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Green accounting and economic policy [1]

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Abstract

Through the lens of conventional national accounting, resource depletion and natural environment degradation often appear misleadingly as desirable economic growth. The old System of National Accounts (SNA) has been revised and a set of environmental 'satellite accounts' proposed. Certain weaknesses, however, pervade the new proposals. The conventional measurements remain largely unaltered, and the satellite accounts are of unclear purpose and unnecessarily complex. As proposed, they rely on the valuation of environmental stocks, while the economically more important flow accounts, to their detriment, are to be derived indirectly from changes in stock values. The SNA, the paper stresses, is primarily an economic framework, incapable of capturing all environmental change, and the national accounts are far more useful economically than environmentally. Greening the accounts would be optional for most affluent countries, whose overriding environmental concern is pollution. This can be addressed directly through taxation and regulation. Pollution information in satellite accounts can indeed be valuable, but revised and fully integrated resource accounting is a priority concern for those developing countries that are running down natural resources, and for which conventional accounting distorts macroeconomic measurement, analysis and policy. The paper argues that green accounting can only ensure income (sometimes called weak) sustainability, which should be considered as a step leading ultimately to an ecological (or stronger) sustainability.

Keywords: System of national accounts; Green accounting; Stocks and flows; Weak and strong sustainability; Macroeconomic analysis and policy

1. Introduction

1.1. Green accounting

Although greening the national accounts has become fairly popular, its course is by no means easy. Its advocates are coming from different directions, bringing in different perspectives and objectives. Some are concerned with preserving the *stock* of environmental assets; and others with the effect of environmental change on *welfare*. The overriding concern in this paper, however, is for the proper

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measurement of national output and expenditure. Improved measurements of output and expenditure will serve many purposes, but it will best serve economic objectives. Selling natural assets and including the proceeds in the gross domestic product, GDP, is wrong on both economic and accounting grounds. GDP should be made up entirely of *value added*, and if it is contaminated with elements representing capital liquidation, these should be expunged. Under conventional accounting, depreciation of produced fixed assets is included in GDP and inflates it just as it inflates the 'gross profits' of an enterprise. Depreciation is excluded for the estimation of the more sustainable net domestic product, NDP, and the net profits of an enterprise. Since NDP is rarely estimated, macroeconomic analysis is regularly based on estimates of the gross product, even though these are recognized as not totally sustainable. Depreciation of produced assets, however, is usually rather small, and its size fairly predictable. Natural asset liquidation and environmental deterioration, on the other hand, have no predictable pattern, and may indeed be large and volatile.

It will be argued that green accounting, as used in this paper, does not involve any value judgment as to the desirability or otherwise of preserving the environment. Greening the accounts merely invokes economic and accounting principles, needed for correctly estimating *income* which must be sustainable by definition. To the extent possible, the arguments made here will keep in line with national accounting practices, including the traditional focus on transacted activities; the use of time-tested accounting methods for the valuation of stocks; and the employment of market prices, however deviant they may be from Paretian optima, as weights for aggregation purposes. Thus shadow-pricing, including internalization of environmental externalities, is eschewed, and imputations of cost are kept to a minimum. While shadow-pricing can illuminate the national accounts, its proper place is in analytical studies, outside the formal accounting system.

Attempts have been made to adjust the conventional national accounts of a number of countries to reflect environmental change, or more accurately *part* of environmental change. Not all such adjustments have been made properly. The revised estimates, in any case, have rarely been taken seriously, and their implications for economic analysis have seldom been worked out, let alone used to revise policies. A principal objective of this paper is to indicate the kind of *economic* policies that will have to be re-assessed once the accounts have been greened. Before that, however, some important issues need to be disentangled, relating to recent efforts to 'integrate the environmental and economic accounts'. [3]

It should be stated at the outset that a *comprehensive* coverage of environmental deterioration in the national accounts is not possible. Certain aspects of environmental deterioration, such as loss of biodiversity or disintegration of ecological systems, are difficult to gauge even in physical units, let alone in money terms. Thus even when the accounts are claimed to have been 'greened' we should not expect the greening to be complete or to provide a panacea for environmental ailments. The national accounts, after all, are an *economic* apparatus, designed to produce economic magnitudes, and even after greening, they can have a limited capacity to indicate environmental change. Physical indicators of environmental deterioration are likely to serve environmental ends much more effectively than the system of national accounts can. Once suitably greened, the revised estimates should be employed to reassess the macroeconomic policies that were based on the unadjusted accounts.

1.2. The environment and the economy

Environmental deterioration impinges on national economies in varying ways and to different degrees. The environment provides the context within which all human actions take place, and sustains basic life-support systems. Even from a narrow economic perspective, the environment is the source of raw materials and energy, and the ultimate recipient and

[3] The new SNA and its companion volume, *Integrated Environmental and Economic Accounting*, imply that the environment is not economic. Note how the conventional measurements are described as *economic*, a description denied to the *environmental* accounts. The ostensible *integration* of the environment in the national accounts is actually never effected, and the so-called economic accounts remain unadjusted and, however flawed, continue to be used for the purposes of economic analysis. For the new proposals see Commission of the European Communities (1993) and United Nations Statistical Division (1993).

assimilator of the wastes of production and consumption. When the world population and the scale of economic activity were small relative to nature's abundance, it made sense for economists effectively to exclude nature from their vision, both as a source and a 'sink', treating environmental services as free goods.

Polluted air and water inflict harm on society that translates to economic loss. Awareness of this fact, often portrayed by physical indicators, has encouraged the identification of sources of pollution, and led in many countries to a successful internalization of the external costs of pollution and reducing its incidence. The drive for pollution-abatement has been strongest and clearest in the richer countries, a fact which has led some analysts to assume that environmental protection is income elastic, and that pollution will be addressed automatically once income per capita has attained a certain threshold. Such optimism has recently been exposed as unwarranted. [4]

For the more affluent nations environmental concerns tend to focus on pollution. Much of their natural resources has long been liquidated, and the bulk of their domestic product derives from value added by secondary and tertiary activities. Since pollution can be captured in physical indicators and redressed by regulation, green accounting appears to them unnecessary or, in any case, of lower priority.

Not that pollution is any less important to the poorer countries, especially where large and rapidly rising populations are pressing on an exhausted environment with a poor carrying capacity. But, on top of the damage caused by pollution, the environment as a source is also frequently being eroded. Agriculture, forestry, fishing, mineral extraction and other primary activities, rooted in the physical environment, are usually the major sources of these countries' prosperity. As their environment deteriorates, the very basis of this prosperity is undermined, and it seems rather elementary that economists should pay attention in their analysis to the sustainability of natural resources.

[4] See, Arrow et al. (1995). As an example of the optimistic argument, see World Bank (1992): Development and the Environment.

2. Sustainability and green accounting

2.1. Weak and strong sustainability

Concern with 'sustainability' gained much from the Brundtland Report (1987) and from the United Nations Conference on the Environment and Development (UNCED, 1992). 'Sustainability' and 'Sustainable Development', are not easy concepts to pin down without ambiguity, but they are now widely accepted as desirable, even when different meanings are attached to them. [5]

'*Weak Sustainability*' has been invoked to define a level of sustainability that revolves around the proper measurement of *income* which, by definition, has to be sustainable. Income must be made up of value added, and should not contain the proceeds of asset sales, and, when reckoned in its net form it should recognize asset deterioration. In order to estimate income from receipts obtained from the sale of natural assets (such as cutting and selling trees in excess of their natural regeneration, over-fishing, or depleting mineral stocks) capital, including natural capital, must be *kept intact* as a device for estimating 'sustainable' income. [6] The accounting principle

[5] Sustainable development is clearly different from a sustainable natural environment. The former implies a process through time relating to the prosperity of the average individual within a finite natural world, and the natural resource stock per capita therefore becomes relevant. Attempts have been made to extend the objective of sustainability to 'human capital' and, less successfully, to a so-called 'social capital', the latter consisting of interrelationships believed to sustain communities (Serageldin, 1996). For national accounting purposes, however, the sustainability of environmental capital far outweighs in importance the other forms of 'capital'. What is called 'social capital' is likely to remain fuzzy and unmeasurable. As to 'human capital', it would be wrong to treat expenditure on education and training (though in many respects *economically* justifiable) as *investment* in human capital since not all education leads to higher productivity: many graduates fail to find productive employment commensurate with the their training. Besides, improvements in productivity due to education get reflected automatically in the conventional measurements of GDP. Human capital deterioration on account of infirmity and death do not threaten the intactness of capital since human knowledge and technology unquestionably raise the stock of such capital all the time, and are bequeathed costlessly to future generations. Admittedly not all formation of produced capital can be regarded as productive, but the scale of inaccuracy here is different, and sorting out what is productive from what is not goes well beyond national accounting.

of keeping capital intact for income estimation purposes, in fact, predates Adam Smith, and has been known to and endorsed by successive generations of economists from early times. It comes into play for national income measurement through allowance for capital consumption which adjusts the gross product into a more sustainable net product. But this principle tends to be ignored when income arises from the sale of natural capital, even when the resource, such as timber or petroleum, is marketable and transacted. Receipts derived from such activities are uncritically reckoned as income though in fact they will cease if asset sales continue. Weak sustainability, in the sense of ensuring, through proper income estimation, that capital, including natural capital, is kept intact may, therefore, be regarded merely as a tool for the estimation of 'sustainable' income. In this sense it can be taken as devoid of value judgment regarding any prescribed course of behavior. In other words, weak sustainability is not *normative*, but *positive* and analytical, required as a workable device for the very difficult task of income estimation. In the context of national accounting the sustainbility thus secured is only a year-by-year sustainability. [7]

'*Strong Sustainability*', on the other hand, focuses on maintaining the *stock* of natural resources over time, including the capacity of nature to assimilate wastes. It is advocated on the argument that natural resources are essential for many purposes, including the continuation of economic activities, as they provide the ingredients to which value may be added by labor and capital. *Ceteris paribus*, if environmental resources diminish, economic activity will decline, if not immediately, but inevitably later. Thus Daly, an advocate of strong sustainability, has claimed the existence of a complementarity relationship between natural resources and produced capital (Daly and Cobb, 1989), arguing that the latter capital cannot easily replace the former as many optimists seem to take for granted. Daly has also proposed that weak sustainability should be strengthened by the reinvestment of the equivalent of the User Cost of a depletable natural resource in ventures to develop renewable substitutes specifically geared to replacing the resource being depleted.

Insisting that capital in general, including natural capital, should be kept intact for income estimation does not mean that all forms of capital are necessarily substitutable for each other. From the perspective of a productive unit, and for ex post accounting, keeping capital intact means that a reduction of one form of capital must be offset by the acquisition of any other form of capital in order that that unit's income may be sustained. Keeping capital intact for the estimation of income is a rolling process, carried out periodically, typically one year at a time. Because of the near horizon of this process, it is not particularly suitable as a normative long - run device. Outside the framework of national accounting, 'strong sustainability' comes into its own when a long view is taken, and the perspective broadened beyond individual productive units. For the situation would be untenable where every productive unit were to tolerate the decline of its natural capital in the expectation that produced capital would compensate for this decline and income somehow could be sustained. The accounting tool of 'keeping capital intact', necessary for the ex post estimation of an income that may be sustained over the following year, should not be taken as an ex ante recommendation to liquidate natural capital on the dubious ground that it can be replaced, without limit, by produced capital (El Serafy, 1996).

[6] Income, as stated earlier, is sustainable by definition. Here, the word sustainable is placed within quotes because in a strict sense it is redundant.

[7] Both Keynes (1936, especially in reference to *net* income, pp. 56–60), and Hicks (1946) drew attention to the difficulties of defining and approximating income. Hicks (p. 176) expressed his skepticism even about his own definitions of income, which revolve around what a person can consume while leaving his capital intact, *viz*: "By considering the approximations to this criterion, we have come to see how very complex it is, how unattractive it looks when subjected to detailed analysis. We may now allow a doubt to escape us whether it does, in the last resort, stand up to analysis at all, whether we have not been chasing a will-o'-wisp'." Referring to the concepts of 'income', 'saving', 'depreciation' and 'investment', Hicks (p. 171) stressed the fact that "[a]t bottom, they are not logical categories at all; they are rough approximations, used by the business man to steer himself through the bewildering changes of situation which confront him." In the context of national accounting (see below), the User Cost method I proposed for estimating income from extraction of depletable resources which, incidentally, was met with the approval of Hicks (private communication, dated 13 May 1987), should be seen in the same light as a practical device for approximating income measurement.

3. The satellite accounting system

3.1. The SEEA

The system of integrated economic and environmental accounting, SEEA, now being recommended by the United Nations Statistical Division as the appropriate device for greening the national accounts, should be seen as the outcome of a long process of exploration and debate. This process dates from the mid-1980s when the United Nations Environment Programme (UNEP), in collaboration with the World Bank, organized joint workshops to discuss the feasibility of adjusting the SNA to incorporate environmental change. Some of the ideas generated under that initiative were subsequently applied experimentally to green the accounts of a number of countries. In December 1993, and in response to this initiative, the SNA, which had remained virtually unchanged since 1968, was finally amended, and a novel system of 'Satellite Accounts' for the Environment launched. The new *System of National Accounts 1993* came out in the name of five international agencies whose representatives had collaborated on its revision as an interagency working group. [8] Guidance for the implementation of the environmental proposals is set out in a companion volume, 'Handbook of National Accounting', which was published, also in 1993, by the United Nations Statistical Division under the title *Integrated Environmental and Economic Accounting.*

Though the Handbook was meant to be a practical guide for implementing the proposed 'integrated System of Economic and Environmental Accounts', SEEA, it showed details of preparatory work indicating methodological disagreements for greening the accounts. Thus the authors of the Handbook wisely called it an '*Interim Version*'. Adjusting the standard macroeconomic estimates, usually the very heart of national accounting, is clearly only one of a number of objectives sought by the SEEA which seems to be intended as a depository of information on points of contact between the environment and the 'economic system', with an apparent bias for accounting for the *stock* of the environment.

3.2. The wrong emphasis on accounting for stocks

By its focus on stocks the SEEA seems to accommodate those environmentalists who had wished to use the national accounts to highlight environmental deterioration. Under the SEEA the estimation of the *stock* of natural assets is the point of departure from which all environmental accounting must begin. Changes in the stock during the accounting period determine the estimation of the flow accounts (GDP, GNP and their component parts). As it is not possible to compile a *comprehensive* list of environmental stocks at either end of the accounting period, it should be obvious that this approach cannot be a useful device for inferring these important flows from changes in an incomplete stock list. Even for produced capital, no country has managed to compile such a comprehensive list. The inappropriateness of this approach is further compounded if the stocks are valued, as recommended, at current prices that differ between the beginning and end of the accounting period. The standard accounting rule for stock valuation at year-end is that the same prices should be employed as those used for valuing opening stocks, unless the market has declined in the interval, in which case the lower prices must be used. This precautionary rule, which ensures that income is not over-estimated to the detriment of sustainability, has little appeal to economists. Unlike the accountants who, like historians, are backward-looking, economists tend to be forward looking, attaching greater importance to replacement costs (El Serafy, 1995). [9] When current prices are used for stock valuation, and changes in stock values are incorporated in the flow accounts, the integrity of the latter

[8] See Commission of the European Communities (1993). The five agencies are the Commission of the European Communities, the International Monetary Fund, the Organisation for Economic Co-operation and Development, the United Nations and the World Bank.

[9] An early proposal recommending the use of current prices for the valuation of stocks for national accounting purposes is to be found in a summary of OECD, Department of Economics and Statistics, Meeting of National Accounts Experts, 29–31 May 1985 under the title, "Treatment of Mining Activities in the System of National Accounts", Note by the Secretariat, DES/NI/85.4, distributed 29 April 1985. It is interesting that this recommendation which flouts well-established accounting conventions has emerged afresh in the SEEA.

is damaged, and very little *environmental* wisdom will be gained from such a procedure, and even less *economic* insight. [10]

We should remember that it is in fact the flow of this decline that gets transacted, not the stock. And it would be wrong to consider the entire decline in environmental stocks, even valued at the same prices, as a charge against the gross product, as it would be equally wrong to incorporate changes due to upward or downward re-assessments of the stock in GDP in the year of the re-assessment. [11] The amount to be charged as capital consumption should be only the imputed cost of environmental resource use, the *User Cost*. Better still would be to exclude this capital element from the gross product altogether since it does not represent value added, and no adjustment of the net product would then be required. The User Cost approach, it should be repeated, is applicable to both depletable and renewable resources, the latter to the extent that they are being 'mined' (i.e., when exploitation exceeds their natural regeneration). Once a User Cost approach is adopted, the accounts become sensitive to sustainability through the device of estimating a correct, i.e., sustainable, level of income. This is because the User Cost makes use of the proportion of the *physical* stock being extracted during the year, taking account of any re-assessments of reserves. The inverse of this proportion, the resource's life expectancy counted in years, is an obvious indicator of the sustainability of current income and extraction rates. [12]

3.3. Income from depletion

How should the depletion of exhaustible resources be reflected in the national accounts? If we include

[10] This accounting rule for stock valuation derives from individual and corporate accounting for entities that hold stocks as 'working capital' for facilitating their principal activities, such as manufacturing. In the present context, where environmental stocks cannot usefully be viewed as working capital in this sense, there is no need at all to put money values on them. It is the *changes* in the stocks during the accounting period that need to be valued for incorporation in the flow accounts. Many of these changes are directly valued by the market so that it would not be necessary to derive them from stock changes. Since the stock of natural resources (say of bauxite or petroleum) may be one or two orders of magnitude larger than annual extraction, the significant market valuation of transacted extraction will be swamped by irrelevant and untransacted changes in the value of a much larger stock. In other words the integrity of the flow accounts would be lost.

[11] Such was the procedure used by WRI for greening the national accounts of Indonesia (Repetto et al., 1989) and this led to unacceptable results. It was also the procedure used for adjusting the US accounts in respect of depletable resources for the first quarter of 1994, an initiative which has subsequently been abandoned, in my view largely because of adoption of the wrong methodology (United States Department of Commerce, 1994).

[12] See El Serafy (1981, 1989) where the surplus realized in the exploitation of depletable natural resources, often called rent, is converted under a User Cost approach into a sustainable income stream. This process excludes from annual revenues an estimated capital element, the User Cost, to be re-invested so that its yield will contribute to the generation of this income both during extraction and after the resource has been totally exhausted. The so-called El Serafy formula for the estimation of the ratio of true income (X), [and its complement the User Cost ($1 - X$)], to net receipts (R), relies on two parameters: (r) a discount rate, and (n) the life expectancy of the resource at the current year's extraction rate. True (i.e., sustainable) income as a ratio of net receipts is given by the expression: $X/R = 1 - 1/(1+r)^{n+1}$. For practical estimation, the discount rate, r, selected should be a precautionary real interest rate representing the expected yield from the investment, and should on no account be a wishful-thinking rate of return. It may be varied from time to time in line with market indications. (In the exploratory studies organized by the World Bank and the UN Statistical Division for greening the accounts of Mexico and Papua New Guinea an optimistic discount rate of 10% was wrongly employed and this biased the results.) Life expectancy is also variable, depending on the resource owner's annual extraction plans which are usually made in line with market developments and expectations about prices. These plans could range from total liquidation of the natural asset in one year to over a hundred years. Some writers have mistakenly interpreted the User Cost approach as relying on the assumption of an invariable rate of extraction until the resource expires. But the only constancy assumed under this approach pertains to the stream of *income* to be generated from the re-investment of the User Cost as derived from a totally flexible annual extraction schedule. Since this is an ex post approach, capable of accounting for any entrepreneurial decisions regarding extraction, no optimality of depletion is posited. And if stocks are reassessed upwards or downwards, the reassessment is automatically reflected in the life expectancy of the resource, and incorporated in the estimation of income and the User Cost. For details and qualifications of this approach, see El Serafy (1989, El Serafy, 1993b, 1995. Among many applications of the 'El Serafy method' is the 1992 United Kingdom Central Statistical Office's exercise to estimate income from oil and gas depletion. See Hamilton et al. (1993).

sale proceeds in the gross product and treat the decline of the stock due to exploitation as depreciation and deduct it for the estimation of the net product, we end up wiping out the contribution of this activity totally from the net product, besides keeping an erroneously estimated gross product, inflated wrongly by asset sales. The proper way to estimate a sustainable income from depletion, as asserted before, is by employing the User Cost method which converts revenue from extraction into a stream of undeclining income. Alternative methods, including the Hotelling–Hartwick approach (Hotelling, 1931; Hartwick, 1977; Hartwick and Hageman, 1993) which seek to estimate 'resource rent' per unit as the difference between the market price and the marginal cost of extraction, while theoretically correct and applicable to optimal depletion, are not operational (and are in many respects irrelevant) for national accounting. [13]

3.4. Treating pollution

When a country successfully curtails pollution by regulation and taxation, insisting for instance on removing lead from gasoline, the costs incurred in this process will show up as intermediate inputs to be charged against output. GDP then would be reduced accordingly, and its estimation will come out right without any greening needed. In the more typical case where anti-pollution regulation has not become pervasive, greening the accounts for pollution should best rely on setting acceptable standards of ambience or emissions impurity, and calculating the theoretical cost of meeting such standards, to be imputed as a cost of conventional GDP. [14] Such a cost will naturally depend on current technology and may contain elements of subjectivity. Some believe that correcting for pollution will call for only a modest adjustment to conventional GDP estimates, but this is by no means a universal judgment. By contrast, running down natural resources can be on a substantial scale and needs to be carefully assessed and directly expressed in the macroeconomic measurements that make up the family of national accounts. This should not be viewed, as stated earlier, as either environmental or novel, but simply as an overdue *correction* of the accounts that already contain many natural resource elements, albeit at erroneous, mainly zero, values. [15]

3.5. What should we be accounting for?

It is important to be clear about the purpose for which we seek to green the accounts. [16] If the goal is to describe the state of the environment, emphasis should understandably be placed on assessing environmental *stocks*. But for this purpose the units of account should not be monetary, but physical. Money values fluctuate with the market and with the general price level, and little can be gained for environmental conservation from hiding meaningful volume

[13] Cf. Devarajan and Fisher (1982). The so-called Hartwick Rule (Hartwick, 1977), which has been endorsed by Solow (Solow, 1992), recommends that *all* the surplus realized from the extraction of a depletable resource should be re-invested to generate future income. This, it may be observed, is a normative injunction meant to ensure the sustainability of future income. Such a recommendation, however, would deny any consumption from the exploitation of a depletable resource until the new investments begin to yield income. If we allow for a gestation period during which the new investments mature, the Hartwick Rule would eventually converge with the (analytically positive) El Serafy Rule, which is an accounting device, divorced from any recommendation of a desirable behavior. This Rule anticipates future income from re-investing the User Cost, thus making room, through the estimation of current income, for immediate consumption out of extraction revenues.

[14] This proposal was first put forward by Hueting. See, for instance, Jan Tinbergen and Roefie Hueting, "GNP and Market Prices", chapter 4 in Goodland et al. (1992).

[15] Much confusion is generated by writers who argue that 'depletable' resources may not be as depletable as environmentalists make out, or that substitutes would eventually be found for them. But such views, even if true, are irrelevant to the national accounts which pertain to *individual* countries. It is no consolation to Tunisia, for example, which is running out of petroleum to be told that there is more petroleum to be found in Alaska or Saudi Arabia. Substitutes for petroleum in commercial quantities and at comparable cost are still very much in the future. The idea that there are enormous supplies of minerals in the earth's crust does not negate the fact that with present technology only a fraction of these can be considered workable.

[16] At the behest of UNEP an international group of specialists is now at work to produce a simplified green national accounting manual based on the SEEA for use by national statistical offices. An important first task of the manual will be to clarify the objectives for which the national accounts should be greened.

changes under the veil of money. But if accounting in physical units, or in indices based on physical units, are best for revealing environmental change, the question may be asked as why this cannot be done outside the national accounting framework? An inevitably partial entering of physical stocks in satellite accounts, deliberately placed outside the '*economic*' accounts, does not amount to 'integration', and is of limited utility for income estimation. If environmental deterioration must be conveyed via the national accounts, whether integrally in the core accounts or peripherally in satellite accounts, the objective should be unambiguously to reach more realistic macroeconomic measurements, with the stocks kept firmly in the background, and not as the prime mover of the green accounting process. [17]

4. Policy implications of greening the national accounts

4.1. Impact on policy

We come now to the very heart of this paper. If the economists accept the measurements of the conventional accounts as valid, and set out to analyze the economic problems of a country that is selling its natural assets on an appreciable scale while counting this as value added, their analysis is likely to be wrong, and the policy cures they prescribe unsuitable or even harmful. When the national output, as expressed in GDP, needs to be adjusted downward because a substantial part of it is not value added, then the economy in fact is much poorer than the accounts make it out to be. The degree of output exaggeration may, in some cases, amount to 20% of the conventionally estimated GDP (El Serafy, 1993a), a finding that is corroborated by estimates of 'genuine savings' made recently by the World Bank (1995). If unaccounted-for pollution is also taken into consideration, this can expose the unadjusted national accounts of many countries as being seriously flawed and misleading.

If we are unable to assess the level of economic activity, how can we, as economists, reckon the productivity of the various inputs that involve the use of natural assets, whether for projects, sectors, or the national economy? Do conventional estimates of individual or total factor productivity have any value when neither the products (if inflated by assets sales) nor the inputs (where natural resources are treated as costless) are measured properly? What significance can we attach to an incremental capital output ratio (ICOR) that implies that rapid liquidation of natural assets represents high productivity and desirable economic behavior? Would we be able to judge if an economy is genuinely growing? How would we justify building apparently sophisticated macroeconomic models to illuminate the structural workings of an economy when the data fed into the model are flawed? Such data may be good enough for short term demand management, but highly questionable either for indicating economic progress, or guiding long-term development.

4.2. International trade and prices

It should be stressed that the unadjusted macroeconomic estimates produced by the conventional national accounts will continue to be used for economic analysis and international comparisons. This is because the new SNA has kept the core accounts immune from change, viewing them as 'economic'. Participation in world trade, which tends to align domestic with international prices, will not lead to the internalization of environmental costs. International prices are seldom ideal, often distorted by non-market forces, including subsidization of agricultural products by important exporters, and political and military interventions by powerful importers that depress the prices of strategic products such as petroleum. Besides, the poorer countries' supply curves for primary exports are often backward rising, reflecting negative income effects caused by the poverty of the sellers and their lack of substitutes for natural resource exports. Lower international prices would thus frequently induce greater rather than smaller volumes of exports and further price de-

[17] Environmental information gathered in satellite accounts can still be useful for the purposes of environmental policy. For instance, data relating to the structure of intra- and inter-industry pollution can, with the help of an input–output framework, direct attention to the sources and impact of pollution, thus enabling the formation of counter-pollution policies.

clines. The international market for primary products is devoid of anti-dumping mechanisms similar in effectiveness to those available for internationally traded manufactures. Selling natural resources below their full environmental cost by one large source motivated by political or military considerations, or simply by short-term expediency will, through international competition, cause primary products to continue to be underpriced, and generate a vicious circle of yet lower prices.

4.3. Economic policies after greening the accounts

There are at least three important policy issues that would need to be examined once the national accounts have been greened. First, savings and investment; second price stability and the exchange rate; and third, the balance of payments on current account. A fourth issue is the fiscal balance which may also be inaccurately estimated if exploitation takes place in the public sector and the receipts from natural resource sales flow directly into the public treasury and get treated as current fiscal revenue. All these issues are obviously inter-related.

4.4. Savings and investment

It matters a great deal for sustainability whether or not an economy is saving and investing sufficiently. If the downward adjustment of GDP on account of resource depletion and degradation is large, this will affect savings and investment estimates. Given consumption, if GDP is significantly reduced in a closed economy, estimates of savings and capital formation must be revised downward (El Serafy, 1981, 1989, 1991). The attention belatedly given to 'genuine savings' by the Environment Department of the World Bank (1995) is certainly welcome. But this is only one of several policy issues that had been raised by the national accounting reformers since the mid-1980s. Concern for macroeconomic policy issues should not be confined to a consideration of net savings or net capital formation, but should be extended to the whole family of national accounts. If capital consumption —perhaps amounting to 10% of GDP—is combined with estimated environmental depletion and degradation of the order of 20% of GDP, then many countries' net savings and capital formation would turn out in fact to be negative, a sure indicator of unsustainability.

4.5. Price stability and the exchange rate

When a country is selling its environmental assets and not insulating the sale proceeds from other monetary flows, a phenomenon known as the Dutch Disease will take hold, and the terms of trade between tradable and nontradable goods will get distorted to the detriment of traded goods activities. A process of 'de-development' is likely to set in, shrinking previously productive sectors, including manufacturing. To counteract this phenomenon monetary sterilization and devaluation often become advisable in order to redress the high domestic cost of exports from the 'non-booming' sectors (Corden, 1984).

A procedure quite often used to determine whether or not a country's domestic currency has appreciated vis-à-vis the currencies of its trading partners frequently fails when applied to natural resource dependent economies. This is due to overlooking the effect on the domestic price level of the availability of cheaper imports paid for by exporting natural capital. The procedure begins by selecting a year in the relatively recent past, judged to have been a year when the exchange rate was roughly 'right'. An index of domestic inflation is then calculated to estimate the general price rise since the base year, and compared with a composite index of inflation in the country's main trading partners. Devaluation would be indicated to the degree that domestic inflation, thus estimated, has exceeded foreign inflation. While this method is capable of yielding reasonably satisfactory results where the national accounts truly reflect reality, it will not be a reliable guide to foreign exchange policy for a resource-depleting economy. If the proceeds from the unsustainable exports of natural assets finance an import surplus, thereby suppressing domestic inflation that may otherwise have become overt, then an apparent stability or near-stability of the domestic price level cannot be taken as genuine, and devaluation, which had not been suspected as a policy option, could in fact have been indicated. Quite often the domestic currencies of resource exporting countries become over-valued,

a factor that encourages imports and inhibits industrial diversification away from the natural resource sectors. Economists have rarely given thought to this important issue.

4.6. The balance of payments on current account

Looking at the same problem from a different angle, a free market for foreign exchange may be artificially sustaining an over-valued domestic currency owing to the simple fact that the proceeds of natural capital exports are recorded in the balance of payments on current account, thus hiding a deficit or showing a surplus. The market for foreign exchange is often too myopic to distinguish current from capital flows, and the inflow of foreign exchange, irrespective of the account in which it is recorded, will push up the value of the domestic currency in terms of foreign currencies. But analysts should make an effort to discern the nature of these flows in order to get a grip on macroeconomic management, and should consider devaluation as a policy option. A cleaned up current account would be an effective tool in this respect.

The question as to whether exports of environmental assets should or should not be recorded in the current account of the balance of payments was first raised by Haberler (1976, p. 184 note 12) but has since been ignored. If, after adjusting the product accounts, a parallel attempt is made to purge the balance of payments on current account of flows of a capital nature, care should be exercised in this process. This is because conceptually the domestic or national product is made up (or should be made up) only of value added, whereas exports and imports contain within them also the inputs used for their production.

It may be added that the process of adjusting the balance of payments flows in the manner just described should focus on exports and not imports. This is because the importing country may be construed as acquiring the imports in question, value added as well as inputs, and for this privilege it has to pay by exports. In the case of trade between two industrialized countries, where trade is largely made up of value added on both sides, the distinction between value added and inputs could be ignored for the purpose at hand. For a developing country, however, where part of exports (and unadjusted GDP) represents a significant amount of user cost of natural resources, this part should be excluded from exports in parallel with its exclusion from GDP. If this is done properly, the current account may look quite different. There will certainly be resistance by conventional economic accountants to adjusting the balance of payments in the manner just described, but an analytical exercise clarifying the nature of the different balance of payments flows, carried out outside the framework of the national accounts, would still be useful for the benefit of economic policy for natural resource dependent countries.

5. Other related issues

5.1. Structural adjustment programs

Attention has been directed at assessing the deleterious impact of structural adjustment initiatives on the environment in a number of countries. Misguided blame has been levelled at policies implemented under stabilization and structural adjustment programs, supported, inter alia, by the International Monetary Fund and the World Bank, on account of their harmful impact on the environment. Macroeconomic adjustment is unavoidable if an economy is living beyond its means, and has accumulated foreign liabilities which it cannot service. Short of the creditors forgiving a significant part of the debt, and most creditors are reluctant to do so, the indebted country must cut its expenditure to balance its accounts. Cuts may fall on the poor, health programs, the environment or other vulnerable ends, normally worthy of protection. To safeguard all these ends against cutting expenditure would defeat the structural adjustment process itself. Alternatively a set of carefully balanced expenditure cuts may be worked out, but environmental concerns, being often of a longer-run nature, may get sacrificed in favor of more pressing needs. This is not an uncommon phenomenon since, even without adjustment programs, the poor have often to run down their meager natural assets for survival in a kind of a Hobson's Choice imposed on them by the severity of their conditions. That is why poverty mitigation programs tend to be generally helpful to the environment.

Much more productive than merely examining the environmental after-effects of structural adjustment on the environment, is to use this instrument actively to counteract environmentally harmful practices already being pursued. For instance policies leading to the wasteful use of water, settling landless peasants on forested public lands, subsidizing ranching activities, and encouraging the exports of under-priced natural resources and their products, should be carefully examined, and their hidden environmental costs estimated and set against the more obvious benefits. In Costa Rica, a minimal land tax that had remained unchanged in nominal terms for half a century was judged to be instrumental in encouraging landowners to expand their holdings, taking land out of the virgin forest through a complex process of settling landless peasants temporarily. While privately profitable, this process is publicly harmful since the deforested land gets eventually acquired by ranchers for what otherwise would be uneconomic cattle raising (El Serafy, 1988).

5.2. Should all countries green their national accounts?

Not all countries would benefit equally by greening their accounts. Which countries would gain most by the adjustment? One cannot be categorical a priori, and judgment has to be made on a case by case basis as to the benefit, net of cost, of such an exercise. There may be a presumption, however, that countries whose industrial structure is dominated by primary activities, or whose exports are mainly or appreciably made up of primary commodities, would be a priority target for investigation. (El Serafy, 1993a, table 2 lists fourteen developing countries where three primary commodities exported made up upward of 40% of exports by value in 1990.) But such presumptions will have to be corroborated by detailed expert knowledge at the level of the local economists who should apprise themselves of environmental studies, the country's environmental action plan if it exists, and any sectoral reports containing relevant information. Economists working on these countries should realize that it makes no sense to produce optimistic extrapolations of exports, say, over a ten - year period, without carefully examining the resource base from which these exports will have to emanate.

5.3. The role of physical indicators

While some industrialized countries have given support to 'green accounting', their focus, as stated earlier, has on the whole been on pollution, and little has been done in those countries to assess the impact of resource depletion and degradation on macroeconomic measurements and policies as described above. The process of revising the SNA, however, has been guided by the industrialized countries, and reflects, in my judgment, the biased view that the economic accounts, as conventionally compiled, are adequate, and that any adjustments to them for environmental purposes can be relegated to peripheral accounts. It is also probably fair to add that national income statisticians, especially those who have been involved in adjusting the SNA, tend to favor leaving the conventional accounts unadjusted to preserve the continuity of historical time series, however, wrongly estimated. Many economists, it should also be added, would resent the kind of criticism made in Section IV above, which in effect says that they have misdiagnosed economic ills, and sometimes prescribed harmful economic medicines based on faulty national accounts. Instead, they safely favor physical indicators of environmental deterioration over any tampering with the so-called 'economic' accounts.

In many instances, physical indicators of environmental change have been invaluable, leading especially to a cleaner environment. But resort to physical indicators will not be sufficient for addressing natural resource deterioration and its implications for economic policies especially for the less developed countries. Physical indicators of deforestation, loss of fish stocks, declining mineral deposits, soil erosion and the like are certainly necessary for drawing attention to environmental decline, and can serve as a basis for monetary valuation of environmental loss, but clearly their economic role would be vastly enhanced if incorporated in an adjusted set of macroeconomic measurements.

6. Concluding remarks

6.1. The economic nature of national accounting

When the greening the SNA was being debated, methodological disagreement among analysts largely

reflected two views of sustainability: whether it is the income (i.e., weak) or the environmental (i.e., strong) variant of sustainability that the adjusted national accounts should be indicating. In the light of the foregoing, this was a conflict between whether it is the flow or the stock that should have primacy in the accounting process. The SEEA, with its focus on accounting for environmental *stocks*, appears to favor strong sustainability. True, flow accounts are also to be drawn, but these are only reflections of changes in the dominant stock accounts. Under the SEEA and its parent, the new SNA, the economic and the environmental worlds are separate, and can only be bridged *outside* the conventional national accounts which remain immune from change and will continue to be used for economic analysis. Considering the lingering lack of methodological consensus about how to green the accounts, confining the greening to satellite accounts is sensible. But further debate about methodology is needed, together with a thorough assessment of the substantial empirical work that has been carried out in various countries, much of which has been passing as greening of the national accounts.

That methodology is important is demonstrated by the recent experience of the United States. When the Bureau of Economic Analysis of the US Department of Commerce attempted to green the US accounts for the first quarter of 1994 to reflect depletion of natural resources it fully integrated the upward reassessment of hydrocarbon stocks into the flow accounts—just as the study of Indonesia (Repetto et al., 1989) had done five years earlier. It also adopted a stock approach whereby stock declines due to extraction were fully charged against GDP. In the light of the results, the erroneous conclusion was reached that since depletion, treated wrongly as depreciation, was counterbalanced by new discoveries, the adjustment to the accounts had been accomplished, but indicated a negligible change from the conventional measurements. This well-intentioned initiative, if it had been done properly, would probably not have been suspended as it now has. [18]

[18] See United States Department of Commerce, 1994.

Finally, it should be stressed that greening the national accounts is more important for economic policy than for environmental policy. Pollution can be indicated directly by physical measurements and addressed, quite adequately, through regulation without any help from national accounting. By contrast, natural resource depletion and degradation need the medium of the national accounts, especially for those developing countries whose natural resources are rapidly eroding, and the erosion is counted misleadingly in GDP as value added. Once the accounts are greened, macroeconomic policies need to be re-examined along the lines elaborated in this paper.

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