SUSTAINABILITY AND NATIONAL ACCOUNTING

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Keywords: Sustainable Development, Natural Resource Accounting, System of National Accounts, System of Integrated Environmental and Economic Accounts,

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Summary

The sustainable development of national economies has been a matter of increasing prominence in national and international policy discussions and formulation. Yet to formally examine sustainable development as a policy goal requires us to have two things: first, a meaningful concept or definition of sustainability, and second, a way to measure this concept so as to be able to assess whether development is being achieved in sustainable fashion. While sustainable development has attracted much attention, and many definitions and measurement schemes have been proposed, analysis of sustainable development at the national scale usually proceeds in terms of suggested adjustments to national accounting aggregates.

The national accounts are designed to track economic performance in the short term, based on productive capacity; sustainable development advocates propose producing modified versions of such accounting aggregates to give a better indication of long term performance and prospects. An extensive literature has developed on the theory and application of adjusted national accounting aggregates, and it is the purpose of the contributions to this topic to review and critique this work on revising and re-measuring economic growth and sustainability. The motivations of advocates of such adjustments typically include (i) to generate a meaningful measure of "sustainability" or "sustainable development", (ii) to generate a measure (or measures) that tracks overall social well-being in a way superior to current economic aggregates, and (iii) to provide information on particular resource use and management issues that allows specific policy improvements to be made. These three broad goals are not the same, and a new measure (or new accounting system) designed to achieve one goal may well not achieve the other goals. Furthermore, the innovations and modifications proposed by economists will often differ quite distinctly to those put forward by national accountants, as national accountants are (with some justification) reluctant to pull apart too radically a framework whose core functions and structure are well established and already serve a key short-run purpose.

In the first section of this overview, the concept of sustainability is presented and discussed, and its relationship to well-being or welfare analyzed. This is followed by a discussion of the history of national accounting, to highlight the motivation for and process of building the accounts in order to measure output and aid in management of economic fluctuations, and to then present the resulting deficiencies of conventional aggregates such as gross domestic product (GDP) when trying to apply broader interpretations. This historical discussion takes us into an examination of conceptual issues surrounding the idea of "income", and differences in how economists conceptualize it compared to national accountants. Key theoretical underpinnings are provided and discussed in terms of their ability to generate and support "green accounting" adjustments to GDP.

The next section moves to a discussion of official revisions to national accounting systems as done through the System of Integrated Environmental and Economic Accounts (SEEA). In practical terms, this has emphasized satellite resource accounts, rather than fundamental changes to core aggregates, and some reasons for and implications of this emphasis are presented.

1. Introduction

1.1 Sustainable Development and Economic Welfare

Concern with resource depletion and environmental degradation has been an aspect of policy discussion for years, reaching international prominence with the publication in 1987 of *Our Common Future* a.k.a. the Brundtland report, which brought the terminology of "sustainable development" into popular currency. (The prior key work presenting a view challenging the possibility of sustainability in modern industrial economies was the controversial "Club of Rome" study, *The Limits To Growth*.) The famous statement from that report, that we should seek to meet the needs of the present generation without in doing so compromising the ability of future generations to meet their own needs, encapsulates nicely a principle of sustainable development. Sustainable development is described there as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs".

However, defining sustainability more precisely, in order to make sustainable development *operational*, is another matter. Moreover, making sustainable development operational requires a definition in theory that itself provides a basis for *measurement*. A precise definition of sustainability is of no practical policy use if we cannot successfully apply it to assess whether sustainable development is being achieved.

In other words, there is a need first for a theoretical definition to analyze sustainability; and second, that theoretical definition must provide the possibility of an empirical framework. Sustainability must be defined if it is to be measured; and then it must be practically measurable so that efforts to undertake such measurement are able to yield useful guides to performance relative to sustainability benchmarks.

Defining sustainability to make it operational in practice is difficult and contentious terrain. Particularly, sustaining *what*, and sustaining it *how*? In the most general, Brundtland sense, we talk of maintaining living standards. So what is the relationship between ideas of sustainability, and ideas of well-being?

1.2. The Semantics of Sustainability

A brief digression before we progress to such a discussion. "Sustainability" and "sustainable development" are terms that are capable of many definitions and for which a number of conceptual frameworks can be constructed. In fact, semantic issues arise as to the choice of whether to talk about "sustainability" or "sustainable development". We confess to being deliberately and tactically vague in our choice of moving between the two labels, treating them as effectively synonymous. For many writers and analysts, the choice of terminology is not neutral. In particular, sustainable development is taken to

be a more general and looser label than "sustainability", with the latter suggesting strict long-run maintenance of some aspect of an economy, a sector, an industry, or some component of the environment and/or its functioning.

Our focus here is largely on the more general issue of "sustainable development": paths that an economy might follow that satisfy some rule or injunction by which current performance or standards of living can be expected to be maintained into a long run future. Much of the sustainable development work in the national accounting area is highly aggregated and "top down", looking at overall standards of living in preference to a disaggregated approach—we will see below that it invokes what is called "weak sustainability", in the sense it imposes fewer restrictions on possible development paths.

1.3. The Connection between Welfare (Standards of Living) and Sustainability

The famous Brundtland quote talks of "meeting the needs" of various generations. Of course, what any generation "needs" is open to serious questioning. Much of the formal discussion in this area has moved towards discussing standards of living, which are in principle measurable in a way that "needs" are not: in particular work in this area has focused on how we first define standards of living, and then how we might achieve the maintenance of these living standards.

Defining "standards of living" for the citizens of a nation is not a straightforward exercise. Many discussions of sustainable development regard average current incomes (typically, some measure of national income per capita) as an unsatisfactory proxy, and wish to take distribution of income into account. Here we will not focus on distributional issues but rather on the possibility for the economy to continue to generate the aggregate standard of living for the entire economy. The issues of the distribution of the total national output can be (as a first approximation) be treated as a policy issue that can be handled "after" the output has been produced. While this is not a satisfactory resolution of distributional questions, it provides a reasonable justification for us to focus on the ability to generate an overall standard of living without also having to deal in detail with the issue of which individuals actually get to benefit from that standard of living.

More importantly from our point of view is the *composition* of output in terms of its implications over time. This in fact is one of the key issues in defining and operationalizing sustainability. To see this, consider we are looking at maintaining the standard of living of one single individual, and assume we impose a restriction that requires that individual's standard of living to not fall, in order for sustainability to be met. If we observed that this individual consumed a constant or increasing amount over a number of years, we might assume that in fact the sustainability requirement was being met. Alternatively, we might observe that the individual's consumption is declining slightly over a period of time, suggesting a violation of the sustainability rule, but on further examination we may also observe that the individual is setting aside some of their income into a fund, allowing for higher consumption later. This might suggest to us that the individual is *choosing* to sacrifice small amounts of current consumption now in order to maintain or increase consumption prospects in the future. If, in the case where the individual's consumption was being maintained during our observation

period, we observed that funds available for future consumption were being depleted, we might think again about concluding that the individual was consuming sustainably.

At the national scale, similar considerations apply. As we shall see, the amount a country *saves* over time—put another way, the amount of capital assets it creates, whether tangible or intangible—is an important criterion in the evaluation of national sustainability. Properly measuring current national consumption, accumulation of capital assets, and *depreciation* of those capital assets will be argued to be important considerations in improving the measurement of sustainability.

We have not here focused on some less tangible aspects of well being that result from personal contentment, relative social status and social tranquility. Some analysts might stress that measuring "consumption" is only meaningful if the measure used is broad enough to encapsulate these various elements. Suffice to say here that "well being" or living standards are in fact complex constructs, and our measurement of their performance over time will be contingent upon the definition(s) we choose.

Having discussed well-being, we can link it to the idea of sustainability as we have done above—sustainability can potentially be defined in terms of what's happening to well-being. Well-being can be defined in various ways, with various arguments being admissible regarding what contributes to well-being. Key determinants of well-being of interest here include current consumption, or some measure of potential consumption. Sustainability can then be defined in terms of paths of current consumption (e.g. that current consumption not decline) or in terms of some expectation of potential future consumption (such as that the present value of future consumption is non-declining, or that the aggregate value capital stocks do not decline).

The conceptualizations of sustainability described above are *ends-based* (sustaining levels of consumption or utility); alternatively we might regard sustainability in a *means-based* fashion (sustaining or maintaining particular "things about the world" such as a pre-defined natural capital stock, or features such as ecosystem resilience). We may adopt a highly aggregated approach (e.g. global scale) or a more disaggregated one (e.g. ecosystem or region). Thus, we again face difficult definitional tasks in order to make any conceptual ground. As mentioned previously, our emphasis will be on the top-down aggregate (ends-based) sustainability criteria.

It is common practice in the literature of analytical economics to construct hypothetical "what if" models that are used as tools to analyze particular questions. In the aggregate growth models used to conduct the analysis (such as those discussed in *On "Green National Product": Theories and a Comparison Among Different Approaches* and *Progress in the Measurement of Sustainable Development*), definitions of welfare and sustainability are clearly defined for specific contexts. Typically, economic analysts conceptualizing these issues tend to start by defining an objective function defined in terms of welfare/well-being over time, and then they impose some restriction on that measure over time, as a sustainability constraint. One approach is to define a sustainable path as one over which current social welfare (technically, instantaneous utility) is non-declining. In simple language, this means that an economy is unsustainable if it is expected that current levels of consumption will not be able to be maintained.

(Measuring our future prospects using adjusted national accounts then becomes the task of those interested in green accounts.) Alternatives to this are that instantaneous utility does not rise above some reference level (where the reference level is deemed to be maximum sustainable—non-declining—utility). A further alternative is that the *present value* of future utilities (sometimes called *intertemporal social welfare*) be non-declining. These relate to the issue of *consumption over time* (and potential consumption) raised previously.

It is important to stress here that, while welfare and sustainability are *related* concepts—a measure of sustainability at the aggregate scale must somehow be defined with reference to standards of living over space and time—they are not the same thing. A measure designed to capture changes in recent well-being (better than conventional GDP does) will be designed differently than a measure that attempts to assess whether future prospects are being maintained.

Having talked about top-down sustainability criteria, we note here that sustainability constraints can be applied at different levels of aggregation (from global to national, further disaggregated to regional or resource-specific), using different criteria (some maintenance of physical sustainability, compared to maintenance of a monetary value of a natural asset), and with different comparisons between actual and "sustainable" outcomes (the choice of counter-factual in assessing the how far the outcome is from the supposedly sustainable path). Drawing conclusions about sustainability is, clearly, a far from objective process.

The focus here is explicitly on sustainability and its measurement through the national accounts. That said, the construction of components of the sustainability-adjusted measure will, in principle, often allow for clearer assessment of changes in current well-being. How then is sustainability to be expressed and modeled in order to make prognostications about whether sustainability conditions are being achieved?

1.4. Two Classifications of Sustainability

While there are many different ways in which analysts have attempted to operationalize sustainability and measure it, there are two well-recognized sustainability themes that have appeared in the economics literature. Respectively, these are widely known as "weak sustainability" and "strong sustainability". Weak sustainability is the broader measure, based on monetary valuation, and it allows the possibility of substitution between different assets (natural and human). In particular, weak/broad sustainability is based on the maintenance of the *total* asset base, which means the diminution of particular natural assets is consistent with sustainability only as long as other assets are correspondingly built up. Particularly, there is no stricture that certain kinds of assets be maintained, only that an overall (aggregate) stock be maintained.

Since the underlying idea is to focus on the maintenance in aggregate of the key things that contribute to, or generate, our standard of living, achieving sustainability is then a matter of *portfolio management*: ensuring sustainability requires managing the total stock of assets such that declines in some components of the national capital stock are met by (at least) equal increases in other components. This also allows, in principle,

trade-offs to be evaluated between environmental, resource management, and other social or public policy goals. (In particular, we can feasibly answer questions such as "Under what circumstances is it acceptable to deplete a particular resource deposit?" The answer is, when the rents earned from that resource depletion are reinvested in other productive capital assets.)

Strong sustainability is a narrower set of criteria that focuses on the maintenance of particular components of the natural resource base. Strong/narrow sustainability measures are thus more disaggregated; different measures may be monetary or non-monetary in nature. Particular concerns raised in discussion of strong sustainability include the limits to substitutability between natural capital and other forms of capital (such as manufactured capital or human capital); whether particular elements of natural capital are subject to "non-convexities" such as irreversibilities or thresholds, that mean smooth changes in both quantity and value of a resource or natural asset cannot be assumed; and whether monetary values can be even assigned as per conventional economic theory to non-marketed natural assets in the first place.

Progress in the Measurement of Sustainable Development contains an extensive discussion of weak and strong sustainability measures. We will link the "weak sustainability" concept to underlying concepts of income in economics, further below. First, we examine the historical context in which national accounts were developed.

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Biographical Sketches

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