WORKING PAPER

A CONCEPTUAL EXPLORATION AND CRITICAL INQUIRY INTO THE THEORETICAL FOUNDATION(S) OF ECONOMIC WELFARE MEASURES

Jonas Van der Slycken
Brent Bleys

August 2019
2019/977

GHENT UNIVERSITY

Department of Economics

Faculty of Economics and Business Administration
Campus Tweekerken, St.-Pietersplein 5, 9000 Ghent - BELGIUM

A conceptual exploration and critical inquiry into the theoretical foundation(s) of economic welfare measures

Jonas Van der Slycken[1] **and Brent Bleys**

Abstract

Economic welfare measures (EWM) such as the Index of Sustainable Economic Welfare and the Genuine Progress Indicator are often argued to lack a sound theoretical foundation. However, we observe that the initial EWM were jointly inspired by Hicksian and Fisherian income, as Daly and Cobb build upon features attributable to both income notions in the construction of the ISEW. Welfare's experiential nature is borrowed from Fisher, whereas seeing the consumption of community capital (e.g. the ecosystem) as a cost is Hicksian-inspired. As most welfare practitioners do not recognize this double theoretical foundation, two distinct welfare interpretations are often conflated in EWM. These measures can be seen as either capturing the benefits and costs experienced by a nation's citizens at a particular moment in time, or as reflecting the benefits and costs of present economic activities. The former interpretation would exclude future costs and capital changes as they are not experienced in the present, while the latter would identify these components as benefits and costs of present activities and thus include them. Besides making decisions on how to account for the time dimension, designing EWM also requires a choice on where to draw the system's geographical borders. Here, we also identify two perspectives: a within boundary and a beyond boundary viewpoint. Looking at the impacts within domestic borders resonates more with a nation's current experiences, whereas a beyond boundary perspective would trace the costs caused by present activities in other regions, just as the Ecological Footprint does. Recent developments in the field reveal that EWM are converging toward the ex post established Fisherian foundation formulated by Lawn (2003) – for instance, by framing welfare losses caused to the future and other regions in an experiential setting. Yet, this 'Fisherisation' or 'experientisation' is not the only way forward. Welfare interpreted as the benefits and costs of present activities would require, from an accountability perspective, that the costs of present activities shifted abroad or to the future are registered, whether they are experienced or not. To avoid inconsistencies, the ongoing standardization process of EWM would greatly benefit from making explicit in future studies which welfare interpretation and which time and boundary perspectives are taken.

Keywords: Index of Sustainable Economic Welfare (ISEW); Genuine Progress Indicator (GPI); theoretical framework; Fisherian income; Hicksian income; experiential welfare; cost-benefit analysis; cost-shifting; accountability; standardization; beyond GDP.

[1] Corresponding author. *E-mail address:* Jonas.vanderslycken@ugent.be; *Tel.:* + 32 9264 3502
Address: Department of Economics, Ghent University – Tweekerkenstraat 2, 9000 Ghent, Belgium.
This research is supported by a doctoral fellowship from the Special Research Fund (BOF) of Ghent University.

1. Introduction

In response to misuse of the Gross Domestic Product (GDP) as a welfare indicator, Daly and Cobb (1989) developed the Index of Sustainable Economic Welfare (ISEW) to provide better information on economic welfare.[2] Economic welfare measures (EWM), such as the ISEW and the Genuine Progress Indicator (GPI), offer information on "the contribution of a nation's economy to the overall level of well-being enjoyed by its citizens (Bleys, 2012). They typically do so by seeing the economy as 'embedded': the economy-in-society-in-the-ecosystem. EWM do not only take a broader perspective on the economy subsystem compared to GDP (that only focusses on market activities), but EWM also make explicit the links between the economic subsystem and the social and ecological domains. Over the next thirty years, EWM have been compiled for countries, regions and cities all over the globe – see Bleys & Whitby (2015) and Long & Ji (2019) for an overview. Soon after the development of the first EWM, however, critics such as Neumayer (1999) pointed out that these measures were lacking a sound theoretical foundation, whereas Hanley et al. (1999) described the ISEW as making a number of ad hoc adjustments to the national income accounts to reflect a broader welfare concept. It was not until the turn of the century that the ISEW was connected to Fisher's concepts of income and capital by Lawn and Sanders (1999) and Lawn (2003).

In his seminal paper, Lawn (2003) meticulously explained how every item included could be consistent with Fisher's concepts, thus potentially providing the ISEW and related measures with a theoretically sound foundation. However, EWM also have been defined as measures of sustainable economic welfare that are tightly linked to Hicks' (1939) maximum sustainable consumption – e.g. Harris (2007) even considers Hicksian income to be superior compared to Fisherian income. To date, Fisherian psychic income is the most commonly used theoretical foundation to underpin EWM (in e.g. Lawn, 2003; Bleys, 2008; Brennan, 2013; Lawn, 2013; Talberth & Weisdorf, 2017; O'Mahony et al., 2018; Kenny et al., 2019; Long & Ji, 2019). Fisher (1906) stressed the psychic or experiential nature of income and relates income to the subjective satisfactions consumption causes in the human psyche. By turning to psychic income to underpin welfare exercises, EWM would reveal information about the net benefits a nation's citizens are experiencing from economic activities, after deducting for instance the costs of air pollution, noise pollution and of commuting to work from the consumption benefits. EWM do more than just registering the traditional net psychic income as they also account, for instance, for the costs caused to the ecosystem. In fact, EWM are based on an extended version of Fisher's income-capital distinction (Lawn, 2008) or on the 'entropic net psychic income' (Brennan, 2008). This entropic extension results in registering the ecosystem services that are sacrificed in the economic process as a cost in EWM.

Despite the theoretical debate moving in the direction of Fisherian income, a clear interpretational consensus on what EWM are capturing, is missing in the field. Table 1 illustrates this by outlining a number of welfare statements of leading scholars. The emphasis we added in this overview highlights

[2] GDP, indicating the monetary value of goods and services of domestic market production, has been criticized from its start as being a social welfare proxy. Kuznets warned in 1934, the very beginning of the use National Accounts, that "the welfare of a nation can scarcely be inferred from a measurement of national income…" (Kuznets, 1934, p. 7). Over the years, prominent economists further fueled this critique (Galbraith, 1958; Mishan, 1967, Nordhaus & Tobin, 1972; Leipert, 1986; Daly & Cobb, 1989; Max-Neef, 1995; Fleurbaey, 2009; Stiglitz, Sen and Fitoussi, 2009; Kubiszewski et al., 2013; Costanza et al., 2014; Jackson, 2017). GDP (per capita) is dismal for approximating economic welfare, as it overlooks many important welfare aspects by only focusing on market activities. Despite GDP's obvious and well-known shortcomings, it is still widely used by economists, media and policy makers as a welfare indicator. GDP's omnipresence is probably causing the 'largest information failure' in the world (van den Bergh, 2009).

that these scholars understand, define and explain EWM differently. Sometimes, EWM are said to capture what is being enjoyed at a particular point in time or as being related to the costs and benefits experienced at a particular point in time. Here, the experiential nature of EWM is stressed, which is directly related to Fisher's *psychic* income. On other occasions, EWM are linked to the value added to nature, to counting the depreciation of community capital as a cost, to the impacts of economic growth or to the consequences of economic activity. In these diverse statements, two welfare interpretations can be detected. The first interpretation sees EWM as what is currently being experienced, whereas the second relates EWM to the costs and benefits caused by present economic activities. Current activities may bring (benefits and) costs abroad and in the future that are not necessarily experienced by a nation's citizens in the present.

Table 1: Various statements by key practitioners on what economic welfare measures are capturing.

Lawn (2003)	"The sustainable economic welfare implied here is the welfare a nation enjoys at a *particular point in time* given the impact of past and present activities" (p. 106).
Posner and Costanza (2011)	"The GPI uses monetary valuation to assess the *impacts of economic growth* on sustainable welfare. GPI is an indicator that goes beyond measuring the quantity of economic activity to include details about quality, … " (p. 2, emphasis added).
Kubiszewski et al. (2013)	"…, the GPI is designed to measure the economic welfare generated by economic activity, essentially counting the *depreciation of community capital as an economic cost*." (p. 57). "Economic activity, it should be recognized, is undertaken to generate a level of *economic welfare greater than what can be provided by natural capital* alone." (p. 58, emphasis added).
Talberth and Weisdorf (2017)	"The Genuine Progress Indicator is a monetary measure of economic welfare for a given population in a given year that accounts for *benefits and costs experienced* by that population in association with investment, production, trade, and consumption of goods and services" (p. 3, emphasis added).
Held et al. (2018)	"Taking the deficiencies of GDP as a starting point for consideration, those indices try to capture the *consequences of economic activities on current welfare* in a more comprehensive way, especially with regard to social and environmental issues. Therefore, monetized costs and benefits are aggregated across social, environmental and economic dimensions into one single indicator." (p. 392, emphasis added).

To make things worse, many EWM studies avoid looking into the theoretical foundations of the measures, and focus exclusively on estimating an additional EMW time series. As a result, these studies make implicit and inconsistent time and boundary choices (i.e. deciding between forward-looking or present-looking perspective and between a within and beyond boundary view). This lack of standardization regarding time and boundary issues hinders the policy-impacting potential of EWM (Bleys & Whitby, 2015). Therefore, the purpose of this paper is to revisit the theory behind the EWM. Section 2 revisits the theoretical foundations of EWM and introduces with Hicksian and Fisherian income two concepts that provide EWM with a (double) theoretical underpinning. Section 3 relates this double theoretical foundation to the existence of two distinct ways to interpret EWM and connects each interpretation to a time and boundary perspective. The conclusion proposes a way forward towards a more consistent standardization in the field.

2. Revisiting economic welfare measures' theoretical foundation(s)

For terminological clarity, we want to stress the distinction between 'income' and 'welfare'. In this paper, *welfare* is used to refer to practically compiled measures such as the ISEW and GPI, whereas *income* is related to the theoretical income concepts which provide EWM with a certain theoretical base. In this section we will scrutinize the theoretical foundations of EWM. First, we will introduce Hicks' and Fisher's income concepts, as they underlie the theoretical discussions on EWM. Afterwards we will explain how extended versions of these theoretical income notions are translated in EWM and explore the ex post theoretical foundation developed by Lawn (2003) based on Fisherian income. Finally, we will discuss the linkages between the ISEW, Hicksian and Fisherian income.

2.1 Income concepts underlying EWM

Daly and Cobb (1989) first turned to Hicksian income when developing the ISEW, while later on, Lawn (2003) connected EWM to Fisher's psychic income notion and his distinction between income and capital. It is important to have a clear view on both income concepts in order to understand how EWM relate to these.

2.1.1 Hicksian income

In his book "Value and Capital", Sir John Hicks explored the concept of income. Hicks (1939, p. 172) explains income as:

> "The purpose of income calculations in practical affairs is to give people an indication of the amount which they can consume without impoverishing themselves. Following out this idea, it would seem that we ought to define a man's income as the maximum value which he can consume during a week, and still expect to be as well of at the end of the week as he was at the beginning. Thus, when a person saves, he plans to be better off in the future; when he lives beyond his income, he plans to be worse off. Remembering that the practical purpose of income is to serve as a guide for prudent conduct, I think it is fairly clear that this is what the central meaning must be."

Hicks' central income criterion is avoiding impoverishment to maintain consumption over time. The practical difficulty, however, lies in operationalizing this principle. A practical attempt to capture this central meaning can be found in his so-called 'Income No. 1', which is "…the maximum amount which can be spent during a period if there is to be an expectation of maintaining intact the capital value of prospective receipts (in money terms)." (p. 173). Hicks gives an example in which an individual with a capital sum only spends the interest yield on her capital. By limiting income to the yield on capital, the capital stock remains intact over the considered time period. The importance to "keep capital intact" is derived from this income approximation.[3] This *ex ante* income expectation has a counterpart that is realized *ex post* by including unexpected profits or losses. According to Hicks, especially the *ex post* variant of Income No. 1 is important and it equals consumption plus capital accumulation (Hicks, 1939). This version is commonly referred to as 'Hicksian income', and it should be noted this is different from Hicks' central income notion that is forward-looking.

2.1.2 Fisherian income

Fisher (1906) defines psychic income as "the stream of consciousness of any human being. All his conscious life, from his birth to his death, constitutes his subjective income. Sensations, thought, feelings, volitions, and all psychical events, in fact, are part of this income stream. All these conscious experiences which are desirable are positive items of income, or services; all which are undesirable are

[3] In other income variants, No. 2 and No. 3, Hicks considered changing interest rates and price expectations. Throughout his quest to properly define income, Hicks pondered about *ex ante* expectations and *ex post* realizations of the maximum amount that can be consumed and about individual income and social income.

negative items, or disservices." (p. 168). Positive income is related to using wealth (i.e. consumption). However, economic activity is not only yielding desirable benefits or services (i.e. the enjoyment of psychic income), it also brings undesirable disservices or psychic outgo like the labor cost or effort. Fisher explains this cost item can be "labor, anxiety, trouble, annoyance, and all the other subjective experiences of an undesirable nature which are necessary in order that the experiences of an agreeable nature may be secured" (p. 175). This negative psychic income or psychic outgo is netted from the (positive) psychic income to obtain the 'net psychic income'.[4, 5] The net income is what ultimately remains uncancelled in the human psyche and is labeled as 'uncancelled benefits'.

To determine what counts as psychic income, Fisher's distinction between income and capital is crucial: psychic income flows should be recorded but not the changes in capital stocks. The basic premise is that consumption and not investment is important as it yields satisfactory services. Of course, investments also play a role but they will only help to maintain the stock from which consumptive services may flow in coming periods. While Fisherian income would count the entire amount of actual consumption as income, even though if this would be capital consumption (Mates, 2004), this would not be the case for Hicksian income. Hicksian income accounts for capital accumulation or decumulation and would not count capital consumption or depreciation as income, since Hicks' stresses the importance to keep capital intact.

2.2 An extended version of Hicksian income (EHI)

In their book "For the Common Good: Redirecting the Economy toward Community, the Environment, and a Sustainable Future", Daly and Cobb (1989) scrutinize the misplaced concreteness of GDP as a measure of economic success. In doing so, the authors propose to make two departures from GDP. The first departure involves turning to Hicksian income as a better income concept. GDP cannot serve as an approximation for Hicksian income since a nation will ultimately be impoverished if it consumes its entire GDP. Part of GDP simply serves to overcome depreciation of human-made capital and cannot be consumed without being worse off in the next period. By subtracting depreciation from GDP, Net Domestic Product (NDP) or its variant Net National Product (NNP) is obtained.[6] This NNP is most commonly regarded as (a basic) approximation of Hicksian income as per Asheim (1994) and Hartwick (1994). Nordhaus (1995) explains this narrow Hicksian income can easily be expanded to incorporate natural capital by subtracting resource depletion and environmental degradation as is done in integrated environmental and economic accounts. The need to subtract the value of using raw materials and capital equipment to obtain a nation's net product was already expressed by Kuznets (1934).

Daly and Cobb (1989) go beyond the basic interpretation of equation Hicksian income to NNP. They argue that NNP is not capable of adequately reflecting the maximum amount of consumption that can be sustained over time since (a) the current produced NNP involves transformations in the biophysical world that are ecologically unsustainable, and (b) NNP includes defensive expenditures, which are intermediate expenditures to protect ourselves from the adverse, future impacts of economic production. The NNP thus overestimates the amount of ultimate, true consumption that is valued for its own sake.[7] Therefore, Daly and Cobb propose to adjust NNP by (a) expanding depreciation to cover

[4] In the dominant economic jargon psychic income and psychic outgo are known as utility and disutility.
[5] Psychic outgo items embodied in the ISEW are for instance noise pollution and the costs of commuting to work.
[6] In their writings Daly and Cobb (1994) still refer to Gross National Product (GNP) and NNP, which are two terms that were used before GNP was replaced by GDP. We prefer to stick to Daly and Cobb's original terminology of NNP.
[7] A more detailed definition is given by Leipert (1989): defensive expenditures are "… outlays with which the attempt is made to eliminate, mitigate, neutralize, or anticipate and avoid damages and deterioration that the

the depletion of natural capital stocks and (b) deducting defensive expenditures. Their extended approximation of Hicksian income (EHI) can be represented as:

$$Extended\ Hicksian\ income = GNP - DHC - DE - DNC \quad (1)$$

In Eq. (1) GNP = Gross National Product, DHC = depreciation of human-made capital, DE = defensive expenditures, DNC = depletion of natural capital.[8]

2.3 An extended version of Fisher's distinction between income and capital

Daly and Cobb (1989) move beyond the extended proxy of Hicksian income by addressing more of GDP's deficiencies in a second departure from the measure. They develop the Index of Sustainable Economic Welfare as a new measure of economic welfare that aims to quantify "the positive contribution of the economy to social welfare" (p. 76). Although the authors did not relate their ISEW to Fisherian income, it was done so by Lawn (2003) in his ex post theoretical framing that he claimed to be superior to Hicksian income. In his work, Lawn puts forward an extended version of Fisherian income to take into account ecosystem services.

2.3.1 The Index of Sustainable Economic Welfare

A second departure from GDP in Daly and Cobb (1989) involves the development of a new measure of economic welfare: the ISEW. In doing so, the authors go beyond EHI by including additional welfare related items such as income inequality and the value of not commodified work. These ISEW items were not connected to Hicksian income by Daly and Cobb.

When developing the ISEW Daly and Cobb drew on previous welfare compilations, i.e. Nordhaus and Tobin's (1972) Measure of Economic Welfare (MEW) and Zolotas' (1981) Index of Economic Aspects of Welfare (EAW). They selected items from both indices, while also incorporating new items in the ISEW. In line with the previous measures, the ISEW starts from personal consumption expenditures and adds the value of household work. Daly and Cobb's measure is, however, the first to account for income inequality.[9] In line with Zolotas, defensive private expenditures on health and education are subtracted while non-defensive public expenditures are added. Other private defensive expenditures that are deducted include expenditures on personal pollution control and car accidents.[10] Daly and Cobb include numerous items related to environmental degradation and natural capital depreciation (i.e. air, water, and noise pollution; depletion of non-renewable resources; loss of farmlands and wetlands; long-term environmental damage; cost of ozone layer depletion). Similar to net investment in Nordhaus and Tobin's sustainable MEW, Daly and Cobb account for net capital growth. Moreover, the change in the net international position is incorporated to indicate whether the source of a nation's capital accumulation is domestic or foreign. Daly and Cobb assume that advanced capitalist societies

---

economic process of industrial societies has caused to living, working, and environmental conditions. They serve only to restore, reapproach, or defend a status (say, a specific environmental quality, secure income, or certain benefits of consumption) that has been lost or compromised by negative impacts of the economic and social process." (p. 844).

[8] GNP minus DHC simply equals NNP.

[9] This section takes the second edition of Daly and Cobb's "For the Common Good" in 1994 as a starting point. After a discussion and review of the original ISEW, Cobb and Cobb (1994) dropped a number of items in the 1989-ISEW, such as the cost of urbanization and advertising. Moreover, the 1994-version introduced the cost of personal pollution control and ozone layer depletion as new welfare items into the index.

[10] Nonetheless, not all scholars agree that defensive expenses should be subtracted in a welfare measure (e.g. Mäler, 1991 and Hamilton, 1996).

require long-term national self-reliance to sustain their welfare levels.[11] Finally, the ISEW also includes the services from consumer durables and the services from the public capital stock ('services from highways and streets'). A way to mathematically represent the 1994-ISEW, based on Jackson et al. (1997) can be found in Eq. (2):

$$\mathrm{ISEW} = \mathrm{Cp} - \mathrm{INQ} + \mathrm{H} + \mathrm{NDg} - \mathrm{Dp} + \Delta\mathrm{K} - \mathrm{E} - \mathrm{N} \qquad (2)$$

In Eq. (2) Cp = personal consumption, INQ = losses from income inequality, H = domestic labour, NDg = non-defensive government expenditures, Dp = defensive private expenditures, ΔK = capital adjustments, E = environmental degradation and N = depreciation of natural capital.

2.3.2 Lawn's ex post theoretical framework

Lawn and Sanders (1999) and Lawn (2003) related the items in Daly and Cobb's second departure to Fisher's concepts of income and capital. Lawn (2003) regards this Fisherian view to be logically superior to a Hicksian perspective that is used to calculate an adjusted GDP such as EHI. Lawn argues that the EHI is a better approximation of Hicksian income than GDP, but that it is not without its flaws. The EHI overlooks welfare aspects such as the cost of reduced leisure time, the cost of commuting, the cost of crime and family breakdown, the value of volunteer and non-paid household work and the welfare losses related to income inequality. Moreover, the EHI "… counts all additions to human-made capital as current income, it wrongly conflates the services rendered by capital (income) and the capital that renders them." (Lawn, 2003, p. 111).

Lawn (2003) believes Fisher's view is superior since Hicksian income is mistakenly connected to the quantity of production and consumption, whereas welfare depends on the 'psychic enjoyment of life' according to Lawn; a view for which Lawn finds support in the work of Georgescu-Roegen (1971) and Daly (1979). Nordhaus (2000) also favors Fisherian income, as he explains that while Hicksian income – consumption plus capital accumulation – is an important measure of current production, it has no clear welfare meaning.[12] Daly and Cobb themselves did not relate the ISEW to Fisherian income as Lawn did in his ex post theoretical framing. However, Daly and Cobb did refer to Fisherian income as having some interesting welfare features: "In Fisher's view nearly all consumer goods are classed as capital or wealth, and their consumption represents depreciation. For Fisher, welfare is the service (the psychic sense of want satisfaction) rendered by this wealth …" (1994, p. 67). Lawn (2013) states that Daly should be credited for having Fisher's income-capital distinction in mind when developing the ISEW and for seeing Fisherian income as suitable for measuring a nation's welfare. Lawn quotes Daly (1988, p. 54) to support his argument: "It seems to me that Irving Fisher's way of looking at things is eminently sensible, coherent, and logical".

2.3.3 An extended version of Fisher's distinction between income and capital

As articulated in Section 2.1.2, Fisher stops his analysis after he obtained the net psychic income or the uncancelled benefits. Nevertheless, one could also account for the 'uncancelled costs' or ultimate costs of the economic process: the input of low entropic resources and the output of high entropic waste. One should not forget that the ecosystem is the ultimate source that makes economic activity possible. Nature's stock of wealth is not only continuously delivering source services such as matter and energy, it also provides sink services to assimilate waste, and offers life-support services such as a stable

[11] This component would indicate whether a nation's capital formation is based on net lending (if positive) or on net borrowing (if negative). A positive change means an increase in capital assets, whereas negative changes indicate capital formation is based on foreign wealth that must be repaid with interest (Daly & Cobb, 1994).

[12] Among the most important drawbacks of Hicksian income Nordhaus states that it excludes nonmarket activity and a population's health status and labels intangible investments in human capital and technology as consumption. Yet, it should be noted that Lawn (2003) and Nordhaus (2000) interpret and operationalize Fisherian income differently.

climate.[13] These ecosystem flows are necessary to maintain the ever depreciating human-made capital, and are lost, used up or sacrificed in the economic process (Lawn, 2003, 2008). For this reason, Daly's (1979) view of seeing lost natural capital services needed to maintain human-made capital as uncancelled costs provides the rationale behind the environmental cost side of EWM (Lawn, 2008, 2013). By also accounting for uncancelled costs one does not arrive at the net psychic income, but one gets the 'entropic net psychic income', as Brennan (2008) calls it. By augmenting the net psychic income by this uncancelled cost account, Lawn (2008) explains that EWM are based on an extended version of Fisher's income-capital distinction.

The costs and benefits that ultimately remain in respectively the ecosystem and the human body are said to be 'uncancelled', because all in-between interactions cancel out as each transaction of primary resources, intermediate goods, or final products pair a buying with a selling act of the same monetary amount. Or in accounting terms: debit equals credit. The uncancelled benefits can be directly related to Fisher. However, the fact that EWM are based on an extended version of Fisher's income-capital distinction raises the question whether the uncancelled costs are in line with Fisher's original view. As explained before, in Fisher's original writings, the only ultimate cost of production was the cost of labor and not the ecosystem services sacrificed. Fisher (1906, p.175) adds: "… if the term "labor" be not itself sufficiently broad, labor, anxiety, trouble, annoyance, and all the other subjective experiences of an undesirable nature which are necessary in order that the experiences of an agreeable nature may be secured." Nonetheless, it should be noted that Tobin (2005, p. 211) clarifies Fisher's concept of capital "… embraces all stocks of material objects that yield services that human beings like. Thus Fisher would include: *land and other natural resources* as well as reproducible goods; objects owned by households and governments as well as by businesses; houses and other consumer durable goods as well as producers' durables; objects whose yields are always in kind, like houses occupied by their owners, as well as those yields are marketed for cash; the bodies of human beings – perhaps their minds too – as well as non-human objects." The emphasis we added discloses Fisher would see the ecosystem as capital. As a consequence, the positive services flowing from the ecosystem's functioning should be recorded from Fisher's income-capital perspective.

Today, it is impossible to know Fisher's thoughts on which categories he would classify as costs of production. Fisher regrets in his memoir that his insistence of seeing income as actual consumption made him lose approval for his income concept and settled that consumption plus capital accumulation is a useful income definition (Tobin, 2005). Perhaps, now that biophysical limits to growth have been detected (Meadows et al., 1972) and planetary boundaries are being crossed (Steffen et al., 2015), Fisher might see ecosystem costs as ultimate uncancelled costs of the production process and may agree with the procedure of deducting lost natural capital services as a way to account for the accumulation or decumulation of natural capital in EWM.

2.4 The Index of Sustainable Economic Welfare: a double theoretical foundation?

Even though Daly and Cobb (1999) stated that their two departures from GDP should be kept separate, a comparison between the extended Hicksian income (EHI) in Eq. (1) and the ISEW in Eq. 2 learns that Daly and Cobb's ISEW was at least partially inspired by the extended approximation of Hicksian income since the features they attribute to this version are mimicked in the ISEW. Firstly, the ISEW also subtracts defensive expenditures and adds non-defensive government expenditures. Secondly, the costs of environmental degradation and depreciation of natural capital are deductions within the ISEW, which corresponds to depletion of natural capital in Eq. (1). Thirdly, the ISEW captures net capital investment, just as EHI does. By deducting the depreciation of human-made capital from GNP in Eq.

[13] Section 2.2 already introduced how Kuznets also would deduct the use of raw materials to arrive at a nation's net product. Albeit limited in scope to only source services, the underlying rationale and procedure to calculate the cost account of EWM is comparable to what Kuznets proposed.

(1), the investments needed to overcome depreciation are not counted. However, if investments exceed capital depreciation, positive net investments contributing to the accumulation of the stock producer goods will be registered in EHI. As such, it accounts for 'capital accumulation'. The ISEW traces changes in producer capital stocks by accounting for *net capital growth*. However, compared to EHI this item is calculated differently, "…as the increase in the stock of producer goods above the amount required to keep the quantity of producer goods per worker intact" (Lawn, 2003, p. 114). The above comparison illustrates that the ISEW shares characteristics with the extended version of Hicksian income. This, in turn, could explain why Talberth and Weisdorf (2017) regard sustainable economic welfare as tightly linked to Hicks' (1939) maximum sustainable income and why Stockhammer et al. (1997) stated that "the ISEW follows Hicks … , but also goes further" (p. 22). The ISEW goes further by accounting for the value of household labor, leisure, income inequality, commuting, etc. As explained in Section 2.3 these items and the psychic services from consumption are connected to Fisherian income.

The above analysis demonstrates that EWM are no perfect replicas of either Fisherian nor Hicksian income as they incorporate more welfare items then one could expect based on each of these original income notions separately. EWM go beyond Hicksian maximum sustainable income and can be linked to an extended version of Fisher's net psychic income. Nonetheless, we explained how certain items have been inspired by Fisherian or Hicksian income and can be seen from an experiential Fisherian view or from a Hicksian perspective. That is why we argue that Fisher's income concept meets Hicks' income notion in practice. This provides EWM with a double theoretical foundation, even though the Hicksian connection is often overlooked in recent work, as EWM are nowadays mostly entirely framed from a Fisherian perspective.

3. A conceptual investigation of economic welfare measures

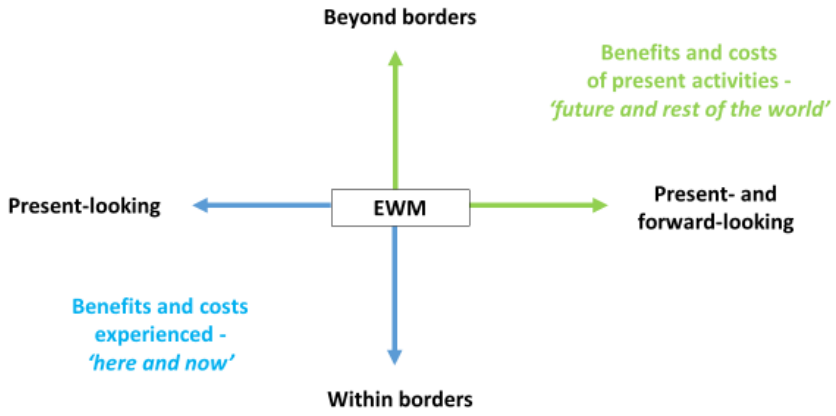
The double theoretical foundation raises many questions. How can both income concepts be combined in EWM? Fisherian income is often regarded as being superior compared to Hicksian income, however, there are some difficulties with the Fisherian foundation. Should the 'extended version of Fisherian income', in which ecosystem services lost during the economic process (i.e. the uncancelled costs), be psychic and in line with Fisher's income-capital distinction or not? Do defensive expenditures not yield positive experiences? Is accounting for capital changes such as net capital growth reconcilable with Fisherian income? These are issues that keep practitioners puzzling and divided, as already demonstrated by the different statements on what EWM are capturing in Table 1 (see Introduction). We believe the double theoretical foundation is based on the existence of two different ways to interpret EWM with distinct time and boundary implications. As we will explain in Section 3.1, EWM can be seen as the *benefits and costs experienced* or as the *benefits and costs of present economic activities*. Both interpretations imply different time and boundary choices and would treat ecosystem costs, capital changes and defensive expenditures differently, as we will see in Section 3.2. Afterwards, we will discuss how recent 2.0 studies are converging toward the experiential interpretation as a way to comply with the ex post Fisherian foundation. However, based on our two interpretational concepts, we will argue that this is not the only way forward when standardizing EWM.

3.1 Two distinct welfare interpretations

In this section we will introduce two ways of interpreting EWM and link each approach to specific time and boundary dimensions. Welfare seen as benefits and costs experienced looks at what is experienced 'here and now'. This implies a present and within border perspective. However, welfare understood as the benefits and costs of present activities has a contemporaneous and forward looking perspective, since present activities also bring costs and benefits in the future. Moreover, present

activities cause costs to the rest of the world, so this approach takes a beyond boundary viewpoint. Figure 1 illustrates each welfare interpretation's time and boundary implications.

Figure 1: Economic welfare measures' two interpretations with their distinct time and boundary dimensions.



Note: The vertical axis depicts the boundary perspective, whereas the horizontal axis reveals the time dimension. Benefits and costs experienced implies a within border perspective and takes a contemporaneous perspective on experiences: it registers what is experienced *'here and now'*. Whereas, the benefits and costs of present activities have a beyond boundary viewpoint and take a present- and forward-looking perspective by also incorporating the costs (and benefits) present activities cause to the *'future and the rest of the world'*.

3.1.1 Benefits and costs experienced (BCE)

The BCE-view is inspired by Fisher's psychic income and reveals information about the welfare citizens experience at this moment. Lawn (2003), for instance, states that EWM are defined as 'the welfare enjoyed at a particular point in time', and that they "convey useful information about the current manifestations and immediate effects of present and past activities, [while] they reveal much less about the future impact of current activities" (p. 116). As Lawn (2008, p. 71) clarifies: "… future consumption possibilities locked up in current wealth are not part of a nation's current welfare." Therefore, it might be useful to have a supplemental index that incorporates the future costs and benefits of present economic activities (Lawn, 2003; Lawn & Clarke, 2008). Here, welfare has a contemporaneous perspective; it is thus not forward-looking and it does not include future costs and benefits of present activities, since the focus is on present experiences (see Figure 1). This means that costs and benefits should only be registered when they are experienced. Recording psychic flows is based on the idea that (a) EWM should only trace services from capital stocks and not mere additions to or subtractions from stocks, and (b) the (dis)investments that are affecting the stocks (e.g. investments in the stock of producer goods), will impact on future flows of services that will be registered in next periods.

This experiential perspective takes an inward perspective when it comes to the boundary dimension (see Figure 1). The BCE-view only looks at the effects felt within domestic borders, since the impacts of present activities that are shifted beyond borders are not experienced by a nation's citizens. Bagstad et al. (2014), for instance, argue that a within border perspective would "… be more consistent with the aims of the GPI to capture the true costs and values of economic activity within a political or geographic boundary" (pp. 481). These authors suggest to account for ecological, social and economic costs of imported hazardous and radioactive waste. By doing so EWM would reveal what is experienced within a certain region.

3.1.2 Benefits and costs of present activities (BCPA)

The BCPA-approach focuses on present economic activities and accounts for both the present and future benefits and costs of these activities. It follows a(n) (extended) Hicksian view, since the consumption of community capital (i.e. human-made or natural capital) is labelled as a cost (Kubiszewski et al., 2013) instead of registering social and ecological costs positively (as in GDP and NNP). This view does not discriminate against future costs and benefits of present activities that violate Fisher's distinction between income and capital such as investments since future costs and capital changes should be seen as the costs and benefits of present economic activities. As a consequence, the BCPA-perspective has both a contemporaneous view on present activities and a forward-looking perspective (see Figure 1). This forward-looking perspective is not be confused with reflecting future consumption possibilities since EWM (both BCE and BCPA) do not try to capture future consumption.[14]

In a similar way that economic activities bring costs that are not necessarily experienced in the present, present activities also causes costs beyond domestic borders since the effects of certain items (e.g. resource depletion and climate disruption) do not discriminate against borders. In a global, entangled economy, nations are no closed economies. Countries trade not just goods and services, but also transboundary 'externalities'. For instance, the United Nations Handbook on National Accounting on Integrated Environmental and Economic Accounting (SEEA) (UN, 1993, p. 77) recognizes that: "Exports include not only cross-boundary product flows to foreign economies (as in SNA) but also flows representing the uses of, and the effects on, the natural environment of other countries by the domestic economy".

The BCPE view looks beyond boundaries (see Figure 1) and would account for the costs that present activities cause in other regions, just as the Ecological Footprint framework does (see e.g. Wackernagel & Rees, 1996). Clarke (2007), for instance explains: "As with GDP, the GPI is concerned only with a particular physical location. Yet, it may be more effective if the GPI was freed from these physical boundaries in a similar manner to GNI [Gross National Income]. The GPI should be concerned more with the *'ownership' of the costs and benefits* associated with economic growth than with the 'location' of those costs and benefits. Those that derive the most benefit from exploitation of the environment are often physically removed from the location of that damage. The GPI does not consider the net consumers of the negative externalities of environmental costs, merely the producers. Currently, however, the structure of the GPI allows a nation to enjoy, without penalty, the benefits of importing goods from countries which bear a disproportionately large cost of environmental degradation. This results in an overstatement of the real progress experienced by the country importing 'dirty goods'**.**" (p. 91, emphasis added).

Several scholars (e.g. Lawn & Clarke, 2008; Posner & Costanza, 2011; Kubiszewski et al., 2013) have pointed out that EWM fail to properly tackle transboundary issues. Hong Kong's upward welfare trend, for instance, can be partially explained by the relocation of heavily polluting industries to China (Delang & Yu, 2014), while Japan's case illustrates that heavily depending on imports results in low costs of domestic resource depletion (Makino, 2008) even though Japan and other resource-poor countries deplete global stocks. From a within boundary perspective, the welfare of these countries is higher than if they would account for environmental costs shifted beyond boundaries. Therefore, the BCPA-perspective with its beyond boundary perspective answers to the calls raised by Clarke (2007) and Makino (2008) for calculating open economy EWM.

[14] One exception can be found in Stockhammer et al. (1997), who tried to connect net capital growth to the increase in future consumption possibilities by multiplying net capital growth with the productivity of capital. As a result, future consumption (im)possibilities are allocated to the present period.

3.2 Welfare items seen from two interpretational perspectives: an application

This conceptual exploration illustrates the need to reflect on where to draw EWM's time and geographical boundaries. Clearly considering and stating which welfare interpretation and thus which time and boundary perspectives are chosen, is vital to know how EWM are operationalized. Both welfare interpretations and their time and boundary implications are not perfectly replicated in welfare studies since scholars often have to make pragmatic choices because of data availability, practitioners could (unknowingly) try to combine experiential welfare elements and cost-benefit aspects of present activities in a single welfare study. Using a marginal social cost of carbon to estimate the cost of climate disruption, for instance, is not compatible with an experiential, *'here and now'* view since this cost estimate embodies future and global costs. In order to illustrate both interpretations, we will explain how the items *net capital growth, climate disruption, resource depletion* and *defensive expenditures* would be dealt with differently from a BCE- and BCPA-perspective. Table 3 gives an overview.

- *Net capital growth* aligns with the BCPA-interpretation: a negative (positive) net capital adjustment is a(n) decrease (increase) of a nation's productive capacity and to be seen as a cost (benefit) of present economic activities. Lawn (2003) argued that an increase in a nation's productive capacity (i.e. investments in human-made capital above the minimum requirement to keep the stock of producer goods per worker intact) is a benefit. This is a benefit of present activities and does, however, not constitute a present experience since this increased productive capacity will lead to future consumption experiences registered in the future, as pointed out by Bleys (2008). Yet this adjustment does not matches the BCE-view. To be in line with the ex post established Fisherian income-capital distinction, one should report psychic income flows but not changes in capital stocks. Therefore, it is no surprise Bleys (2008) pointed out that capital change items like *net capital growth* (and *change in net international position)* are inconsistent with Fisher's income-capital distinction. That is why, these items should not be included in BCE-studies.
- The *costs of climate disruption*, previously referred to as long-term environmental damage, can be calculated in two ways. The BCPE-perspective would account for the costs that present activities cause today and in the future, both domestically and in the rest of the world. These damages are linked to the current emissions of greenhouse gasses (GHG), either domestically emitted, or, preferably, also taking into account the net GHG imports or exports related to international trade. The BCE-interpretation, on the other hand, would incorporate only the costs that are already experienced at this moment and within domestic borders. These costs are typically linked to the impacts of climate disruption that are currently felt (e.g. extreme weather events, droughts, …).
- The rationale for including *non-renewable resource depletion* is evident from a BCPA-view since it is a cost of present activities as the natural capital stock is being depleted by these activities. This depletion can be seen from two viewpoints, depending whether the country involved has resource endowments or not. Resource-rich countries deplete their national energy stocks via present extraction activities, whereas resource-poor countries' present activities are depleting global energy stocks via the domestic combustion of imported fossil fuels. Yet, in both cases, resource depletion is a cost of present activities and should be accounted for. However, the inclusion of resource depletion is less evident from a BCE-perspective: what is currently experienced from the ongoing depletion of non-renewable energy (and by extension of arable land, water, etc.)? Will resource depletion not result later on in reduced consumption and lower experiences?
- Deducting *defensive expenditures* classifies them as a cost of present economic activities instead of counting them positively in GDP or NNP. Leipert (1989) explains that defensive expenditures are additional macroeconomic costs and should be registered as such in the GNP. Nonetheless, defensive expenditures "… are certainly not superfluous in the short term. They

are under the given socio-economic and ecological conditions, both necessary and useful" (Leipert, 1986, p. 116). This would imply that defensive expenditures on for instance personal pollution control, air filters, locks could be part of an EWM from a BCE-perspective. Yet, from a BCPA-view, defensive expenditures should be deducted in EWM as they should be regarded as costs of current activities.

Table 3: Welfare items seen from both interpretational perspectives.

Welfare items	*Benefits and costs experienced (BCE)*	*Benefits and costs of present activities (BCPA)*
Net capital growth	Omit	Include
Climate disruption	Damages currently experienced within borders	Damages caused to the future and rest of the world
Resource depletion	What is currently experienced within borders?	Depletion is a cost of present activities and to be accounted for.
Defensive expenditures	Include	Subtract defensive expenditures of present activities, since they are a cost.

3.3 Puzzling time and boundary issues: 'experientisation' or 'Fisherisation' is not the only way forward

The contribution of our paper is to point to the existence of two distinct ways of interpreting EWM: as the benefits and costs experienced or as the benefits and costs of present economic activities. Yet, since EWM were ex post connected to an extended version of Fisherian income by Lawn's (2003, 2008) seminal work, most scholars are trying to make EWM compatible with the ex post theoretical foundation by stressing item's experiential nature or making items more experiential, which aligns with the BCE-perspective. This turn to Fisher's income and capital concepts or 'Fisherisation' (as explained in Section 2.3) is leading to quite some confusion on what EWM are actually measuring and to the use of a wide variety of (sometimes inconsistent) valuation methods in the literature as most scholars are not explicit about the time and boundary perspective they take. In this section, we will critically assess the Fisherisation in the EWM literature by focusing on discussions within the GPI 2.0 process on the following items: *net capital growth, climate disruption and resource depletion* and for the method of subtracting ecosystem costs. Yet, this Fisherisation or 'experientisation' may not be the only way forward. In line with our BCPA-view this is not the only way to deal with these items' time and boundary issues since the BCPA-interpretation deals with them differently as argued in Sections 3.1. and 3.2.

The 'Fisherisation' is probably most clear in Talberth and Weisdorf (2017), who try to frame welfare losses caused by present activities in an experiential perspective. The authors account for the 'benefits and costs *experience*d' including the welfare losses *caused* to the future and the rest of the world (emphasis added). They register the disutilities associated with externalities caused to future generations and the rest of the world since "most people also care about adverse effects local economic activity may have on other communities" and as "people also care about conditions and trends facing their children and future generations" (p. 4).[15] Their focus on experiential costs and benefits indicates they are inspired by Fisher's psychic income. Nevertheless, without denying that present generations care for the future and for the rest of the world, it can be questioned to what extent welfare losses caused to future eras and other regions are "experienced" today? Kapp (1950,

[15] Talberth and Weisdorf's (2017) general mathematical representation clearly visualizes their time and boundary extension: $W_t = \frac{1}{N}\sum_{i=1}^{N}[U_i\,(C_i) + U_i\big(\hat{s}(K)\big) - dU_i((UCT) + (-\triangle W_{ROW}) + (-\phi \triangle W_{t+1}))]$.

1978), for instance, regards externalities as cost-shifting of economic activities, so that one could wonder whether shifting these losses is not simply a way to inflate the own presently enjoyed welfare flow at the expense of others? Passing on costs may increase currently experienced welfare, yet, from a holistic perspective, the costs are not eliminated, nor reduced. These costs will eventually be paid by someone in society or by the ecosystem. That is why, it would be good accounting to not only register future costs, but also the costs caused abroad in the BCPA-view. Furthermore, evidence from the pro-environmental behavior literature indicates that there is a gap between the environmental knowledge, attitudes, values and awareness people have and actually behaving pro-environmentally (see e.g. Vermeir & Verbeke, 2006). To put it differently, people may care for the environment but simultaneously behave or act in environmentally harmful ways. As such, caring for the future generations or the rest of the world is not enough since actual behavior brings inescapable socio-environmental costs. This makes Talberth and Weisdorf's reasoning potentially flawed, especially from a BCPA-view. The rationale for including resource depletion further exemplifies this point. As explained in Section 3.2 resource depletion is a clear cost of present activities that should be included in BCPA-studies, however, including this item is less evident from a BCE-view. Talberth and Weisdorf are aware of this issue and associate the depletion cost with the disutility from passing costs to future generations or from being an undesirable trend or condition. The authors try to relate resource depletion to current experiential welfare by stating some people care for this disutility and have willingness to pay to prevent this loss (e.g. the premium for goods sustainably produced). Nevertheless, these scholars also wonder if the depletion adjustment should still be included in future studies if it is not better linked to a current [experiential] welfare loss. Pushing this argument further, resource depletion will later on result into reduced consumption and thus lower experiential welfare levels in future periods.

Other scholars also have tried to align the items included in welfare studies with Fisher's income-capital distinction. *Net capital growth* and *change in net international position* were gradually removed in more recent studies (e.g. Bleys, 2008; Talberth and Weisdorf, 2017; O'Mahony et al., 2018; Held et al., 2018) to strengthen EWM experiential base as they are inconsistent with Fisher's income-capital distinction (Bleys, 2008). It is interesting to note that Lawn (2013) also abandoned his initial position of including productivity increases and proposes to capture stocks of human-generated capital in satellite accounts. At the same time, other EWM scholars continue to include one or both of these items which is consistent with the BCPA-view.

Calculating the *costs of climate disruption* is to some extent also prone to experientisation. Most authors (e.g. Jackson, Marks, Ralls, & Stymne, 1997; Talberth et al., 2007; Bleys, 2008; Talberth & Weisdorf, 2017; Held et al., 2018; O'Mahony et al., 2018) calculate this item using a marginal social cost of carbon (MSC). This is related to a BCPA-view since the MSC entails future costs (i.e. global future damage costs caused are discounted to the present). The MSC is multiplied by the current or cumulative emissions related to the domestic combustion of fossil fuels. Yet, Bagstad et al. (2014) suggest to replace this valuation method by other items like the costs of natural disasters, water scarcity, extreme weather events, or other region-specific impacts. This replacement is to be seen from a BCE-view since it focuses on items threatening welfare experienced locally and right now, and not climate related costs caused in time or beyond borders. Next, we believe that the climate disruption item could be improved in future BCPA-studies by accounting for the emissions embodied in trade, in a footprint-like manner. The European Union, for instance, has net embodied imports for carbon (Tukker et al., 2016), while two thirds of the carbon footprint of Flemish consumption is located outside Flanders (Vercalsteren et al., 2017).

Most scholars subtract the costs of lost ecosystem services in EWM. The studies in which the flows from the ecosystem are positively counted for – in line with Fisher's view – are rare. Recently, however,

scholars tend to move in the direction of Fisher by experimenting with positively valuing ecosystem services: O'Mahony et al. (2018) value protected Spanish wetlands in a positive manner, Talberth and Weisdorf (2017) value the services offered by natural capital positively by the management cost made to conserve and improve protected terrestrial and aquatic areas, whereas Berik and Gaddis (2011) list the ecosystem services from forests, wetlands, croplands and desert grassland and scrubland in the state of Utah positively.

4. Conclusion

Economic welfare measures (EWM) have been around for over thirty years. Even though voices were raised for a more robust, standardized set of the items included (Lawn, 2003) and for some convention in the valuation of environmental items (Forgie, 2007), EWM's lack of standardization is hindering their policy-making impact (Bleys & Whitby, 2015). We found that this lack of consistency is related to scholar's different understanding and operationalization of what welfare is. Nevertheless, there is consensus among practitioners that EWM provide better welfare information than GDP by distinguishing between the costs and benefits, by extending the analysis beyond market activities and by also looking at the social and ecological spheres in which the economy is embedded. By doing so, proponents argue that EWM are able to debunk (Daly & Cobb, 2007) or dethrone (Stockhammer et al., 1997) GDP as an economic policy indicator. For instance, Ziegler (2007) considers EWM to play a crucial role in undermining the belief large systems of governance have in certain statistics such as GDP that serve as a tool to establish legitimacy and accountability.

In this paper we have revisited EWM's theoretical foundations to foster standardization. The critique that EWM are lacking a solid theoretical foundation is related to the fact that Hicksian income meets Fisher's income concept, which gives EWM a double theoretical foundation. Welfare's experiential nature is derived from Fisher, whereas treating the consumption of community capital as a cost is Hicksian. The novelty of our paper is that we disentangle both income notions and identify two distinct ways to interpret EWM. One interpretation sees welfare as the costs and benefits experienced and does not include capital changes nor future costs, whereas these elements could be registered when EWM are thought of as the benefits and costs of present economic activities. Designing EWM also implies choices on boundary issues, for instance looking within or beyond boundaries regarding the impacts of ecosystem costs. We articulated that a within border view aligns with an experiential welfare standpoint, whereas a beyond boundary perspective matches welfare seen as the costs and benefits of present activities. That is why, our distinction between both interpretations helps to structure the theoretical and conceptual debate and helps to understand the diversity of choices regarding time and boundary issues. Nonetheless, more research is needed to analyze the compatibility between welfare items and each of these welfare interpretations, and to verify which valuation methods need further refinement.

It is ill-acknowledged that EWM have a double theoretical foundation and two different welfare interpretations with distinct time and boundary implications. Most practitioners aim for compatibility with the ex post established Fisherian income theoretical framework and thus with the experiential interpretation (e.g. by omitting capital changes). Yet, following our interpretational understanding, compliance with current experiential welfare is not the only way forward since EWM can also be understood as the costs and benefits of present economic activities. Therefore, it can be seen as artificial when future costs and impacts abroad are explained from an experiential view as in Talberth and Weisdorf (2017). If EWM are a tool for accountability and for disclosing 'invisible' costs caused abroad and in future eras, then there is no logical reason to overlook these costs from a cost-benefit perspective of present activities. Including these costs would be good accounting and would follow Kapp's (1950, 1978) view by framing externalities as cost-shifting.

The diverse welfare interpretations do, however, not have to compete against each other as they can (and should) be regarded as complements, each visualizing alternative economic viewpoints. Depending on the purpose of EWM alternative perspectives can be identified. If the goal is to reveal the welfare level domestic citizens are enjoying today, then current experiential welfare can be estimated without taking into account the costs inflicted upon other communities and future generations. This contemporaneous perspective reduces the 'forward-looking' policy-guiding potential of EWM. However, if the purpose is to account for the benefits and costs of present activities and disclose the costs shifted, then good accounting requires an analysis that does not discriminate against jurisdictional boundaries, nor against the future. Here, the BCPA-perspective could broaden the scope of ex ante policy evaluations.

In theory, it is clear to define these dimensions and interpretations. However, in practice we see that scholars make inconsistent and pragmatic choices depending on the data and estimates available. In order to improve future studies, it is crucial for scholars to properly reflect on the interpretation taken and to clearly mention which perspectives they take on time and boundary dimensions and where deviations occur. Additionally, these statements would (a) make clear which valuation methods should be used, (b) make welfare studies more consistent and comparable, (c) foster the standardization process, (d) legitimize the use and (e) improve the policy-guiding relevance of EWM. Finally, these evolutions could provide economists, media and decision-makers with better welfare information than GDP. As such, standardizing the measurement and reporting of EWM may help to go beyond GDP and promote true economic welfare.

References

Asheim, G. B. (1994). Net National Product as an Indicator of Sustainability. *Scandinavian Journal of Economics, 96*(2), 257-265.

Bagstad, K. J., Berik, G., & Brown Gaddis, E. J. (2014). Methodological developments in US state-level Genuine Progress Indicators: Toward GPI 2.0. *Ecological Indicators, 47*, 474-485.

Berik, G., & Gaddis, E. (2011). *The Utah Genuine Progress Indicator (GPI), 1990-2007: A Report to the People of Utah*. Retrieved from https://utahpopulation.org/our-projects/genuine-progress-indicator/

Bleys, B. (2008). Proposed changes in the Index of Sustainable Economic Welfare: An application to Belgium. *Ecological Economics, 64,* 741-751.

Bleys, B. (2012). Beyond GDP: Classifying Alternative Measures for Progress. *Social Indicators Research, 109*, 355-376.

Bleys, B., & Whitby, A. (2015). Barriers and Opportunities for Alternative Measures of Economic Welfare. *Ecological Economics, 117*, 162-172.

Brennan, A. J. (2008). Theoretical foundations of sustainable economic welfare indicators - ISEW and political economy of the disembedded system. *Ecological Economics, 67*, 1-19.

Brennan, A. J. (2013). A critique of the perceived solid conceptual foundations of ISEW & GPI - Irving Fisher's cognisance of human-health capital in 'net psychic income'. *Ecological Economics, 88*, 159-166.

Clarke, M. (2007). Is the GPI really genuine? Considering Well-being Impacts of Exports and Imports. *International Journal of Environment, Workplace and Employment, 3*(2), 91-102.

Cobb, C., & Cobb, J. B. (1994). *The Green National Product: a Proposed Index of Sustainable Economic Welfare.* Lanham: University Press of America.

Costanza, R., Kubiszewski, I., Giovannini, E., Lovins, H., McGlade, J., Pickett, K., . . . Wilkinson, R. (2014). Time to leave GDP behind. *Nature, 505*, 283-285.

Daly, H. E. (1979). Entropy, growth, and the political economy of scarcity. In V. K. Smith (Ed.), *Scarcity and Growth Reconsidered* (pp. 67-94). Baltimore: John Hopkins University Press.

Daly, H. E. (1988). On Sustainable Development and National Accounts. In D. Colland, D. Pearce & D. Ulph (Eds.), *Economics, Growth, and Sustainable Environments* (pp. 41-55). New York: St. Martin's Press.

Daly, H. E., & Cobb, J. B. (1989). *For the Common Good: Redirecting Economy toward Community, the Environment, and a Sustainable Future*. Boston: Beacon Press.

Daly, H. E., & Cobb, J. B. (1994). *For the Common Good: Redirecting the Economy toward Community, the Environment and a Sustainable Future* (2nd ed.). Boston: Beacon Press.

Daly, H. E., & Cobb Jr, J. B. (2007). ISEW. The 'Debunking' Interpretation and the Person-in-Community Paradox: Comment on Rafael Ziegler. *Environmental Values, 16*(3), 287-288.

Delang, C. O., & Yu, Y. H. (2014). Beyond economic growth: the genuine progress of Hong Kong from 1968 to 2010. *Int. J. Sustainable Development, 17*(4), 387-402.

Fisher, I. (1906). *The Nature of Capital and Income*. New York: Kelley.

Fleurbaey, M. (2009). Beyond GDP: The Quest for a Measure of Social Welfare. *Journal of Economic Literature, 47*(4), 1029-1075.

Forgie, V. (2007). The need for 'convention' in environmental valuation. *Int. J. Environment, Workplace and Employment, 3*(2), 72-90.

Galbraith, J. K. (1958). *The affluent society*. Boston: Houghton Mifflin Company.

Georgescu-Roegen, N. (1971). *The Entropy Lawn and the Economic Process.* Cambridge: Harvard University Press.

Hamilton, K. (1996). Pollution and Pollution Abatement in the National Accounts. *Review of Income and Wealth. 42*(1), 291-304.

Hanley, N., Moffatt, I., Faichney, R., & Wilson, M. (1999). Measuring sustainability: A time series of alternative indicators for Scotland. *Ecological Economics, 28*, 55-73.

Harris, M. (2007). On income, sustainability and the 'microfoundations' of the Genuine Progress Indicator. *Int. J. Environment, Workplace and Employment, 3*(2), 119-139.

Hartwick, J. M. (1994). National Wealth and Net National Product. *Scandinavian Journal of Economics, 96*(2), 253-256.

Held, B., Rodenhäuser, D., Diefenbacher, H., & Zieschank, R. (2018). The National and Regional Welfare Index (NWI/RWI): Redefining progress in Germany. *Ecological Economics, 145*, 391-400.

Hicks, J. (1939). *Value and Capital: An Inquiry into Some Fundamental Principles of Economic Theory*. London: Oxford University Press.

Jackson, T. (2017). *Prosperity without Growth - Foundations for the Economy of Tomorrow* (2nd ed.). London: Routledge.

Jackson, T., Marks, N., Ralls, J., & Stymne, S. (1997). *Sustainable Economic Welfare in the UK, 1950-1996.* London: New Economics Foundation.

Kapp, K. W. (1950). *The Social Costs of Private Enterprise*. New York: Shocken.

Kapp, K. W. (1978). *The Social Costs of Business Enterprise.* Nottingham: Spokesman.

Kenny, D. C., Costanza, R., Dowsley, T., Jackson, N., Josol, J., Kubiszewski, I., Narulla, H., Sese, S., Sutanto, A., & Thompson, J. (2019). Australia's Genuine Progress Indicator Revisited (1962-2013). *Ecological Economics, 158,* 1-10.

Kubiszewski, I., Costanza, R., Franco, C., Lawn, P., Talberth, J., Jackson, T., & Aylmer, C. (2013). Beyond GDP: Measuring and achieving global genuine progress. *Ecological Economics, 93*, 57-68.

Kuznets, S. (1934). National Income, 1929-1932. Report presented to the 73rd U.S. Congress, 2nd Session, Senate Document No. 124, p. 7. Reprinted as National Income, 1929-1932, *NBER Bulletin 49,* 7 June 1934, p. 1.

Lawn, P. (2003). A Theoretical Foundation to Support the Index of Sustainable Economic Welfare (ISEW), Genuine Progress Indicator (GPI), and Other Related Indexes. *Ecological Economics, 88*, 167-177.

Lawn, P. (2005). An assessment of the valulation methods used to calculate the index of sustainable economic welfare (ISEW), genuine progress indicator (GPI), and sustainable net benefit index (SNBI). *Environment, Development and Sustainability, 7*, 185-208.

Lawn, P. (2008). Response to "Income, sustainability and the 'microfoundations' of the GPI". *Int. J. Environment, Workplace and Employment, 4*(1), 59-81.

Lawn, P. (2013). The failure of the ISEW and GPI to fully account for changes in human-health capital - A methodological shortcoming not a theoretical weakness. *Ecological Economics, 88*, 167-177.

Lawn, P., & Clarke, M. (2008). In defence of the Genuine Progress Indicator. In P. Lawn & M. Clarke (Eds.), *Sustainable Welfare in the Asia-Pacific: Studies Using the Genuine Progress Indicator* (pp. 69-88). Cheltenham: Edward Elgar.

Lawn, P., & Sanders, R. (1999). Has Australia Surpassed its Optimal Macro-Economic Scale? Finding Out with the Aid of 'Benefit' and 'Cost' Accounts and a Sustainable Net Benefit Index. *Ecological Economics, 28*(2), 213-229.

Leipert, C., (1986). Social Costs of Economic Growth. *Journal of Economic Issues, 20*(1), 109-131.

Leipert, C., (1989). National Income and Economic Growth: The Conceptual Side of Defensive Expenditures. *Journal of Economic Issues, 23*(3), 843-856.

Long, X., & Ji, X. (2019). Economic Growth Quality, Environmental Sustainability, and Social Welfare in China – Provincial Assessment Based on Genuine Progress Indicator (GPI). *Ecological Economics, 159,* 157-176.

Makino, M. (2008). Genuine progress in Japan and the need for an open economy GPI. In P. Lawn & M. Clarke (Eds.), *Sustainable Welfare in the Asia-Pacific: Studies Using the Genuine Progress Indicator* (pp. 153-190). Cheltenham: Edward Elgar.

Mäler, K.-G. (1991). National Accounts and Environmental Resources. *Environmental and Resource Economics. 1*, 1-15.

Mates, W. J. (2004). Income, investment and sustainability. *Ecological Economics*, *48*, 1-3.

Max-Neef, M. (1995). Economic growth and quality of life: a threshold hypothesis. *Ecological Economics*(15), 115-118.

Meadows, D. H., Meadows, D. L., Randers, J., & Behrens III, W. W. (1972). *The Limits to Growth: A Report for the Club of Rome's Project on the Predicament of Mankind.* New York: Universe Books.

Mishan, E. J. (1967). *The cost of economic growth*. London: Staples Press.

Neumayer, E. (1999). The ISEW - not an Index of Sustainable Economic Welfare. *Social Indicators Research, 48*(1), 77-101.

Nordhaus, W. D. (1995). How Should We Measure Sustainable Income? *Cowles Foundation Discussion Paper N° 1101*. New Haven, CT: Yale University.

Nordhaus, W. D. (2000). New Directions in National Economic Accounting. *American Econmic Review, 90*(2), 259-263.

Nordhaus, W. D., & Tobin, J. (1972). Is Growth Obsolete? In NBER (Ed.), *Economic Growth* (pp. 1-80). New York: Columbia University Press.

O'Mahony, T., Escardó-Serra, P., & Dufour, J. (2018). Revisiting ISEW Valuation Approaches: The Case of Spain Including the Costs of Energy Depletion and of Climate Change. *Ecological Economics, 144*, 292-303.

Posner, S. M., & Costanza, R. (2011). A summary of ISEW and GPI studies at multiple scales and new estimates for Baltimore City, Baltimore County, and the State of Maryland. *Ecological Economics, 70*, 1972-1980.

Steffen, W., Richardson, K., Rockstrom, J., Cornell, S.E., Fetzer, I., Bennett, E.M., … Sörlin, S. (2015). Planetary boundaries: Guiding human development on a changing planet. *Science, 347,* 6223.

Stiglitz, J., Sen, A., & Fitoussi, J.-P. (2009). *Report by the Commission on the Measurement of Economic Performance and Social Progress*. Retrieved from www.stiglitz-sen-fitoussi.fr

Stockhammer, E., Hochreiter, H., Obermayr, B., & Steiner, K. (1997). The index of sustainable economic welfare (ISEW) as an alternative to GDP in measuring economic welfare. The results of the Austrian (revised) ISEW calculation 1955-1992. *Ecological Economics, 21*, 19-34.

Talberth, J., Cobb, C., & Slattery, N. (2007). *The Genuine Progress Indicator 2006: A Tool for Sustainable Development*. Oakland: Redefining Progress.

Talberth, J., & Weisdorf, M. (2017). Genuine Progress Indicator 2.0: Pilot Accounts for the US, Maryland, and City of Baltimore 2012-2014. *Ecological Economics, 142*, 1-11.

Tobin, J. (2005). Fisher's The Nature of Capital and Income. *American Journal of Economics and Sociology, 64*, 207-214.

Tukker, A., Bulavskaya, T., Giljum, S., de Koning, A., Lutter, S., Simas, M., . . . Wood, R. (2016). Environmental and resource footprints in a global context: Europe's structural deficit in resource endowments. *Global Environmental Change, 40*, 171-181.

United Nations. (1993). *Integrated Environmental and Economic Accounting*. New York, NY: UN.

van den Bergh, J. C. J. M. (2009). The GDP paradox. *Journal of Economic Psychology, 30*, 117-135.

Vercalsteren, A., Boonen, K., Christis, M., Dams, Y., Dils, E., Geerken, T., Van der Linden, A. (VITO), & Vander Putten, E. (VMM) (2017). *Koolstofvoetafdruk van de Vlaamse consumptie, studie uitgevoerd in opdracht van de Vlaamse Milieumaatschappij.* MIRA, MIRA/2017/03, VITO, VITO/2017/SMAT/R.

Vermeir, I., & Verbeke, W. (2006). Sustainable Food Consumption: Exploring the Consumer "Attitude – Behavioral Intention" Gap. *Journal of Agricultural and Environmental Ethics, 19,* 169-194.

Wackernagel, M., & Rees, W. (1996). Our Ecological Footprint: Reducing Human Impact on the Earth. Gabriola Island: New Society Publishers.

Ziegler, R. (2007). Political Perception and Ensemble of Macro Objectives and Measures: The Paradox of the Index for Sustainable Economic Welfare. *Environmental Values, 16*(1), 43-60.

Zolotas, X. (1981). *Economic Growth and Declining Social Welfare*. New York: New York University Press.