadow value of comprehensive investment at  $t$  that accompanies the perturbation is positive (resp. negative)” (ibid.).

As noticed by the authors themselves, a critical linkage in their analysis is between changes in comprehensive wealth at constant prices and changes in intergenerational well-being.

### 2.2.2 Some Steps Beyond the Adjusted Net Savings

The IWI undoubtedly goes some steps beyond the Adjusted Net Savings by addressing some of its shortcomings<sup>12</sup>. Let us review some of them.

<sup>9</sup>Human capital is discounted at an annual rate of 8,5 percent (following Klenow and Rodríguez-Clare, 1997). For cropland and pastureland, non-timber forest resources and health capital, the discount rate is assumed to be 5 percent per year (no justification is given).

<sup>10</sup>“Comprehensive wealth” becomes “Inclusive Wealth” in UNU-IHDP and UNEP (2012). Since the IWR 2012, “inclusive wealth” refers to the IWI while “comprehensive wealth” refers to the World Bank Genuine Savings.

<sup>11</sup> $r(t)$  is the shadow price of time, which is considered as a specific kind of capital, and equals  $\partial V/\partial t$ .

<sup>12</sup>The ANS has been criticised, e.g. by Everett and Wilks (1999), Falconi (1999), Neumayer (2000), Pillarisetti (2005), Dietz and Neumayer (2006), Pillarisetti and van den Bergh (2010), van der Ploeg (2010), Thiry and Cassiers (2010).

First, contrary to the ANS and for the sake of enhanced realism, the IWI does not necessarily assume optimal allocation nor intertemporal efficiency. Second, the ANS was criticised for being unable to capture the effects of changes in future terms of trade on importing and exporting countries. “If resource rents rise, then the resource exporting country will be better off and the resource importing country worse off than initially predicted. Hence it is theoretically possible at least that the exporting country is not unsustainable, even though its GS rate is negative” (Dietz and Neumayer, 2006:124). In response, the IWI includes adjustments for net oil capital gains. Third, while the ANS assumes constant population, “by including population, the [inclusive wealth] framework acknowledges growing population as an important variable in determining a country’s sustainable track” (UNU-IHDP and UNEP, 2012:269). Per capita measures are therefore computed. Fourth, the IWI broadens the range of natural capital assets accounted for by including cropland and pastureland. Fifth, unlike the ANS, where a major part of the wealth values are embedded in the intangible capital category, which is computed as a residual, the IWI aims to capture as much as possible of the wealth within distinct capital categories. Finally, the term “investment” is preferred to “savings”<sup>13</sup>.

Though such theoretical and methodological improvements are welcome, several shortcomings and ambiguities remain, which unfortunately prevent from considering the IWI as a reliable and timely sustainability indicator (see section 3).

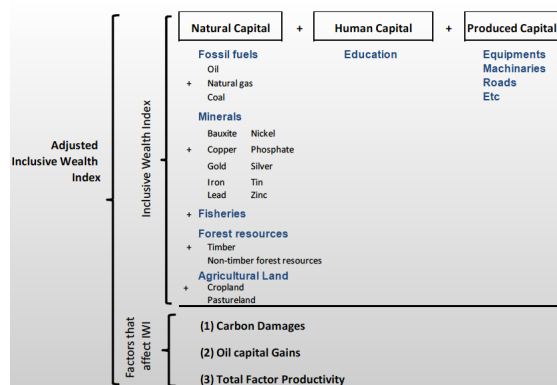
## 2.3 The Indicator : Elements and Construction

As mentioned above, sustainability consists in “preserving a portfolio of capital assets to ensure that the productive base can ultimately be maintained to sustain the well-being of future generations” (UNU-IHDP and UNEP, 2012:xxiv). These capital assets encompass manufactured, human and natural cap-

<sup>13</sup>“Dasgupta (...) and Neumayer (...) share the view that genuine investment would be a better term to use than genuine savings, because in macroeconomics savings tends to be defined as private savings. As GS applies it, savings means the sum of private plus public savings (the latter being taxes minus public expenditures), hence genuine savings equals genuine investment” (Dietz and Neumayer, 2006:16).

ital<sup>14</sup>, and they are aggregated with shadow prices as relative weights. In the Adjusted IWI, the countries' capital assets are corrected for three factors liable to affect the size of the production base: carbon damages, oil capital gains and total factor productivity (TFP) (see Figure 2).

Figure 2: The Adjusted Inclusive Wealth Index



Source: Presentation of Pablo Muñoz, “Overview on IWR 2012: Methods and Datasets”, UNU-IHDP, Paris, April 2013.

Inclusive wealth includes a health dimension. The latter, though, does not appear on Fig. 2. The authors of the IWR 2012 decided not to compute it because it represents a huge part of the IWI<sup>15</sup>. Produced capital is computed following the perpetual inventory method (PIM, King and Levine, 1994) by setting an initial capital estimate<sup>16</sup>.

Human capital is computed following Klenow and Rodríguez-Clare (1997). Human capital is a function of educational attainment and of life-long returns on education. The shadow price of a unit of human capital is equal to the discounted sum of the wages it would receive (the rental price) over the expected number of working years remaining.

<sup>14</sup>Social capital, while recognized as a determinant of well-being (see fig. 1), is not computed in the IWR 2012 due to a lack of data.

<sup>15</sup>Drawing on Arrow et al. (2012), Hamilton (2012:357) shows that, for the US, health represents 95,4% of the total value of the IWI. Duraiappah and Muñoz (2012:366) question the way the relative weight of health is computed.

<sup>16</sup>The PIM consists in computing the aggregate value of gross investment less depreciation. It is assumed that the economy is at its steady-state, implying that the capital-output ratio is constant in the long-run

Five categories of natural capital are accounted for in the IWI<sup>17</sup>. Though valuation is resource-specific, it “shares a relatively common accounting method, where total wealth is estimated by multiplying the physical amount available of the asset under study by its corresponding resource rent. (...) The resource rent is represented by the average market value of one unit of natural capital over the years 1990–2008” (UNU-IHDP and UNEP, 2012:32).

Besides, the IWI is adjusted with variables liable to affect the productive base. Changes in health capital are mainly captured by changes in the individuals' life expectancy. The shadow price of health capital “is constant over time and taken from the Value of the Statistical Life estimated by United States Environmental Protection Agency (EPA)” (UNU-IHDP and UNEP, 2012:32). Following Arrow et al. (2012), time is included in a society's productive base. As mentioned above, the IWI includes the changes in the terms of trade that might arise due to oil prices fluctuations. To adjust for population growth, the IWI per capita is computed. Finally, the accounting of technological changes is obtained by adding TFP growth to the IWI.

Formally, the IWI is computed as follows:

$$IWI = P_{MC} * MC + P_{HC} * HC + P_{NC} * NC$$

where  $MC$  is manufactured capital,  $HC$ , human capital,  $NC$ , natural capital, and  $P_{MC}$ ,  $P_{HC}$ , and  $P_{NC}$  are their respective shadow prices.

Inclusive investment is the time variation of inclusive wealth:

$$\Delta Wealth = P_{MC} * \Delta MC + P_{HC} * \Delta HC + P_{NC} * \Delta NC$$

An economy's development is sustainable if the IWI is non-decreasing.

To conclude the section, one may ask if the IWI is a weak or strong sustainability indicator. Recalling that monetization in itself does not necessarily entail weak sustainability<sup>18</sup>, the IWI framework does

<sup>17</sup>Forests, represented by timber and non-timber forest benefits, fisheries (only for four countries), fossil fuels (oil, natural gas, and coal), minerals (bauxite, copper, gold, iron, lead, nickel, phosphate, silver, tin, and zinc) and agricultural land.

<sup>18</sup>See Fleurbaey and Blanchet (2013:38 and following) for further details.

allow for strong sustainability. Indeed, high relative shadow prices of relatively scarce assets could limit the degree of substitutability with other assets. However, gaps in the construction of shadow prices (especially for natural capital) shed doubt on the possibility for an index such as the IWI to capture a strong view of sustainability (see section 3.2).

### 3 Critical Reading of the IWI

The inclusive wealth framework is based on debatable theoretical and methodological grounds. Moreover, its tractability as well as its relevance as a milestone for sustainability policies are doubtful. We propose a critical reading of the indicator, from the standpoint of both its internal coherence and its normative and political implications. Three kinds of criticism are in order. The first one questions the use of an intergenerational utilitarian welfare function. The second one addresses various issues related to monetary evaluation. The third one points to the economism at the root of such an all-encompassing index.

#### 3.1 Challenging the Welfare Function

##### 3.1.1 *Articulation between Well-being and Sustainability*

Theoretically and practically linking sustainability and well-being is a daunting task (Bartelmus, 2013; Stiglitz et al., 2009). However, the whole comprehensive accounting endeavour underlying the IWI relies upon this link: “the elegance of the inclusive wealth framework comes from the equivalence theorem whereby the framework allows the move from the constituents of well-being to their determinants” (UNU-IDHP and UNEP, 2012:6). Such a claim about the so-called “equivalence theorem” is questionable. Only one mention of this theorem is made in the IWR 2012 without any further details on its grounding, and there is no mention of it in Arrow et al. (2012). Since no compelling evidence is provided, the so-called theorem should rather be termed a conjecture.

Recent research has shed valuable light on the constituents of well-being (Rogers et al. 2012; MacKerron, 2012; Layard, 2005; Dasgupta, 2001) but the link between capital assets and future well-being remains elusive. Insofar as intergenerational well-being is proxied by present stocks of assets valued at shadow prices, the accurate assessment of the social value of assets requires huge amounts of information about the present and the (far and uncertain) future. As acknowledged by the authors themselves, such information is scarce. Therefore, the whole normative justification of the index is undermined. One may wonder if the theoretical thread of the IWI holds in the light of such informational gaps.

Since the link between capital assets and well-being is taken for granted on the basis of an equivalence theorem, the authors do not make the effort to define well-being through its constituents but only as a function of its determinants. It seems then tautological to affirm that ““comprehensive wealth” moves in unison with well-being, in that, a perturbation increases (resp., decreases) well-being if and only if, holding shadow prices constant, it increases (resp., decreases) comprehensive wealth” (Dasgupta, 2009:2). This pivotal link relies essentially upon theoretical elaboration and hardly on empirical grounds. Without any justification of the link between constituents and determinants of well-being but an equivalence theorem, the welfare interpretation of the index becomes meaningless. As stated by Howarth (2007:660): “operationalizing the concept of sustainability in terms of maintaining the experienced utility of a typical member of society is an elusive and possibly infeasible goal.”

##### 3.1.2 *Ethical Issues*

Dasgupta (2013:42) praises inter- and intra-generational equity. The IWI actually does not account for intragenerational equity. Its value is not affected by intragenerational inequality in the distribution of wealth. Concerning intergenerational distribution, three remarks are in order. First, given the sustainability criterion ( $dV(t)/dt \geq 0$ ), nothing prevents a generation from being sacrificed: sustainability at time  $t$  is defined as the non-decreasing weighted sum of utilities across time. Second, it is often argued that utilitarian discounting is a dictatorship of the present because, for any  $\delta > 0$ , the distant future is undervalued (Chichilnisky, 1996; Cairns, 2013). Third, the sustainability criterion

does not clearly make room for improvements in welfare. As stated by Gerlagh and Sterner (2013:158): “The paradigm does not provide us with tools for designing a better future for our children. When we define sustainability as non-decreasing welfare, and if this condition is binding, it means literally that the path chosen will be one of constant welfare.” This applies in particular to poor countries.

### 3.1.3 *Wealth is Not Sustainability*

One of the key innovations of the inclusive wealth framework is the articulation of wealth (weighted sum of capital assets) and sustainability, through the intergenerational welfare function. Still, such an articulation is highly debatable. Smulders (2012:370) argues that “the paper is about measuring whether the dynamic per capita welfare potential (wealth) of a country is sustained over a short horizon [which] makes the link with sustainability (...) somewhat weak”.

More fundamentally, Cairns (2013:642) challenges the very choice of the sustainability criterion. “The welfare integral (...) is present, not intergenerational, wellbeing. (...) A shortfall of their approach is that a consistent criterion for sustainability is not provided. (...) Discounted-utilitarian welfare (...) is not required in order to define a consistent, current criterion.” What is at stake here is the articulation between short term and long term. As Cairns words it: “the analysis maintains two conflicting sets of values. One is discounted-utilitarian welfare. The other is growing welfare in the short run. If  $V(t)$  is a full expression of the value of a society with a non-optimal resource-allocation mechanism, the economic problem for the generation at time  $t$  is to increase the current value with the given capital stocks rather than to maintain its current level over the next instant. The analysis, although normative, cannot prescribe what to do if welfare is not being maintained” (ibid.:643). The criterion provided by Arrow et al. (2012) would therefore be neither sufficient (it is not a condition for the very long run), nor necessary (a sustainable society can suffer a short-term drop in welfare).

## 3.2 Shadow Prices and Monetary Evaluation

The IWI’s authors pretend to improve the ANS approach by focusing on the productive base rather

than on consumption. It is however dubious whether they manage to *really* account for the economy’s productive base, given the way the latter is valued. While shadow prices play a key role in the IWI, we identify problems precisely originating in their definition and implementation.

### 3.2.1 *Do Shadow Prices Reflect the Relative Contributions of Capital Assets to the Productive Base?*

#### *MRS and MRT*

The IWI’s authors rightly extend the conceptions of welfare and of productive base to make them “inclusive”. Though such an endeavour is welcome, it bears the risk of turning the analysis intractable and confusing.

In the IWI, the social value of contributions of capital assets to well-being is given by shadow prices, that reflect the rate at which the representative agent would trade a capital for another. This is the marginal rate of substitution (MRS). In parallel, it appears that shadow prices determine the degree of technical substitutability between capital assets, that is, the marginal rate of transformation (MRT). It is therefore implicitly assumed that  $MRS = MRT$ . This entails highly problematic corollaries, not least because Arrow et al. (2012:323) “do not assume the economy to be on an optimum trajectory.” Let us cite Solow full-length:

“The authors understand completely that, in an economy that is not engaged in maximising  $V(t)$ , that is to say in our economies, marginal rates of substitution (MRS) and marginal rates of transformation (MRT) are not necessarily equal. They seem to think of their estimated shadow prices usually as approximate indicators of MRSs on the utility side. When the issue is sustainability for a long period of time, however, MRTs are just as fundamental. The relative shadow prices of human capital and depletable resources, say, have a story to tell. Social wellbeing depends on consumption, and future consumption depends on, among other things, the ability of human capital to replace depletable resources in the production of objects of consumption. Possibly there is

some assumption about MRTs hidden in the use made of shadow prices in the calculations; possibly there ought to be an explicit assumption” (Solow, 2012:354).

In their reply to Solow, Arrow et al. (2013) consider their focus on MRSs as a virtue rather than as a problem. They argue that since MRTs do not determine shadow prices, they are not able to reflect changes in utility, while MRSs do. This reply appears unsatisfactory. The problem should be understood the other way around. While MRTs do not determine shadow prices, they are supposed to reflect the degree of technical substitutability between assets. MRTs thus determine the material productive base that would support well-being. If shadow prices only reflect MRSs and not MRTs, the question is: to which extent do the MRSs reflect the economy’s capacity to transform capital assets in the long-run? Since the aim of the IWI is to measure the productive base of the economy that is supposed to sustain well-being, it appears far more relevant to evaluate the variations of MRTs rather than MRSs.

Arrow et al. (2012) are all the more confusing that they explicitly state: “Shadow prices are functions of the degree to which various assets are substitutable for one another”. If shadow prices depend on the stocks of all capital assets, they effectively reflect MRTs and not MRSs. Duraiappah and Muñoz (2012:366) suggest, for instance, that taking natural capital as a determinant of health would entail a totally different shadow value for natural capital.

### *MRS and Output Elasticities*

At this stage, it is worth pondering upon what is meant by “productive base” in the IWI. Actually, the framework does not provide any explicit production function. If there ever were any, it would be a revealed, immanent and implicit one. Shadow prices give the relative weights of capital assets in the production process of intergenerational well-being (see Fig.1). However, nothing ensures that these shadow prices correctly reflect the capital assets’ elasticities of output, and all the more the future consumption opportunities. For instance, recent research shows that cost shares significantly depart from output elasticities and that energy is not valued as it should be (Kümmel, 2013; Ayres et al., 2013; Ayres and Voudouris, 2014).

It is a fact that in the inclusive wealth approach, growth is not understood as narrowly defined GDP growth, so the cost share vs. output elasticity criticism does not strictly apply here. However, there is probably still room for a better recognition of energy as an essential constituent of the productive base. Not appropriately accounting for energy in the productive base could amount to creating “aeroplanes without engines” (Folmer and Johansson-Stenman, 2011).

### *Shadow Prices and Physical Evolutions of Capital Assets*

Though the productive base is valued in monetary terms, the authors want the IWI to reflect physical changes: “Changes in IWI are solely driven by changes in the physical side of the economy, since prices (...) are assumed to be constant and represented by the average price of the time span under evaluation”(UNU-IHDP and UNEP, 2012:30). In reality, even though shadow prices are maintained constant, the amplitude of the assets’ physical changes strongly depends on their relative weights. Therefore, for instance, when health accounts for 95% of the total value of the IWI, a huge change in natural capital would only appear as a minor variation.

### *3.2.2 Actuarial valuation*

The IWI’s architecture largely relies upon an actuarial approach of accounting where the assets are valued on the basis of the future flows of benefits they are liable to generate. Some of the natural capitals (cropland, pastureland, non-timber forests), ecosystem services and human capital are valued alike. Three problems arise from that kind of valuation (Richard, 2012). First, fluctuations of anticipated prices can hide ecological scarcities, if price variations overcompensate the opposite variation in capital. Second, actuarial valuation incorporates potential results, which can be revised at next estimation. Third, and more fundamentally, even if future quantities and prices were realised, no concrete means are provided to implement a conservation policy. Saving enough for the restoration of capital assets requires knowing the level of degradation and the replacement costs. Since the depreci-



ation of assets is valued through shadow prices, such costs are not properly estimated.

### 3.2.3 Shadow Prices and Forecasting

The above-mentioned ambiguities are compounded by the lack of explicit forecasting. Indeed, the framework does not provide any dynamic model of the economy (Smulders, 2012; Collins, 2013). So, it is not “prospective” and does not tell us if development is sustainable (Collins, 2013). The absence of such a model implies no consideration of capital dynamics across time, which is illustrated in the actuarial valuation of cropland, pastureland, non-timber forest, ecosystem services and human capital: no assumption is made about the evolution of rental prices. They are assumed to be constant over time and discounted at a fixed rate, which moreover is not explicitly justified.

The absence of a dynamic model makes the IWI vulnerable to exogenous shocks. As Dietz and Neumayer (2006:123) noticed, “the difficulty with exogenous shocks is that the prices existing at the outset (...) will not adequately reflect economic scarcities (...). The paradox one ends up in, however, is that the whole method of accounting remains on some level dependent on efficient pricing.”<sup>19</sup>

The IWI does not account for possible threshold effects either. “In defining shadow prices (...), it was assumed that (...) human well-being ( $V$ ) is a smooth function of the stocks of capital assets ( $K_i$ )” (UNU-IHDP and UNEP, 2012:20). How would the IWI evolve if a critical threshold of natural capital were reached, eroding humanity’s well-being?

### 3.2.4 Shadow Prices and Market Prices

When operationalised, the IWI is valued at market prices. This raises a fundamental problem. Since the evolutions of well-being and the productive base are linked through shadow prices (and not market prices), the whole architecture of the indicator collapses. Since the indicator is intrinsically built to be empirically implemented, this fundamentally questions the consistency of using shadow prices, whose function only holds theoretically. This is in contradiction with what Dasgupta wants: “the

<sup>19</sup>This remark is targeted at the ANS but also applies to the IWI.

motivation behind the welfare economic theory of green accounting should be practical application” (Dasgupta, 2009: 8).

## 3.3 Economism of the IWI

Beyond the narrow economic way of seizing such dimensions as human or health capital<sup>20</sup>, the IWI carries a highly problematic worldview, granting economists a demiurgic role. Monetary valuation is considered the most suitable way to settle the democratic debate and to inform public policies: “The balance that’s struck [between competing demands] needs to be informed of the unseen benefits human societies enjoy from natural capital. That is why economic evaluation is a vital exercise” (Dasgupta, 2013:42). In choosing to let the monetary valuation of some dimensions to future editions of the IWI, the authors act in accordance with the Stiglitz-Sen-Fitoussi Report, which advocates “focusing the monetary aggregation on items for which reasonable valuation techniques exist” (Stiglitz 2009:17). However, as Hueting rightly cautions, “the great danger here is that politicians and the public come to interpret the relatively very small part of scarce environment goods that can be valued in terms of money as the only part of the environment that is of importance in decision making. This is the well-known *pars pro toto* hazard: a part is regarded as the all” (Hueting1984:212).

By definition, the ambition underlying the IWI is comprehensive. So, satisfactory implementation of the indicator implies comprehensive monetary valuation. This leads to enlarge the scope of monetary valuation, potentially unlimited. Such an endeavour is grounded on the belief (or the hope) that shadow prices will be able to synthesise a very wide array of information: they are supposed to capture the degree of substitution across the different forms of

<sup>20</sup>Health is measured at the prism of future productivity, on the basis of the value of statistical life (VSL). Any type of initiative aimed at improving human fate is therefore interpreted in the light of consumption and investment categories. This leads to debatable conclusions such as this one, for instance: “Providing additional food to undernourished people (...) not only increases their current well-being, it enables them also to be more productive in the future and to live longer. Because their human capital increases, the additional food intake should count also as investment. Note though that food intake by the well-nourished doesn’t alter their nutritional status, which means the intake is consumption, not investment” (Dasgupta, 2013).



capital, to reflect the contribution to intergenerational well-being at each time period by each capital asset, to reflect future scarcities, and to capture all the externalities. Beside the fact that shadow prices are not able to play these roles (as shown above), “comprehensive” (monetary) valuation grants an exorbitant privilege to economists, as organisers (“orchestrators”) of all other sciences. It is the achievement of the chrematistic logic, applied to an always broader reality<sup>21</sup>. Focusing on the search for the “right” shadow prices bears the risk of reducing the range of democratically debatable issues. This demiurgic role might be further enhanced by the fact that beside being allocation signals, shadow prices can be used as behavioural incentives.

Since the IWI is supposed to be all-encompassing, one might wonder what its place is regarding other sustainability indicators: Should it synthesise all information and become a meta-index? Or should it stay aside other indicators within a dashboard?

## 4 Discussion and Conclusions

Accounting for the wealth of nations is undoubtedly desirable. While steady progress is made on the economic front (Piketty, 2014; Piketty and Zucman, 2014), quantifying other dimensions remains particularly challenging. Nations increasingly attempt to elaborate broad accounting systems including environmental dimensions (e.g. System of Environmental-Economic Accounting (SEEA), UK National Ecosystem Assessment). Focusing on and accounting for stocks in a sustainability perspective is more and more widespread and consensual among policymakers and researchers. Quantifying stocks is certainly good for monitoring purposes. But who ultimately monitors and for whom? Who makes sense of gathered raw information and to what purpose? Economists play a significant part in organising such information, through the provision of theories and ideas on how wealth and sustainability should be defined and measured. As a matter of fact, most wealth accounting initiatives are designed by economists. The IWI is no exception.

<sup>21</sup>Cf. the Aristotelian distinction between chrematistics and economics (Martínez-Alier, 2002) and the Polanyian distinction between formal and substantive economy (Polanyi, 1977).

The indicator aims at reflecting whether a nation is eroding the productive base on which its current and future well-being is assumed to depend. The way the IWI is built, however, sheds doubt on its ability to accurately serve the purpose it has been given.

First, the underlying utilitarian welfare function raises (at least) three kinds of issues. The link between intergenerational well-being and capital assets relies upon a fragile theoretical construct (the “equivalence theorem”) which, because it is neither theoretically justified nor empirically grounded, renders the welfare interpretation of the index artificial, if not meaningless. At an ethical level, intragenerational distribution does not affect the welfare function, while the discount rate favours present over future generations. Eventually, the utilitarian welfare function does not provide any consistent sustainability criterion.

Second, strong reliance on shadow prices and monetary valuation proves problematic. Shadow prices do not accurately reflect the relative contributions of capital assets to the productive base. The actuarial valuation of some assets hardly copes with uncertainty and does not inform about these assets’ replacement costs. While shadow prices are assumed to reflect future evolutions of capital assets, no dynamic model is provided, which makes forecasting uneasy and vulnerable to exogenous shocks, and prevents from considering the possibility of threshold effects. Last but not least, the fact that the IWI, once operationalised, is valued at market prices (and not shadow prices) implies that the whole architecture of the indicator collapses.

Third, the IWI is characterized by strong economism. Dimensions such as human or health capital are grasped according to a narrowly productivist approach. More fundamentally, the pivotal role attributed to shadow pricing grants economists a demiurgic role in the definition of “what to value” and “how”. So, beside the fact that believing in an all-encompassing pricing scheme appears unrealistic, mediating all values through prices prevents any democratic debate on values and may undermine the value-pluralistic claims made by the authors of the IWI themselves.

For all the above-mentioned reasons, the IWI does not seem to have the qualities of a good sustainability indicator. While the IWI departs from some

of the "mainstream fallacies" pointed out by Lélé (2013), as the focus on narrowly-defined growth, it does not manage to provide a more precise, workable and widely acceptable definition for sustainable development, in the sense advocated by the same author as early as in 1991 (Lélé, 1991). Contrary to Aricò (2013: 172), we do not think that "the notion of 'inclusive wealth' (...) provides a constructive framework for taking up [the] challenge" of measuring progress towards the achievement of sustainable development. Alternative principles and theoretical foundations should be investigated.

Among the critics of the IWI, Cairns (2013) and Cairns and Martinet (2014) propose an alternative sustainability axiomatic based on a maximin criterion. In order to operationalise their criterion, they suggest adopting viability analysis. This consists in studying feasible paths once constraints are defined (both according to democratic debate and scientific validation)<sup>22</sup>. On the basis of viability theory, Cairns (2013) proposes to think about the possibility of elaborating accounts based on maximin shadow prices. While we agree with Cairns that adopting a maximin criterion for sustainability could be a sounder basis than intergenerational discounting utility, the relevance of searching for maximin shadow prices is doubtful. Indeed, the elaboration of such prices would probably face the same difficulties as those identified for the IWI. In any case, one should stay cautious while monetizing assets<sup>23</sup>. Anyway, we believe that future research should further investigate the potential of viability approaches to design sustainability indicators and policies at the macro level.

Some considerations emerge from critical reflexions on indicators. They are reinforced by our own analysis of the IWI. "The quantification process is a proving ground, and as such, should be approached with caution, since inappropriate methodological choices can easily deflect indicators from the ends they were intended to serve"(Cassiers and Thiry, 2014). Such caution is necessary, given the increasing use of numbers in the governance of societies (Desrosières, 2008; Jany-Catrice and Bardet, 2010). The present article modestly tries to contribute to clarify the current debate on new sustainability measures.

<sup>22</sup>See Baumgärtner and Quaas (2009), Cairns and Martinet (2014), Durand et al. (2012), Martinet (2011).

<sup>23</sup>Some relevant criteria to decide whether to use monetary valuation or not are provided by Kallis et al. (2013).

The analysis suggests that one should not appraise the quality of an indicator according to its formal elegance solely. Dasgupta is right when he points out that "the weighting scheme in HDI (...) is entirely *ad hoc*: the weights aren't derived from any known welfare consideration" (Dasgupta, 2014:16). But is it better to weigh sustainability dimensions following a highly debatable and obscure theoretical model? The sophisticated architecture of the IWI may reveal a card house, once the index is applied, since the use of market prices prevents from accurately assessing the value of the productive base. Moreover, such a theoretical complexity occults the underlying normative foundations, leaving no space for deliberation on ends and values to abide by. This strongly contrasts with the ambitions of the authors to elaborate a measure respecting value pluralism, which would effectively reflect the sustainability of societies' well-being.

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