

Building Indicators for Inclusive Growth and its Sustainability: What Can the National Accounts Offer and How Can They Be Supplemented?

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Abstract – How can the national accounts be linked to the objective of obtaining an inclusive measurement of growth, integrating distributional issues and all determining factors of well-being, in both the short and long term? The accounts offer measurements of real income that have undeniable connections with the quantification of current well-being, but they ignore the non-monetary factors of such well-being and they do not allow for evaluation of its sustainability. We present a way of dealing with the first limitation, the notion of equivalent income. It fits well with the accounts approach, it has relatively strong normative justifications and it lends itself well to the micro-macro bridging exercises needed to evaluate inequalities. Creating overall measurements of sustainability seems much more problematic, as it is impossible to do so without projection models that go far beyond the framework of current statistical output.

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Reminder: The opinions and analyses in this article are those of the author(s) and do not necessarily reflect their institutions or Insee's views.

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The term inclusive growth has gradually spread to refer to growth that is not limited to that of the usual monetary aggregates (OECD, 2014). It covers two ideas, the idea of growth that includes all the determining factors of quality of life for individuals and the idea of growth that benefits everyone without leaving anyone by the wayside. The notion of inclusion can also extend to future generations, since the increase in current well-being should not come at the expense of their future well-being. This brings us closer to another traditional notion, that of sustainable development, as defined in the Brundtland report, with its three economic, social and environmental pillars (World Commission for the Environment, 1987).

Whichever of these concepts is used, they both raise the same issues for the national accounts. There is extensive literature on them, which was used as the basis for the Stiglitz-Sen-Fitoussi report published around ten years ago (Stiglitz *et al.* 2009). Recent reviews of this literature are provided by Coyle (2014), Gadrey & Jany-Catrice (2016) and Laurent & Le Cacheux (2016). GDP is the flagship indicator of the national accounts and does not claim to measure inclusive growth or sustainable development. From their introduction, the national accounts chose to focus on measuring production or activity rather than well-being, restricted to productive activities that result in monetary flows. Since GDP is an aggregated measurement, it also provides no information on the individual distribution of these monetary flows: the institutional sector accounts merely disaggregate those flows between the main stakeholder categories, which are corporations, households and government departments. Finally, GDP is a measurement of current activity, without any information on the sustainability of this level of activity or the well-being derived from it. The recurring issue, therefore, is determining how to supplement it. Can we use other indicators that are already available in the national accounts? Can we proceed by expanding their conceptual framework or should we work completely outside that framework, leaving national accountants to focus on their comparative advantage, i.e. the structured and as exhaustive as possible view of all monetary flows between economic agents?

The aim of this article is not to propose a systematic review of all these tracks and the way in which all or part of them are already implemented. An example of a much more in-depth

survey is provided by Jorgenson (2018). The aim is only to present their analytical background, in as concise and educational a manner as possible, by returning to what we are ultimately attempting to measure, the degree to which the existing indicators do or do not measure it and what methodological problems we face if we want to go beyond their limits.

The paper is organised into four sections. The first section is positioned within the stylised framework of a single-good economy: it will allow several introductory clarifications on the link between measurements of current well-being, of its sustainability and the main concepts of national accounting: gross or net production, consumption, gross savings or savings net of capital depreciation. The difference between well-being, on the one hand, and production or consumption, on the other, will appear here quite easily: the first is not necessarily proportional to the other two, even if it depends positively on them. This is even more the case in respect of sustainable well-being.

This basic framework seems to validate the idea of a simple frontier to be drawn between national accounts centred on the measurement of part of the resources of well-being, and the actual assessment of such well-being. However, taking into account the multiplicity of goods and services blurs this border. Aggregating quantities of heterogeneous goods and services requires the choice of a common metric, and it is difficult to see how this can be done without reference to the relative well-being or utility derived from these goods and services. Aggregation based on prices is admitted only because prices are considered acceptable proxies for these relative utilities and, indeed, much effort is put into making this approximation as relevant as possible: investing in hedonic price calculations or trying to approximate the concept of “constant utility” price indices are well-known examples of this. What maintains the gap with the true notion of current well-being is the fact that these volume-price splits are at best a reference to an ordinal notion of well-being and, above all, the failure to take into account things that have no price as they are too far from the market for a monetary value to be easily imputed.

The rest of the article will be structured around this dual issue of aggregation by prices and determining the value of things that have no price. The two middle sections will focus solely on issues relating to current production, consumption and well-being. The first of

these two sections will examine in what sense volume-price splitting techniques can be said to go towards an assessment of the well-being content of production or consumption. The second one explores a possible avenue for incorporating the non-monetary determining factors of well-being: the pseudo-monetary approach based on the calculation of so-called “equivalent” incomes.

The final section revisits the issue of sustainability, in a more succinct manner, but still with the same problem of aggregation. The problem is to determine how to assess sustainability when it is not reduced to the preservation of a single transferable good but depends on a multitude of assets, whether produced or natural. The obstacles here are far greater than when measuring current well-being. The primary reason for this is the forward-looking nature of the question being asked, which forces us to question the future well-being content of these assets. Finding keys to aggregation requires making long-term projections about a future unknown by nature, which leads far beyond the standard statistics centred on the exploitation of directly observable data.

1. Production, Well-Being and Sustainability in a Stylised Single-Good Economy: Which Indicators Should Be Given Preference?

Let us start with the most rudimentary framework possible, that of an economy based on a general purpose single good, both a consumption good and a production good. This will help to set some base ideas on the link between measurements of production, well-being and sustainability, temporarily leaving aside the issue of the diversity of the goods produced and the existence of non-monetary components of well-being or those that cannot be monetised directly.

Adopting usual notations, K is the physical quantity of capital available on a given date, and L the amount of work provided by the agent(s). Combining them makes it possible to produce a quantity $Y = F(K, L)$ of the single good. Part of this production, C , will be consumed, while the other part will be saved. The savings rate is noted σ . Savings $S = \sigma Y = Y - C$, will first be used to offset capital depreciation δK , and, where sufficient, to increase the stock thereof, by the amount $\sigma Y - \delta K$.

Within such an economy, GDP is a measure of Y but not of current well-being in the cardinal sense of the term. Within this stylised framework, cardinal well-being is generally represented as a function $U(C)$, as the unconsumed part of the production does not generate current well-being. The most that can be done to reconcile the concepts of national accounting and the measurement of well-being is to consider C as one among all the possible parameterisations of this function $U(C)$, compatible with ordinal preferences, but whose limit is to ignore that perceived cardinal utility may not grow linearly with material consumption.

Let us now move onto the measurement of sustainability. As it does not measure well-being, Y measures the sustainability of that well-being even less. Formally, current well-being is said to be sustainable if its level can be reproduced to infinity, i.e. if, from the current state, there is at least one feasible trajectory ensuring, on any given date, a level of well-being that is never lower than that of the current period. Within the very simple economy considered here, there is an obvious criterion of sustainability, which is having a net savings rate above zero. If that is the case, there will be $K(t+1) \geq K(t)$, it will again be possible to consume C while leaving an amount of capital $K(t+2) \geq K(t+1)$ making it possible to do the same on the date $t+2$ and so on. Net savings or the variation in “wealth” K are thus the right concepts to measure the sustainability of this very simple economy.

At the same time, this framework allows us to understand the limitations of another quantity evaluated by national accounts, net production $Y_{net} = Y - \delta K$, which has sometimes been presented as an alternative to GDP as a measure of both well-being and its sustainability (Weitzman, 1976). This net GDP is effectively related to both of these notions. Based on the foregoing, Y_{net} measures the maximum level of sustainable consumption, since consuming a maximum of $Y - \delta K$ makes it possible to generate savings at least equal to δK , which exactly offset the capital depreciation. However, this is where the contribution of net GDP stops. The observation of Y_{net} taken in isolation is not sufficient to say whether we are on a sustainable trajectory or not. What is needed is to know whether actual consumption is higher or lower than this threshold Y_{net} . The correct sustainability indicator is still the net savings rate. It is the net savings rate and not Y_{net} that tells us whether or not there is overconsumption of what is produced as at the current date: this applies to

the usual asset produced and will also apply in our final section to environmental assets. The limitation of the indicator Y_{net} stems from the fact that this measure of current well-being and the measure of sustainability require at least two figures: by claiming to summarise both notions using a single figure, net production can measure neither of them.¹

Now a few words on taking inequalities into account. Although highly simplistic in its description of the world of goods, the analytical framework of this section does not preclude taking into account a form of heterogeneity of individual situations. Indeed, many inequality analyses are implicitly placed within this single-good framework or, more specifically, they accept the homogenisation of the world of goods and services implicit in all monetary statistics (Alvaredo *et al.*, in this issue). Within this framework, for example, it is possible to replace the measurement of average income or average consumption with generalised averages, in the form proposed by Atkinson (1970):

$$W_{1-m} = \left(\frac{1}{n} \sum_{i=1}^n c_i^{1-m} \right)^{1/(1-m)}$$

in which m is the inequality aversion parameter: the scenario $m = 0$ returns the usual average, thus a total absence of taking inequality into account and the focus shifts towards increasingly disadvantaged individuals as the parameter m increases.

The issue of inequality can also play a role in an expanded definition of sustainability. If the collective well-being function involves inequality, the sustainability of collective well-being implies control of inequality dynamics. In this case, the preservation of the stock of capital K is only a necessary condition for sustainability: it must be accompanied by allocation mechanisms making it possible to ensure that the future benefit of this stock of capital is not increasingly appropriated by a part of the population. However, this means that the question of sustainability can no longer be answered by observing the net savings rate alone; it is necessary to add to it modelling of inequality dynamics. This last point gives a first taste of what will be the main message of the final section: except in hyper-simplified scenarios, evaluating sustainability cannot be limited to a simple instant accounting of flows and stocks; it is the full dynamics of the system that must be modelled. National accounts can provide a part of the data needed for this modelling, but

they alone cannot deliver sustainability and non-sustainability messages.

To sum up, within the very basic framework from which we started, there is a range of indicators that fit together or complement each other in a fairly evident way: stock of capital, consumption, and net and gross production and savings, etc. What GDP measures is production Y , which is obviously not sufficient to fully describe the state of the economy. Net GDP provides interesting additional information, assuming a sufficiently precise measurement of the depreciation of capital, which is not an easy task, but that is not sufficient either. The reason is that, attempting to measure both the standard of living and its sustainability, it measures neither; measuring two distinct phenomena requires a pair of indicators. A good option would be the pair that combines current consumption and the net savings rate. It provides the same information as the net GDP/net savings pair, but in a form more directly oriented towards the joint measurement of current well-being and its sustainability. However, this solution remains unsatisfactory because consumption is merely a fairly poor proxy for well-being. This proxy ignores the fact that the relationship between consumption and cardinal well-being is not necessarily linear. All the physical accounting that is proposed here does not therefore answer the question of the utility that is really derived from the different quantities that are measured. This problem of the non-observability of well-being will arise with greater relevance when comparing two economies in which the preferences of agents are not necessarily the same and/or because well-being also depends on factors that are not produced and are therefore not measured by C or Y .

The situation will be even more complex once out of this framework of a single all-purpose good, but with the paradoxical effect of forcing a partial overlap between measures of production and well-being, as both measures face a common problem of the relative valuation of different goods and services. The diversity of goods and services will only add to the complexity of both the measurement of the current situation and that of sustainability. In the following two sections,

1. For the record, this point has been clearly identified and addressed in one of the founding texts of the "beyond GDP" literature, that of Nordhaus & Tobin, who proposed two versions of their "measure of economic well-being", MEW-A ("actual") measuring current well-being, and MEW-S ("sustainable") measuring sustainable well-being. It is from comparing the two that a message on the sustainability of the current living standards could be drawn (Nordhaus & Tobin, 1974).

we will leave aside the prospective question of sustainability and focus on the issues of current production and well-being.

2. Production, Income and Well-Being in the Presence of Multiple Goods: What Do Standard Indicators Say and Do Not Say?

The single good approach is obviously only a heuristic convenience. To what extent does the diversity of goods complicate the reading of the aggregates produced by the accounts? This issue has been debated since the 1940s (Hicks, 1940) and this debate played a major role in the shift away from the objective of measuring well-being²; however, it did not prevent the problem from repeatedly coming back. A new illustration of this is currently provided by the debate on the mismeasurement of growth, i.e. the capacity of GDP to measure the contribution of new forms of innovation made possible, *inter alia*, by the development of the digital economy.³ Participants in this debate generally acknowledge that the purpose of national accounts is not to measure well-being. However, even when focusing on the volume of production, we inevitably end up looking for a common metric that can make it possible to aggregate volumes of production of all goods and services, both old and new, and we do not see what other theoretical metric to refer to than the utility that is derived from each of them. Aiming to disconnect completely the measurement of GDP from any reference to the notion of utility or well-being is a position that appears difficult to maintain. The way economists approach the subject inevitably requires using utility functions and other concepts provided by consumer theory.

To keep this paper as short as possible, we will not go into further detail on the issue of the renewal of goods, which is covered in another contribution to this issue, that of Aeberhardt *et al.* We will restrict ourselves here to the simpler scenario in which the list of goods is fixed, even limiting ourselves to a scenario in which there are only two goods. This section and the next will also ignore the inter-temporal dimension: everything that is produced is immediately consumed, which will allow us to speak indifferently of production, income or consumption, to focus on how these notions both differ from and are connected with that of well-being. This framework will make it possible to show how indicators of volumes and well-being can

diverge even more than in the single-good framework, with a risk of conflicting messages on the direction of developments. However, we will also see how methods aimed at avoiding this risk reintroduce some link between measures of volume and utility, in the ordinal sense of the term.

Thus x_1 and x_2 are the quantities of these two goods produced and consumed and we use x to write the pair $(x_1; x_2)$. It is assumed in this section that these are two market goods. The problem with aggregation is determining how to summarise the change in the quantities of these two produced and consumed goods using a single figure. Let us imagine, for example, a reference basket $x = (1; 1)$ and another economy or the same economy at another time, with the basket $x' = (2; 2)$. In this first example, it is commonplace to claim that both production and consumption are doubled when moving from one situation to the other, though it is not possible to be as certain with regard to well-being. However, what can be said about the magnitude of the increase if production or consumption changes from $x = (1; 1)$ to $x' = (1.5; 2)$, and what can be said about the direction of this development in the ambiguous scenario in which it changes to $x' = (0.5; 2)$?

Faced with this question, the pragmatic response is to rely on the prices observed in the reference situation, i.e. $p = (p_1; p_2)$. Production or consumption x' are said to be higher (or lower) than production x if the aggregate at base prices $px' = p_1x'_1 + p_2x'_2$ is higher (or lower) than the initial aggregate $px = p_1x_1 + p_2x_2$, i.e. if the Laspeyres Index px'/px is higher (or lower) than one.

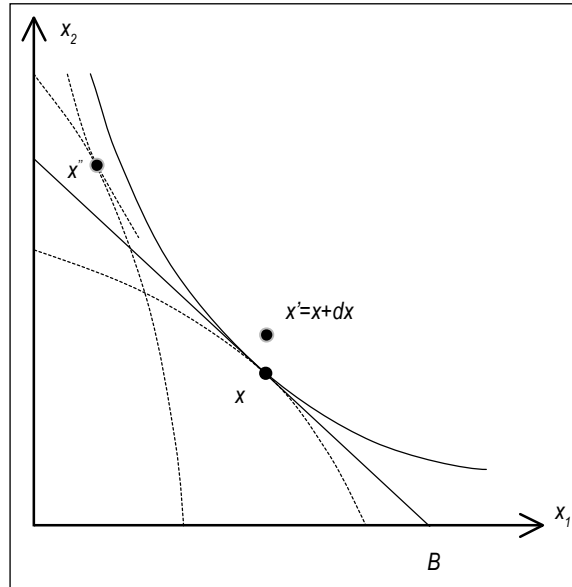
Such a calculation will not solve the issue of measuring cardinal well-being any more than the one-dimensional quantity x of the previous section, but the problem may go even further, as an error risk will also arise concerning the sign of its variation, which is therefore an error concerning the ordinal message.

Figure I sets out the problem assuming that the initial level x corresponds to a market equilibrium that maximises utility $U(x_1; x_2)$ (a concave indifference curve) under the production frontier represented by the convex curve at the bottom. The straight line B describes the

2. See also the survey by Sen (1979) from the late 1970s and Vanoli's (2002) developments on this subject.

3. For an overview of this debate, see Blanchet *et al.* (2018).

Figure I – Well-being and volume indices at constant prices



Reading Note: The production frontiers correspond to the convex curves. The indifference curves are the concave curves. From the initial equilibrium x , point x' corresponds to an improvement both in well-being and of the volume index at initial equilibrium prices, px'/px , as it is above budget constraint B of this initial equilibrium. This is not the case for point x'' , which is positioned between the straight line B and the indifference curve passing through x .

budget constraint under which the maximisation of U is carried out. It is tangential to the two curves with a slope $-p_1/p_2$ corresponding to the equilibrium price system. The movements of x verifying $px'/px > 1$ are the set of movements that pass above the straight line B . As long as these movements are marginal, the tangency to the indifference curve at point x ensures that there will also be an increase in U : this is indeed the case in respect of point x' . In this case, the increase in the Laspeyres Index for production reflects an increase in well-being. Only the quantitative problem of the previous section remains: we know that well-being rises, but we cannot say by how much since we do not know to which quantitative levels of U the indifference curves passing through x and x' correspond.

However, this qualitative message ceases to be correct in the other reference scenario illustrated by point x'' . In this case, the movement is not marginal. This point is always located above the straight line B , therefore giving $px''/px > 1$; however, it is on a lower indifference curve than that of the initial point x . Thus, there is an increase in the aggregate and a decrease in well-being. A Paasche Index based on prices associated with the state x'' would avoid this problem, as we have $p''x'' < p''x$, but this does not help since we do not know *a priori* which index to use when they send contradictory messages. This

property applies to all points positioned between the budget straight line B and the indifference curve passing through x . The scenario involving marginal variations $x + dx$ only made it possible to avoid this problem because of the tangency between B and this indifference curve.

The same problem arises again when measuring production. We could have imagined that sending an incorrect message about well-being does not prevent having a correct message about production. However, this is not the case. Point x'' is indeed positioned above the initial production frontier, which would argue that production has increased. However, if this point also corresponds to a market equilibrium, it must result from a new production frontier of the type shown in the dotted line crossing the first one; therefore, it cannot be said that scenario x'' corresponds to an economy that is more productive than the one with the equilibrium point x . It is even rather tempting to say that this production is lower, since it can only provide a lower level of utility. This example illustrates the false simplicity of the notion of production: in the ambiguous scenario in which production decreases for one good and increases for the other, it is impossible to say whether total production is increasing or decreasing without reference to the way in which the consumer values such productions, therefore to the relative utilities. To ensure it is relevant, the measurement

of production has to rely on a well-being related metric.

Two responses to this problem will in fact go in the direction of a partial reconciliation between the measurement of quantities and the measurement of well-being, confirming the difficulty of completely disconnecting the two notions. The first is the replacement of the calculation using base prices with a calculation of volumes using chained prices from the previous year: the idea of chained prices is to decompose the non-marginal move from one basket to another as to a sequence of small variations of type $(p, x) \rightarrow (p', x')$, for which there is at least the assurance of having good qualitative information on the evolution of the well-being content of what is produced. The other is deflation using constant utility price indices, of which the use of volumes at the previous year's chained prices can be presented as an approximation. A constant utility price index indicates by how much income must change to maintain a reference level of utility in the presence of a price variation: it therefore measures the change in the price to be paid to obtain a given level of utility. Although this is only a theoretical reference that the practical indices can, at best, approximate, it is the most appropriate one for a good conceptualisation of what these price indices seek to measure (Triplett, 2001) and the term constant utility is obviously very illustrative of the link with the well-being approach. This link is also apparent in the use of hedonic price indices, another of the techniques used to improve volume-price splits.

Online Appendix C1⁴ indicates more precisely how chained prices or constant utility price indices tend towards the estimation of a notion that is linked to the notion of consumer well-being or utility, and it also makes the link with the so-called equivalent income approach, which is the one that will be used hereinafter as one of the avenues allowing the non-monetary determining factors of well-being to be taken into account: equivalent income measures the minimum budget required to reach the utility level of the basket of interest under a price system chosen as the reference price system. The three approaches converge towards the same notion of volume or real income when assuming homothetic preferences that can be represented by a function $U(C_1, C_2) = F(G(C_1, C_2))$ with F a monotonic function and G a homogeneous function of degree 1. In this scenario, the volume-price splits make it possible to estimate the function G , in other words, broadly speaking, what C was

for $U(C)$ in the single-good scenario, but incorporating a significant portion of the properties of $U(C_1, C_2)$, those reflecting the relative marginal preferences for different goods. Samuelson & Swamy (1974) speak of a “cardinal indicator of ordinal utility”, a term subsequently used by Sen (1979), while stressing its ambiguities. Such ambiguities can be avoided by reserving the term “well-being” for U and keeping the more traditional terms of “volume of consumption” or “standard of living” for G . Nevertheless, this function G incorporates a significant amount of information on the function U , all that which concerns the extent to which substitution is possible between the goods, and we will see hereinafter that there are ethical arguments for considering that it is on the basis of this concept of standard of living that inter-personal comparison should be made, rather than on the basis of cardinal well-being.

Moreover, the volume-price splits are not the only area in which the national accountants' initial concept of market production is led to incorporate elements borrowed from the question of well-being, even without formally using the equivalent income approach, which we will discuss hereinafter. Having expanded the initial scope of market GDP to include public administration production basically stems from the idea that such production has to be counted as contributing to the well-being of the population: it would be extremely embarrassing to have a GDP that signals that living conditions are worse where a greater number of services are provided collectively and funded through taxation. Another specific form of production considered by the national accounts is that of housing services that homeowners households are deemed to provide to themselves: classifying these services as production is very conventional, the real reason for their inclusion in the accounts being to prevent GDP from showing a lower standard of living, and thus lower well-being, in countries with a higher proportion of homeowners.

The positioning of national accounts on the measurement of well-being is thus less clear-cut than suggested when it is claimed that the objective of GDP is “only” to measure production. The reason is that it is difficult to develop a measure of production without any reference to the well-being content of what is produced. National accountants, even though they defend

4. See the link to the Online appendices at the end of the article.

themselves from doing so, put a lot of effort into avoiding an excessively wide gap between what they measure and a certain notion of well-being.

However, these efforts are only able to achieve half the job. The example of self-produced housing services is one where a monetary equivalent can be easily imputed, based on observation of the rental market. But what is the best way to proceed in the total absence of such references? Should we abandon any idea of monetisation, which takes us in a very different direction from the national accounting approach, or can we resort to indirect monetisation, and with what theoretical or normative justifications?

3. The Non-Monetary Components of Well-Being: How Should They Be Aggregated?

So far, several types of solutions have been adopted or proposed in response to this issue of aggregation of the monetary and non-monetary components of well-being. The first is rather a non-response or, more precisely, it consists in acknowledging the impossibility of a shared response. This is the dashboard approach, which entails multiplying indicators that shed light on the different aspects of well-being. In a sense, these dashboards are unavoidable. At some point, it is necessary to go back to area-by-area investigations, and we will ultimately come to the conclusion that aggregation comes up against insurmountable limitations: it is necessary to learn to give up aggregating what cannot be aggregated. However, the problem with dashboards is their opposite tendency to provide too much information, in a manner that proves difficult to order and summarize, with the emblematic example being the sustainable development indicators adopted by the United Nations to monitor the 17 goals of its 2030 agenda (Cling *et al.*, 2019). Structured summary information is also required.

There are two other ways of obtaining aggregate indicators: first, the calculation of composite indicators such as the Human Development Index (HDI), which uses a statistical rule to aggregate GDP per capita, life expectancy and educational attainment, seen as the three essential components of well-being, and second, the measurement of subjective well-being.

The problem with the composite indicator approach is that it introduces a high degree of arbitrariness in the way it combines its

arguments, and it can prove very problematic. Ravallion (2013), for example, details the implicit trade-offs that the HDI makes between GDP per capita and life expectancy depending on the level of development of the countries, showing how they can be deemed questionable.

The subjective approach has the advantage of bringing us closer to the notion of cardinal well-being, but at the risk of many of the biases (see Accardo, in this issue). In brief, its advantage is the fact that it is based on individual quantitative information that is fairly easy to collect and can be directly manipulated to produce aggregate indices. This information is deemed to respect the individual preferences of respondents, rather than the arbitrary weights used in composite indices and, in principle, it is these respondents who are best placed to know what is important to them. However, the problem is the lack of visibility regarding how individuals express their satisfaction in the scoring grid proposed to them by the interviewer: two individuals with similar living conditions may score their living conditions very differently. It can be said that the subjective nature of the measurement is both its advantage and its limitation: it is interesting to know how people evaluate their lives, but this does not necessarily provide a valid benchmark for interpersonal comparisons or, to a greater extent, for comparisons of living standards between countries and over time.

Therefore, we will focus here on a third approach, the pseudo-monetary approach based on the calculation of so-called “equivalent” incomes. It uses the ordinal representation of well-being, with good normative justifications, and it is the one that best fits with the national accounts’ general framework. These properties do not necessarily justify giving this approach exclusive preference, but they nevertheless invite further exploration.

This notion of equivalent income, like the subjective approach, respects individual preferences, using weights for the determining factors of well-being that are consistent with these preferences. What this approach will have in common with the national accounts is that it expresses results in monetary units. Of course, there should be no misunderstanding about the meaning of this choice of unit: it is only a measurement benchmark, which does not mean that all the items considered can and must be produced and exchanged on the market. The approach includes both the case of market

goods and non-market goods that are to remain as such.

In the first case, in which there are only market goods, the equivalent income method consists in establishing a reference price system p° and valuing the pairs (p, x) located on the different indifference curves by the amount $R_{eq}(p, x) = \min(p^\circ y; U(y) \geq U(x))$, which gives the minimum level of income required, under the reference price system p° , to achieve a level of utility at least equal to that obtained by the basket x under the price system p , taking into account the possibilities of substitution between goods along the indifference curve passing through x .

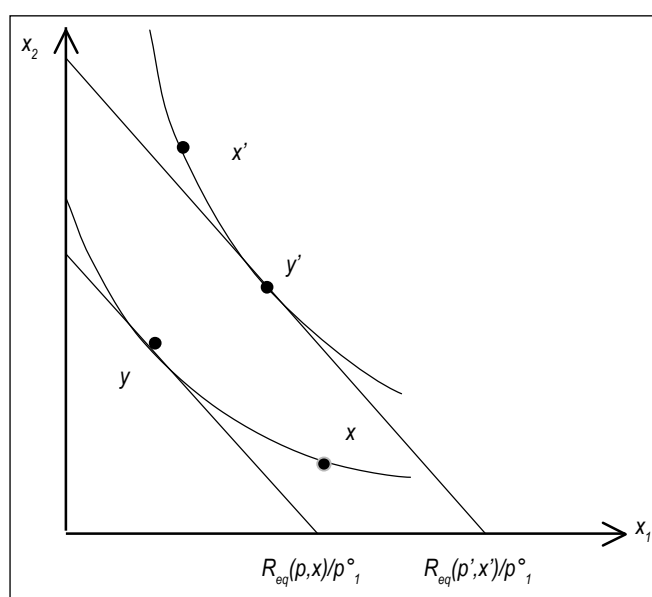
Figure II shows how this method allows a unique scalar to be associated with each indifference curve, with equivalent incomes normalised by using good 1 as the numeraire. In this example, the same levels of “utility” are associated respectively with the pairs (x, y) and (x', y') and these quantities make it possible to create a hierarchy for the two baskets x and x' for which a classification based on quantities alone would have been impossible since we have $x_1 > x'_1$ and $x_2 < x'_2$.

From there, it is easy to extend the same idea in case the two states to be compared differ not only in the price system and the resulting

consumption of market goods, but also in the levels of a certain number of non-monetary factors of well-being. We will use $l = (x, e)$ to denote the extended consumption or production basket merging the goods x with a market price p and the vector e of the non-monetary determining factors of well-being, and we adopt the reference values (p°, e°) for both p and e . R remains the monetary income px in the observed state (p, e) . We term equivalent income equivalent the monetary income $R_{eq}(x, p, e, p^\circ, e^\circ)$ necessary to achieve the same level of utility under the reference conditions (p°, e°) as under the observed configuration (x, p, e) . The adoption of a unique reference vector (p°, e°) makes it possible to compare the levels of well-being of any individuals whose situations differ in terms of consumption x and the levels of non-monetary factors, and who are not necessarily exposed to the same price system.

This method is already implemented in at least one relatively common production of public statistical systems, the computation of equivalence scales allowing the comparison of living standards across households of different compositions: the household structure is indeed a non-monetary parameter of the standard of living, for which a monetary equivalent is proposed by evaluating how much the monetary income of the household must be increased in order to preserve the levels of utility or well-being of its

Figure II – Equivalent income with two market goods



Reading Note: We want to compare the two baskets x and x' observed under the price systems p and p' . This is done by evaluating the two baskets y and y' providing the same levels of utility under a common reference price system p° . The equivalent incomes are the associated monetary incomes. Their levels can be read on the horizontal axis, after division by the price p_1° .

members when its size increases. The general principle is shown by Figure III in the scenario in which both x and e are one-dimensional, with the good x used as the numeraire, which makes it possible to equalize x and R . To make the link with the HDI, let us assume that e is the health status rather than household size and that the reference state used is good health. In other words, we will try to calculate the loss of income that, for an individual in good health, leads to the same drop in well-being as being in poor rather than good health. The equivalent incomes of two individuals in the situations $I = (x, e)$ and $I' = (x', e')$ can be read directly as the abscissa of the intersection points between their indifference curves and the horizontal line of level e° . In the example shown in the graph, the individual I' combines better health and higher income. Her equivalent income takes both of these factors into account.

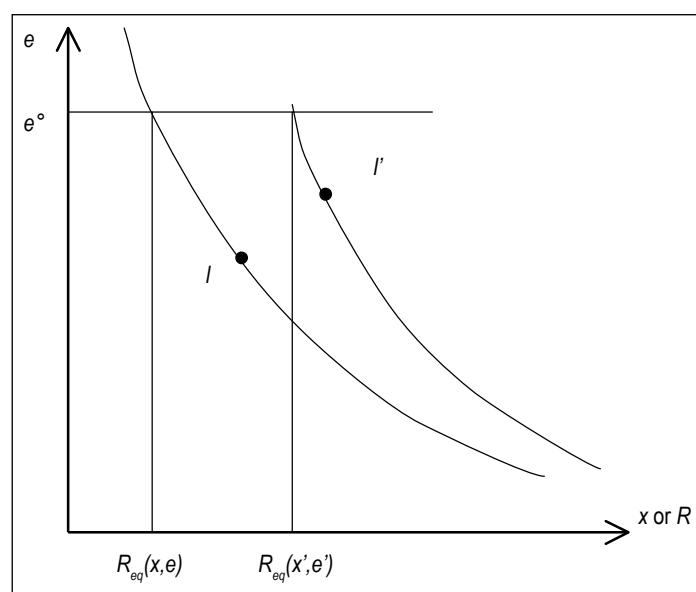
We can see how this approach differs from both the subjective approach and the composite indicator approach. An indicator of subjective well-being will eventually reveal that the individual I is happier than the first one, if she is naturally undemanding and/or used to her lot in life. The equivalent income approach chooses to ignore this issue of character. But it takes into account the way in which this second individual weights material goods and health in the evaluation of her well-being, as opposed

to the a priori weighting that would be assigned to them by a composite index, and it takes into account the way in which the individual's preferences would cause them to modify their basket of goods in response to a change in the price system with which they are confronted, if x is multidimensional.

We are thus on the middle path between the ignorance of individual preferences, which characterises composite indicators, and the complete taking into account of the satisfaction reported in the subjective approach. What the approach does take into account is a sub-set of the utility function's characteristics, those determined by ordinal preferences. In contrast, it neutralises everything that shifts the focus from ordinal preferences to cardinal well-being, including the fact that a basket of goods that is double the amount of another does not necessarily provide twice as much utility. We again find the distinction presented above between the notion of standard of living and its translation into perceived cardinal well-being.

Working on preferences corrected like this can be ethically defensible. The assessment of resource allocation needs not take into account the fact that individuals may have more or less demanding natures, except to recognise that policies should seek to systematically compensate individuals who are more dissatisfied than others

Figure III – Equivalent income when well-being depends on a market good and a non-market factor



Reading Note: Well-being depends on a market good x that is used as the numeraire (hence the integration of x and monetary income R) and on a non-market factor e . We want to compare the combinations $I=(x, e)$ and $I'=(x', e')$. We use a reference level e° for e . The equivalent incomes $R_{eq}(x, e)$ and $R_{eq}(x', e')$ are those providing the same utility levels as I and I' for e and e' reduced to the common value e° .

by disposition. As regards the phenomenon of globally decreasing marginal utility, the idea is not to ignore it completely but rather to reintroduce it in a second step, when moving to social utility functions of the generalised average type in which this decreasing marginal utility allows us to account for the phenomenon of aversion to inequality. In addition, the way in which inequality is taken into account is preferable to approaches that would measure inequality on the monetary and the various non-monetary axes separately and would aggregate the various inequality indices thus obtained. When there are individual accumulations of handicaps on these various axes, the correct approach is to first assess the impact of these accumulations at the individual level, otherwise the overall impact of these different dimensions of inequality is minimised.

Of course, this approach itself raises certain questions, first of which is that of its implementation. Several pieces of work have attempted to apply it to a more or less wide range of non-monetary dimensions of well-being, including work by Fleurbaey & Gaulier, (2009), Murin *et al.* (2015), Boarini *et al.* (2015, 2016), Decancq *et al.* (2015), Decancq & Schokkaert (2016) and Jones & Klenow (2016). Three types of techniques are possible in principle: (a) relying on calibrations of preferences, as revealed by behaviours, (b) the use of contingent evaluation techniques, i.e. direct questioning of individuals' willingness to pay for or receive given changes in their situations or environment, and lastly, (c) relying on subjective satisfaction data. We will focus on the latter in particular, because of its link to what was presented earlier. The idea is to obtain estimates of the degree to which individuals are willing to make trade-offs between material factors and other aspects of living conditions, by empirically analysing how they each affect subjective well-being, which is possible with surveys that combine a direct measurement of perceived well-being and objective components. Typically, if we have a measurement S of perceived well-being, regressing S on quantities x and y will provide coefficients the ratio of which can be interpreted as a measurement of substitutability between x and y . This is, of course, assuming that the various factors that bias the measurement of S do not hinder the estimation of these different coefficients: this will be the case if it is assumed that the noise that affects the measurement of S correlates neither with x nor y .

The other main question is that of the link between the practical and the ethical. The fact that the method requires the selection of reference values (p°, y°) means that it is necessary to establish principles on which to base that selection. These principles are fairly easy to establish when the non-monetary factor to be taken into account has unambiguous monotonic effects on well-being: either the highest or the lowest value of this factor is used, for example, the state of good health, which amounts to giving a monetary equivalent for the "disutility" associated with different levels of poor health. The choice is more complicated for a variable combining utility and disutility, such as working time. Here, the problem is determining the degree to which the individual would accept a decrease in their income decrease (resp. would like it to increase) to move from their actual working time d to a reference working time d° . However, total idleness $d^\circ = 0$ is not a more attractive reference than the maximum possible working time, as having productive work is also a factor of well-being. The result of the calculation may be sensitive to the selection of this reference working time and there is not always an obvious standard for setting it.⁵

4. Measuring Sustainability

The problems of measuring current well-being having been clarified, if not fully resolved, let us briefly revisit the question of its sustainability, outlined in the first section. How would it look if we were able to move towards a shared measurement of this current well-being? The first section gave the answer within the basic framework of a single-good economy. Assessing the sustainability of consumption and thus of current well-being was reduced to the calculation of a net savings rate, with the sole difficulty of knowing the rate of capital depreciation.

The important element of this first result, which may seem obvious but has not always been so in the search for indicators of sustainable growth, is re-emphasised here: the clear separation that is thus made between the measurement of sustainability and of current well-being. It is opposed to the idea that the measurement of sustainability could be reduced to calculations of green GDP and also to some attempts to calculate composite indices of sustainable development that mix the measurement of current progress and of its sustainability. It is fairly easy to understand that

5. On this issue, see Appendix 1 in Fleurbaey & Blanchet (2013).

by attempting to measure two different things using a single figure, neither of those things is measured. As its name suggests, current well-being is relating to the current situation. Sustainability is an issue relating to the possible prospects of the evolution of this well-being. Attempts to combine the two pieces of information in a single figure can only be explained by the obsession with establishing an international ranking of good or bad sustainable development practices, but it is clearly inappropriate. The one-dimensional approach inevitably leads to the risk of classifying countries with a high level of well-being but little concern for their future or that of the planet as a whole in the same manner as more sober countries that are more capable of sustaining their current way of life.

Presented in this manner, the problem of measuring sustainability thus consists of calculating one or more indicators that can alternatively be presented as indicators of net savings, net investment, over-consumption/over-exploitation of resources, or even as a variation of an expanded notion of capital. This approach was initiated at the World Bank (Hamilton & Clemens, 1999; Lange *et al.* 2018), illustrated by Arrow *et al.* (2004), then taken up and expanded upon since 2012 under the name “inclusive wealth” as part of the United Nations Environment Program (2018).

All these terms do not necessarily have the same connotation: the term net investment is more reminiscent of the idea of renewing productive capital in the traditional meaning of national accounts, the terms over-consumption or over-exploitation are more reminiscent of the idea of the over-use of natural capital, which more clearly brings out the relationship with the notion of ecological footprint or its particular variations, such as the carbon footprint. Formally, all these terms refer to a common problem that is an extension of that in the first section: the fact that, in practice, sustainability does not boil down to the preservation of a unique productive resource, measured by K , it will depend on the evolution of a very wide range of assets K_i . It will simultaneously include the various components of natural capital, human capital, physical productive capital, financial capital and various forms of intangible capital, the list of which can be very wide ranging: one spontaneously has in mind the stock of knowledge and expertise, but the sustainability of our way of life also depends on the durability of several other intangible

elements, such as the quality of institutions or social relationships.

What we are facing is therefore the same type of problem as that faced in the two previous sections, that of the heterogeneity of the “goods” or, more generally, of the items to be taken into account in the assessment. How can we hope to reduce a multiplicity of factors to a single figure for sustainability? There is little doubt that the problem will be at least as difficult as in the case of measuring current well-being. It is in fact much more difficult, as illustrated by the recurrent debate between “weak” and “strong” visions of sustainability, with the former interested in the expanded version of the list of K_i and considering that an increase in some of them can perfectly well compensate for the disappearance of others, while the latter focused instead on a subset of environmental assets deemed critical, refusing to consider the possibility of substituting them for non-environmental assets, with therefore very different sets of explicit or implicit weightings for each of these two approaches.

What should be done in this context? Market prices cannot be used as references. They can be accepted as proxies for the relative values to be assigned to different goods and services, when the issue is only that of measuring current well-being. Clearly, they can no longer fulfil this role in assessing sustainability, if only because some of the assets of interest cannot be assigned a market value. This leads back to an imputation problem, though one much more complex than imputing monetary equivalents to the non-monetary components of current well-being.

The theoretical answer to this question is detailed in Online Appendix C2. First, it involves monitoring “physical” measures of the various sub-components K_i of the “expanded” capital, as at date t , each of these items shows a net variation dK_i . In the case of exhaustible natural resources, this net variation will automatically be negative. In the case of renewable natural resources, this change will compare the drain on these resources and their regeneration, whether spontaneous or amplified by voluntary environmental restoration policies. In the case of productive physical capital, accurate measures of its volume and depreciation are needed. Concerning other categories of assets, it is for human capital that the exercise seems the least inaccessible, with the possibility of valuing human capital by the future income flows it is

likely to generate (on this point, see Canry in this issue). In contrast, huge difficulties can be foreseen in the case of intangible capital.

However, let us assume that this first step of calculating the dK_i is dealt with. In order to weight them, the contributions of each of them to the flow of future well-being must then be evaluated. The marginal value of an asset should be assessed by quantifying what its variations add or take away from the future flow of well-being. This can only be done by modelling these trajectories of well-being and the way in which they would be affected by more or less consumption of the asset under consideration at the current date, based on a comprehensive and integrated simulation of the economic, social and environmental dynamics, starting from specified initial conditions. This therefore requires much more than a set of separate evaluations of different assets. What we need to know is how the variation of one affects the dynamics of all the others. For example, in the case of climatic “capital”, what is theoretically needed is a comprehensive cost-benefit evaluation of the long-term effects of current greenhouse gas emissions (on this point, see Germain & Lellouch in this issue). If this is achieved, it can become possible to overcome the conflict between the notions of strong and weak sustainability. An indicator that is considered “weak” and aggregates the variations of the different assets on a linear basis remains quite capable of addressing the issue of strong sustainability if the reaching of critical thresholds is reflected in the form of very high values imputed for the most affected natural assets, making any compensation by the accumulation of non-natural assets impossible (Fleurbaey & Blanchet, 2013).

The work conducted in this area is increasingly pointing towards the finding of a lack of sustainability for a significant number of countries. For example, the 2018 edition of the Inclusive Wealth Report covers 140 countries monitored since 1992 and shows a decline in natural capital in 127 of them, with a decline in overall inclusive wealth in 44 of them (United Nations, 2018). However, in spite of the efforts that have been developed, this approach continues to expose itself to criticism of insufficiently taking into account the environmental constraints (Roman & Thiry, 2016).

In addition, though presented as logical extensions of the standard national accounts analytical framework, such “expanded” accounting

approaches are clearly outside the scope of normal statistical output. They cannot be based solely on the observation of current data, they force the confrontation of assumptions about what these dynamics are thought to be, leading at best to evaluation brackets. What the statistical system in general, and the national accounts in particular, can do is to feed base data into these exercises, i.e. evaluations of some of the K_i and of their variations, partially aggregated where possible, but without being able to pretend to step out of this role of supplier of base data.

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Let us recap the main lessons to be taken from this article. Much emphasis has been placed on what differentiates GDP and other national accounts indicators from the measurement of well-being, but also on what makes them related. The aim of measuring well-being was quickly abandoned when the tools of national accounting were introduced, with the kind of argument discussed in the second section: even when all goods have correctly measured prices, a volume index evaluated at constant prices provides, at best, an information on the direction in which well-being is changing, not on the intensity of its change, and good information on the direction of its changes is only guaranteed for marginal changes in quantities. It is this finding that has led national accountants to put forward a more modest and pragmatic conception of their tool: national accounts as an overall picture of the monetary and physical flows between economic agents, and GDP as the main summary of this overall picture, representative of the economic activity and overall income, particularly for the requirements of cyclical macroeconomic regulation and the steering of public finances.

There are reasons for this position, but it is also ambiguous, as the objective of measuring well-being remains indirectly present in many of the choices that have been made as the conceptual framework of the accounts has been enriched: attempting to quantify public sector production as well as possible, integrating into GDP a formal production of housing services that homeowners provide to themselves and improving the volume-price splits using hedonic pricing methods or by trying to get as close as possible to the notion of constant utility price indices are all ways of preventing GDP from deviating too far from what can be spontaneously expected from a well-being index. We

do not want GDP to show as less well-off the inhabitants of countries where a large number of services are provided outside the market, or countries where the vast majority of the inhabitants are homeowners. Furthermore, we do want GDP, through its deflator, to give the best possible account of the contribution to well-being of the decreasing costs of many products, or of the replacement of existing products by cheaper and/or higher performing ones. It is difficult to sustain such efforts while simultaneously claiming to be free from any concern for measuring well-being. GDP is not well-being, but it cannot be conceptualized independently from it (Schreyer, 2016); it would be counterproductive to ignore or downplay this link, both for users of the accounts and for national accountants themselves.

Nevertheless, this link well-being remains only very partial and the central framework of the accounts is not the right place for going beyond this partial character. There would undoubtedly be more to lose than to gain because, by aiming to take on too much, the main contribution of this central framework would be lost: its function as an information system on all current monetary flows between agents and on the monetary value of the assets they hold.

These shortcomings of the national accounts should rather be addressed outside their central framework. The composite indicator approach and the subjective approach have been mentioned without being expanded on in this article. They lack a normative basis and can pose significant problems for interpretation. In contrast, the equivalent income approach is positioned as a direct extension of the central accounts framework. It is in line with national accounts as far as market contributions to well-being are concerned, proposing a measure of the standard of living that takes into account what is known about the ordinal preferences of economic agents, revealed by their behaviour, that can be extended to the other components of this well-being. By also being applicable at the individual level, it equally allows a systematic approach to the issue of inequalities, more adequate than the composite index approach – which works directly on aggregate indicators – and more adequate than the subjective approach – which risks providing a very reduced view of real inequalities, due to the ability of individuals to adapt to their living conditions. All of these characteristics make it an avenue to consider in order to make the measurement of growth more “inclusive” in nature.

Saying this does not mean that we ignore the limitations of this approach. We have mentioned its dependence on the selection of reference standards, for both the prices and the non-monetary characteristics of individuals, as well as the implementation difficulty – the need to indirectly reconstruct monetary valuations. It also seems difficult to apply it to more than a small number of non-monetary components of well-being. Therefore, we still remain far from the level of granularity of the work carried out to construct the central framework of national accounts. Finally, we should also mention an obstacle that may be a major hindrance to communication, the difficulty of getting the public to accept the neutrality of the monetary metric, as the trend of resistance to GDP is also fuelled a great deal by a rejection of this metric, associated with the idea of generalised commodification of all aspects of existence. There is certainly a strong argument against this rejection, which is that implicit forms of monetary valuation are actually implemented in any approach to constructing an aggregate index. Aggregating automatically means assigning relative values to the things being aggregated, doing so using a monetary account unit is just one choice of account unit among others, but this argument is not necessarily easy to get across.

What all this could argue for is therefore a rather eclectic and tailor-made approach. The conclusions of the Stiglitz Report in 2009 were already pointing towards eclecticism and it is also a characteristic of the recent follow-up to that report under the aegis of the OECD (Stiglitz *et al.*, 2018). However, eclecticism does not exclude a certain form of structure. The plan could be to have (a) a main core of accounts focused on their core business, while at the same time ensuring that they provide the most ready-to-use components for measuring well-being, notably through the refinement of volume-price splits, and (b) a satellite account focused on the measurement of household well-being, with an important place being naturally reserved for the approach that is most in line with the core accounts methods, and which shares its monetary metric, though without at all excluding the alternative approach of the subjective measurement of well-being, a bit like weather reports that combine objective temperature measurements and how it is felt.

The same sort of approach should guide the measurement of sustainability. In this case, the construction of a summary sustainability

index appears to be much less feasible than for measuring current well-being. However, a mini sustainability dashboard could be useful for coherently bringing together the main components of this sustainability: net savings or investment in the meaning of national accounts are part of it, together with indicators of financial sustainability such as the debt levels of different categories of economic agents, and physical indicators of environmental pressure and other indicators to be

defined for quantifying the social component of sustainability.

All this may seem to lead to nothing more than the fourth and final way of going beyond GDP that we have merely mentioned in passing, the dashboard approach, but with the important nuance of introducing into it a dual concern for parsimony and conceptual integration, which are often not really present in the existing dashboards or those in development. □

Link to the Online Appendices: https://www.insee.fr/en/statistiques/fichier/4770146/ES-517-518-519_Blanchet-Fleurbaey_Online_Appendices.pdf

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