Re-thinking Economic Progress

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The call for countries to pursue sustainable development, and in doing so place the environment at the heart of policy-making, was established notably in the report of the Brundtland Commission in 1987 (WCED, 1987) and at the Earth Summit meeting between world leaders in Rio de Janeiro in 1992. Many national governments have now pledged a commitment to this goal and the transformation of these pledges into policy is a formidable challenge faced by decision-makers. It also raises fundamental questions regarding the design of indicators needed to construct suitable policy responses and, furthermore, to monitor progress towards stated goals. Allied to this is a feeling of dissatisfaction with the way in which economic progress is currently evaluated. In particular, this unease has found a focus in, often trenchant, criticism of the perceived emphasis of policy-makers on changes in Gross Domestic Product (GDP). This has led, over the past decade, to a view that unless the way in which progress is currently evaluated is changed, or at least augmented, commitments to sustainability or environmental goals will be largely meaningless. Of particular interest in this respect are proposals for the construction of green alternatives to GDP.

What is GDP?

Before we proceed to outline efforts to green GDP, it is useful to get some sense of, on one hand, what GDP is and, on the other, why there has been criticism of this indicator. The background to this is that the national accounts consist of a large body of information confined primarily to observable marketed transactions. Hence, the goods and services that get counted are those which pass through the market and the costs of provision of certain services, like state education, supplied by government. From this mass of economic data, most attention is given to the aggregate measure of income or product, i.e. GDP, resulting from the accounting

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process.[1] GDP is estimated using either of three methods (World Bank, 1998): (i) by value added (gross output of producers less the value of intermediate goods and services consumed in production); (ii) by incomes (e.g. wages and profits); and, (iii) by expenditure (e.g. consumption and saving). What GDP tracks is the current flow of economic activity over an accounting period, e.g. annually or quarterly. The growth rate of GDP is arguably the single most important economic indicator at the disposal of policy-makers although few would propose that it alone is sufficient to summarise economic performance (Atkinson *et al.* 1997). Its primary use, along with a small number of additional indices such as the unemployment rate, inflation rate and balance of payments, is to characterise the state of the economy in the past and to forecast prospects for the near future.

The emphasis of the national accounts on economic activity is a source of much criticism, as it appears almost wholly to ignore the broader quality of life concerns. Furthermore, concern for sustainable development, placing an additional emphasis on the wellbeing of future generations, is also poorly reflected in the national accounts. The neglect of the environment in the accounts encapsulates both of these concerns in that environmental resources are a significant source of wellbeing both now and in the future. Yet, existing national accounting practice, and thereby GDP, does not reflect this. As result of the increasing importance attached to the depletion of resources and accumulation of pollution, the national accounts are a less useful guide to the consequences of human activities.

This has led to calls to augment the existing accounts with information reflecting changes in environmental resources. Indeed, many have taken this line of argument further (see, for example, Lutz, 1993): if GDP, and its growth rate, is central to evaluating development prospects then an analogously powerful indicator must be sought to redress this imbalance. The idea is not so much to replace this economic indicator, although some suggest this should be the case, but rather to complement the existing

[1]GDP measures the total output of goods and services for final use occurring within the domestic territory of a given country (World Bank, 1998). An alternative definition of a country's income is Gross National Product (GNP). GNP is defined as GDP plus net property income from abroad. However, this distinction does not affect our discussion.

accounting framework in such a way that an additional green national accounting aggregate can be estimated. In this way, new information is provided that might alert policy-makers to the underlying 'true' trends in an economy and to the way in which their policies may affect those trends. Hence, the impetus for the pioneering studies was to provide empirical evidence that economic progress was being achieved increasingly at the expense of the environment. It was argued that this would be reflected in a lower rate of 'green GDP' growth vis-à-vis the growth rate of GDP or, to take a more extreme case, negative growth in 'green GDP' thereby indicating that development is unsustainable.

Greening GDP

An important reason for the current focus on GDP is that it provides policy-makers with a measure of a nation's income. Hence, by extending GDP to take account of what is happening to the environment, it is hoped that a better measure of income can be reached. The basic framework for greening GDP begins from the definition of GDP as consumption (C) plus gross saving (S).

$$GDP = C + S$$

The most prominent theme within green accounting is that use of resources and the environment represents asset consumption, i.e. depreciation of natural assets, a concept ideally suited to treatment within the national accounts. Alternatives to GDP attempt to approximate 'net' or 'sustainable' income; income in excess of asset consumption, a definition that goes back to Hicks (1946). Thus, green Net Domestic Product (gNDP) is defined as GDP net of asset consumption. The latter includes the depreciation of produced capital (e.g. machines and infrastructure), *D*, an item which is already measured in the existing accounts. In addition, further subtractions are made for resource depletion, *R*, (i.e. changes in resource stocks) and environmental damage, *E*, (i.e. changes in environmental liabilities). The former is made up of commercial natural resources (such as energy and mineral resources as well as commercial forestry and fishing) where there is a market price. The latter refer to environmental resources such as clean air which, for the most part, lie outside the market system and so are an entirely new component of national accounting.

Hence, gNDP is defined as,

$$gNDP = GDP - D - R - E$$

Efforts to estimate this green alternative to GDP have led to a burst of activity over the past decade resulting in a plethora of studies in the developed and developing world (see, for a review, Hamilton and Lutz, 1996). The best known study remains the pioneer exercise by the World Resources Institute (WRI) (Repetto *et al.* 1989) for Indonesia. Changes in the stocks of natural resources (oil, forests and soil) were deducted from GDP along with changes in produced capital. The results showed that while GDP during 1971–84 grew at 7.1% per annum (p.a.), it was estimated that gNDP grew at 4.1% p.a. Put another way, this means that while conventional income (i.e. GDP) appeared to be doubling every 10 years, 'true' (i.e. green) income was doubling roughly every 17 years. Hence, although progress was achieved over this period, Repetto *et al.* appeared to show that the 'true' growth rate, taking into account the resources upon which the economy depends, was not as robust as previously thought.

Table 1: Resource depletion in selected Latin American and Caribbean economies, 1980–94

Country	Resource depletion 1980–94 (% of GDP)
Argentina	3
Bolivia	16
Brazil	2
Chile	11
Colombia	6
Ecuador	17
Guatemala	2
Haiti	7
Jamaica	8
Mexico	12
Peru	9
Trinidad and Tobago	28
Venezuela	30

Source: World Bank (1997)

Green national accounting data now exist for a number of countries, the most consistent and complete being the results published in World Bank (1997). Table 1 illustrates the value of resource depletion, using these data, for selected Latin American and Caribbean economies. This indicates the magnitude, R (as a % of GDP) that is subtracted in order to arrive at an estimate of gNDP. In turn, this reflects the physical depletion of commercial resources such as oil, metals (e.g. copper) and timber resources, each valued according to its market value minus cost of extraction (or harvest)

including a normal profit. The data show a range of average values across countries, from 3% in Argentina to 30% in Venezuela, over the period 1980–94. Clearly, given these magnitudes, it is conceivable that the correct accounting for resources, as a type of asset consumption, could make a considerable difference to how these resources are managed.

Most studies, to date, have focused exclusively on accounting for the depletion of commercial natural assets such as energy, mineral and timber resources (see, also, Young and Seroa da Motta, 1995; Soloranza *et al.* 1991; Vincent and Hartwick, 1997). For those economies dependent on such activities, accounting for depletion correctly is clearly central to the design of policies to manage resources prudently over time. However, for countries with few resources, where estimates of depletion are empirically insignificant, there is little practical sense in constructing accounts for commercial resources. This does not imply, however, that green national accounting is irrelevant but instead necessitates a change in emphasis according to the relative importance of particular policy questions. For example, air pollution is a considerable problem in many industrialised and industrialising economies. Accounting for the costs of this pollution could reveal important new insights regarding economic progress. Prince and Gordon (1994) estimate the cost of air and water pollution in the United States to be a near constant 1% of GDP throughout the 1980s. Hamilton and Atkinson (1996) obtained larger values in a study of the United Kingdom where it was estimated that the costs of air pollution alone varied between 3–5% of GDP during the same period. Markandya and Pavan (1999) also appear to show that the aggregate costs of air pollution across several European Union countries are similarly large.

Re-appraising the usefulness of 'Green GDP'

Despite significant interest in estimating alternative accounting aggregates, few if any countries have signed up to the eventual goal of estimating 'green GDP' in their green national accounting programmes. Existing studies have largely been conducted outside official statistical offices (although, for an exception, see van Tongeren *et al.* 1993 and Bartelmus *et al.* 1993). Several factors explain this reticence on the part of official agencies. Clearly, underlying the re-evaluation of economic progress is the potential political contentiousness of the results. To take a cynical view, the reluctance to provide a balance to the existing focus on GDP reflects

a traditional focus on public policies that often appear to ignore what is happening to the natural assets. This, however, is not the whole story. It is also argued that environmental goals are just as well served by observing physical indicators, as is the case with the measurement of unemployment rates, rather than by placing a dollar value on changes to natural assets and subtracting this from existing GDP (Brekke, 1997). Moreover, existing studies have identified a number of conceptual and practical problems that dispute the claim that gNDP is an indicator that can be both easily measured and has wide-ranging policy implications. It is worth considering some of these measurement problems in more detail.

While in principle gNDP is a better measure of income than conventional accounting aggregates such as GDP there is significant debate concerning whether this indicator is best thought of as a better measure of current rather than future welfare (Vellinga and Withagen, 1996; Dasgupta and Mäler, forthcoming). Much of this stems from the obvious difficulties that are encountered in trying to construct an indicator that provides information about development prospects into the far-off future. For example, a crucial determinant of the ability to sustain development is technological change (Weitzman and Löfgren, 1997). For the purposes of constructing gNDP, what must be ascertained is how much of this change is currently reflected in the national accounts (e.g. via investment in Research and Development) and how much is not 'bought' and 'sold' in markets in this way (Pemberton and Ulph, 1998). In doing so, some guidance can be sought regarding whether items reflecting technological change are reflected currently in GDP (and thereby gNDP).

An alternative, but equally important, criticism is that the focus on green alternatives to GDP does little to address the anxieties of those who advocate stronger forms of sustainability. For example, by valuing changes in resource stocks and environmental liabilities, the basic framework that we have outlined assumes that it is possible to substitute alternative assets, such as produced capital, for natural assets. The essential idea underlying ideas of strong sustainability is that a given amount of particular resources must be preserved intact, in order that these continue to provide critical (i.e. life-supporting) services (Pearce *et al.* 1989). However, while a green alternative to GDP has little to say regarding strong sustainability, it could be used in conjunction with indicators that do serve this purpose. The challenge is to provide policy-makers with a reasonable

signal that development is being financed by liquidating natural assets (or otherwise) rather than search for a single indicator whose upward or downward movements indicate whether development today unequivocally can be sustained into the far-off future.

Early debate was beset by argument regarding what adjustments should be made to existing accounting aggregates and how these adjustments should be calculated. The means by which pollution damage can be 'monetised' (i.e. valued) illustrates important aspects of these disagreements. For example, one idea was that expenditures made to mitigate environmental damage, so-called defensive expenditures, could serve as a lower bound estimate of the value of this damage (Juster, 1989; Herfindahl and Kneese, 1973; Daly and Cobb, 1989). At the heart of this argument was the proposition that these expenditures, e.g. on protection from pollution, are not genuinely welfare-enhancing but made in response to some welfare-reducing episode, e.g. exposure to pollution. A competing view was that, rather than concentrate on expenditures that have actually been made, what should be measured are the maintenance costs, that would be incurred if the environment was to be restored to some previous state (Bartlemus *et al.* 1993; Hueting and Bosch, 1992). Typically, maintenance cost is defined relative to an environmental standard or the level of environmental quality prevailing at the beginning of the accounting period. Lastly, other critics have argued that neither approach was satisfactory and that pollution should be valued directly, perhaps using non-market valuation techniques advocated by environmental economists (Pearce *et al.* 1989).

This disagreement led to a great deal of discussion of the relative merits of each approach without apparent resolution. This, in turn, has led to the perception that there was no clear way forward on the question of greening GDP. Nor did the international green national accounting guidelines published in United Nations (1993) offer an answer, instead opting to advocate several approaches including maintenance costs and non-market valuation. However, it is only by examining the theoretical basis of the national accounts that a deeper understanding of the problem can be achieved. In the pollution example, contributions from Mäler (1991) and Hamilton (1996) have convincingly argued that it is better to focus upon the value of the pollution itself (the source of welfare-reduction), rather than defensive expenditure (which is a welfare-enhancing adaptive

response to pollution). Furthermore, pollution should be valued according to damage caused (Hamilton and Atkinson, 1996). The price with which pollution is to be valued is known as 'willingness to pay'. That is, the amount of income that an individual will be prepared to give up in return for a small improvement in environmental quality. This gives the magnitude in 'dollar' terms of the change in the stream of benefits that society derives from the environment, arising as a result of pollution. Indeed, using maintenance costs may grossly understate, in plausible circumstances, the impact of pollution on human welfare. This could explain some of the divergence between the costs of air pollution, outlined above, in the Prince and Gordon (1993) study (which used maintenance costs) and the Hamilton and Atkinson (1996) study (which was based on willingness-to-pay).

Despite significant progress on settling methodological disputes about what should be measured and how, significant practical problems remain. In particular, the problem is to value these changes systematically for a whole country whereas most of the methods used by economists to value environmental goods (see, Bateman and Willis, 1999) are concerned with specific projects or assets. Determining how to add up values for a nation is a formidable problem. Furthermore, national accountants in general are reluctant to put monetary values on aspects of the environment, or other goods, which do not pass through markets. Specifically, it is argued that this requires that data providers exercise a far greater degree of judgement in assembling estimates of non-market values than is desirable. However, with the increasing experience of methods to value environmental goods, in particular with respect to estimating the social costs of energy use (European Commission, 1995; Smith, 1996) valuable lessons may be learned for the future.

Difficulties also have arisen in interpreting trends in gNDP both in a given year and over time. To reiterate, conventional wisdom held that economic progress might be re-evaluated in the light of: (i) a comparison of gNDP and GDP levels; (ii) a comparison of gNDP and GDP growth rates; and, (iii) the desire to measure sustainable development (e.g. growth of gNDP greater or less than zero). However, in practice, there are problems with each interpretation. Just because gNDP is some amount lower than GDP does not in itself yield interesting information to policy-makers (Hamilton, 1994). Furthermore, comparisons of gNDP

and GDP growth rates have also led to ambiguous policy signals. For example, Soloranza *et al.* (1991) found that for Costa Rica during 1970–89 the p.a. growth rate of both GDP and gNDP was 4.9%. Young (1993) found much the same parity between conventional and green growth rates in Australia over the period 1980–88. Finally, gNDP measures only *potentially* sustainable income. This does not in itself answer the question of whether the rate of saving is sufficient to maintain this income indefinitely. However, it is information that could provide policy-makers with valuable information regarding prospects for sustaining development.

Genuine savings and sustainable development

The above criticisms suggest that the direct policy uses of 'green GDP' appear to be limited owing to a mixture of methodological and practical considerations. However, it would be wrong to conclude that this activity has been a largely futile gesture. The basic framework used to estimate 'green GDP' can itself be used to construct an indicator of sustainability that avoids at least some of the ambiguities that have arisen as a result of the focus on gNDP and its growth rate. Pearce and Atkinson (1993) provided one of the earliest suggestions for this change of emphasis; an adjusted national savings measure that accounts for the depletion of natural resources and environmental damage. Hamilton (1994) terms this 'genuine' saving. Genuine saving (S_g) is defined as gNDP minus consumption (C).

$$S_g = gNDP - C$$

or,

$$S_g = S - D - R - E$$

For a definition of sustainable development as a development path along which welfare does not decline (Pezzey, 1989), this definition will be satisfied as long as genuine savings are not persistently negative (Pearce *et al.* 1996). Genuine savings represent the amount of saving over and above the value of asset consumption—i.e. the sense in which such savings are 'genuine' (Atkinson *et al.* 1997). What this means is that, while it is feasible, and sometimes desirable, to run down one type of asset

(e.g. resources) while building up stocks of another asset (e.g. produced capital), changes in the (real) value of assets should not be negative in aggregate.

The genuine savings rate is a one-sided indicator of sustainability in that it is only negative savings that will lead to non-sustainability. Hence, the measurement of a positive genuine savings rate at a given point in time is not sufficient to lead to the conclusion that the economy is on a sustainable path (Asheim, 1994) and further evidence must be sought before any judgement can be made. However, the policy prescription arising from measuring a negative genuine savings rate is clear: continuing dissaving is not sustainable and must be rectified (Atkinson *et al.* 1997).

Examples of the application of the concept of genuine savings to sustainability in the developing world can be found in World Bank (1997) and some of these results are illustrated in Table 2. In these estimates, genuine savings are defined as gross savings net of the depreciation of produced capital and resource depletion (see Table 1) (i.e. no allowance has been made for environmental damage). Nevertheless, the results indicate that, on average over the period 1980–94, genuine savings were negative for all countries featured in the table except Argentina, Brazil and Colombia. It is reasonable to speculate that this arose as a result of a failure to re-invest adequately the proceeds of resource depletion in alternative assets over this period. Put another way, several Latin American and Caribbean countries appear, on balance, to have been liquidating their assets. Understanding the reasons for this persistent dissaving and the design of policy responses to manage more carefully an economy's portfolio of assets in the future are integral to making good commitments to the goal

Table 2: Genuine savings in selected Latin American and Caribbean economies, 1980–94.

Country	Average genuine savings rate (% of GDP)
Argentina	2
Bolivia	–30
Brazil	6
Chile	–3
Colombia	2
Ecuador	–14
Guatemala	–2
Haiti	–7
Jamaica	–12
Mexico	–3
Peru	–1
Trinidad and Tobago	–23
Venezuela	–24

Source: World Bank (1997)

of sustainable development. The search for green national accounting aggregates may be the essential first step in addressing what has gone wrong with past development decisions.

Discussion and conclusions

A growing dissatisfaction with GDP has provided the impetus behind proposals to construct a better measure of income so as to provide policy-makers with a consistent and summary signal of 'true' trends in the economy both now and into the future. At its most simple, 'green GDP' or gNDP is defined as conventional GDP net of the value of net asset consumption including resource depletion and environmental damage. A large number of studies now exist that attempt to re-evaluate economic progress in this way. Although these studies have yielded useful information, it is arguable that the contribution to our understanding of development, arising as a result of the focus on gNDP, has been disappointing. One specific problem is how to evaluate prospects for sustainable development using this indicator where, in practice, the results of several studies have provided equivocal signals in this respect owing to a variety of methodological and data problems. Moreover, the theory of 'green GDP' suggests that it is unlikely that this indicator can perform this function even in principle. Nevertheless, rather than throw the baby out with the bathwater, a more optimistic interpretation is that while the focus on green national accounting aggregates is not misplaced the predominant emphasis on gNDP is. A more useful emphasis is on improved measures of saving thereby providing a better link between actions in the present and their implications for the future. Clearly, however, many problems are generic, rather than applicable to a specific accounting aggregate, such as the valuation of air pollution and stronger interpretations of sustainability than is implicit in green national accounting. With regard to the latter, policy-makers require a range of indicators. Some might be based on the idea that physical stock size, of critical natural assets, should not fall below a threshold level while others, such as the rate of genuine saving, will be based on more flexible criteria. This allows policy-makers to balance the conservation of certain natural assets within a broader goal of managing the portfolio of assets held by an economy over time, thereby capturing much of the essence of the sustainable development debate. That policy-makers can not rely exclu-

sively on a single indicator to inform complex questions such as those surrounding the goal of sustainability should come as no surprise.

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