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**Internalizing Environmental
Assets: An Environmental
Accounting Perspective**

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Abstract

Increases in national income are usually treated as economic growth. If large enough to produce increases in per capita income, they are generally considered as welfare enhancing. Yet, at the same time, these increases in national income might be accompanied by severe destructions of the most fundamentally scarce resource at man's disposal, the environment. Traditional economics has overwhelmingly treated such destructions as external to its analysis, models and information systems. Conventional methods of national accounting are no exception, in that only market transactions are recorded. With the growing awareness that long-term sustainability is now under threat (as a result of the current abuse of environmental resources), a large number of social scientists are now calling for rethinking traditional economic analysis of the relationship between the environment and the economy. In particular, there have been attempts by "green economists" to establish a new tradition of national accounting, "green accounting", which advocates including environmental and resource considerations as part of income measurement and variations of assets. This paper discusses an extension to the conventional economic accounts. In this paper, we take a similar stand and propose a framework of GDP measurement which treats consumption of environmental stocks as any other type of private capital consumption.

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1. Introduction

The current system of national accounts was developed almost five decades ago by the United Nations. For more than two decades now, the system has been heavily criticised by social scientists for neglecting important environmental resources (and for other shortcomings). Yet today, it is still to a large extent the same system used all over the world to provide aggregate measures of national economic performance. Standard Gross National Product (GNP) and Gross Domestic Product (GDP) measures continue to be the main indicators for economic welfare and progress of a country.

"Green" economists are among the social scientists who have been advocating a modification of the standard accounting system. They are of the opinion that economic activity is limited by the physical availability of natural resources (Daly, Peskin and El Sarafy, 1992). On this basis, traditional economics should pay more attention than it is already paying to the interaction between the natural resource base and economic activity. A greater consideration in national accounting should be given to society's long-term environmental ability to sustain drawing resources necessary for production and dumping waste.

In particular, changes in any country's natural resource base (comprised of subsoil, natural plants and animals, oceans, lakes, and rivers and their aquatic life, and the atmosphere and its meteorology) should be kept in check; because those changes determine the future's productive capabilities. These resources provide services and resource flows that constitute inputs into current and future production and consumption processes in every economic system. Since renewable and non-renewable resources directly affect economies, national accounting should reflect the change of natural resources base. It should also reflect the change in quality of the environmental product resulting from releasing pollutants and substances that disrupt the earth's balance, the quality of life and the very existence of the human race.

The interdependence between the economy and the environment calls for rethinking traditional national accounting. But as economists, we cannot rethink national accounting unless we first reconsider our position about the environment in economic analysis. The environment should not be just an "externality" in economic analysis, models and information systems. Treatment of the environmental dimension should be "internalized". The connecting links between the environment and market commodities have to be recognised as very much internal to the abstract world of economic modelling. Economic theory teaches us that "internalizing" externalities actually leads to an improved allocation of resources in the Pareto sense. Green economists advocate the use of market incentives for environmental costs internalization. They reflect a philosophy of making agents accountable for causing environmental impacts. It is this proposed approach that is at the heart of greening the fundamental economic information system, the national account.

The case of the Exxon Valdez oil spill is typical in that no value in national accounts was put on the adverse impact of the degradation on things like wild life and recreational opportunities. If anything, the cleaning efforts of the spill were perceived as growth generating because of the economic stimulus initiated in the process. However, there was little doubt that the overall effect on the Alaskan environmental stock as well its economy was negative, considering the damages to wild life, and the natural resource base of the region (fisheries, tourism, etc.). But the well-being indicators did not account for all the damages. This is a typical case of the conventional national accounting system failing to record in the national balance sheets every

good as a good and every bad as a bad. Rethinking economics might thus usefully begin by valuing stocks of environmental assets at the margin and measuring flows of environmental services from them.

The purpose of this paper is to shed some further light on the general economic principles and theories underlying the notion of green national accounting. The paper also proposes an alternative to standard GDP accounting based upon internalizing environmental effects. It will be argued that this alternative measure leads to improved indicators of the phenomena underlying economic performance of a country. Section II of this paper is devoted to a brief description of the current national accounting system. Section III discusses the need for an alternative system. In Section IV, a simple framework based on accounting for environmental costs in the value added is proposed. Section V is devoted to concluding remarks.

2. National Accounting Calculation

The conventional methods of accounting for national income are part of the United Nations System of National Accounts (SNA), first published in 1942. The accounts consist generally of three sectors accounts (industries, government and households), for which output, income, or expenditure are measured. The system was based upon J.M. Keynes' (1936) ideas, that emphasised macroeconomic variables such as employment, aggregate demand, and income. Fundamentally the system provides an index of a country's tangible income at different points of time, facilitating inter-temporal and international structural comparisons.

The basic social accounting measure of the total output of goods and services is called the gross domestic product (GDP). GDP is defined as the total market value of all final goods and services produced in the economy in a given year. There are three different approaches of looking at GDP: the expenditure, production and income approaches. That is, GDP can be determined either by adding up all that is spent to buy a year's total output, all values added, or all incomes.

3. The Need for Green Accounting

The traditional national accounting practices have been criticised for producing distorted indicators of economic performance, growth and development. Hueting (1989) and Repetto et al. (1989) relate some of these distortions to:

1. the failure to address the scarcities of natural resources that threaten the sustained productivity of the economy;
2. the failure to address the degradation of environmental quality from external effects in production and consumption activities; and
3. the failure to address the accounting for environmental protection expenditures as social costs.

A similar view was expressed by Daly (1989), that the conventional national accounting system does not include changes in natural stocks and funds, such as depletions of geological stocks, and deteriorations and disruptions of ecological funds of other species upon which we depend. These environmental depletions are not accounted for in calculating changes in stocks and funds. Likewise, the resulting losses of current services of environmental functions are not subtracted from the value of current services from production. For example, conventional accounts never show the value for the negative impact of waste disposal services, nor do they show impacts of defensive expenditures to counter pollution because there are no market transactions associated with them. Obviously, the omission of such factors raises questions about the reliability of standard GDP as a welfare measure. For the same reasons, Brown (1993) holds conventional national accounts as partially responsible for the degradation and destruction of the economy's environmental carrying capacity and support systems. From this perspective, GNP and GDP have been considered as *diabolic indicators*, misleading policy makers into wrong focuses with little accuracy in terms of utility and welfare (Huetting, 1989).

Green accounting (or environmental accounting) has been suggested as an alternative in addressing this discriminatory treatment by treating depletion and deterioration of natural resource as capital consumption. This includes any loss of value of natural resources as the result of our consumption and production patterns. Such a method of measuring the national product or national income is imperative for understanding sustainable social net national product and sustainable development in general. Green accounting attempts to correct the distortion in the conventional national accounting by addressing depletion and deterioration of natural resource capital. The argument calls for treating consumption of natural resources as regular capital consumption.

Including environmental information in published reports, accountants would be doing more than just communicating and transmitting data, they would be establishing an accountability relationship. In conformity with this view, some Australian corporations are now reporting some environmental information in disclosing financial statements. Coopers and Lybrand (1992) report that 63 percent of 272 respondents from a sample of 1000 Australian corporations indicated that they have now undertaken an environmental audit. This represents an increase from 39 percent in their 1991 survey.

Most of the proposed solutions to the problem of lack of inclusion of environmental capital changes in the literature would require expanding of the current system of accounting. Peskin (1994) argues that this would be unavoidable as additional items will have to be added and/or satellite accounts will have to be created. One of the simple approaches to address the problem is to record environmental expenditures, such as pollution control and treatment plants, as part of GDP calculations. This approach would require no major modification of the current accounts structure, but would provide real figures of amounts spent in pollution control by firms and capital consumption reposition. However, this approach will not make it possible to evaluate the net impact on welfare of changes in environmental capital stocks.

A second approach is to account for physical flows of resources and pollutants along with other flows of regular accounts that describe economic activities. For practical purposes, a ratio of resources to output could be developed. This ratio would show with a negative sign with the likes of waste and pollutants. The main drawback of this approach is that it would not lend itself to feasible aggregation because of the variety in physical environmental resources.

Another approach is based on the proposition that resources ought to be valued by their market worth. In which case, there would be a need to approximate present values of the future net income or future rent that could be derived from the resources use. It must be noted though, that in this case, prices (or present values) would change as preferences, needs, and values of people change with time. In other words, present values would require periodic revisions, which would obviously be a complicated process.

The recent modification of the United Nations SNA (Inter-Secretarial Working Group, 1994) provides a means to examine how deteriorations and depletions of the environment and natural resource base might be addressed. The revised system provides a broader framework capturing some of the external and other imputed environmental costs and benefits. But it is still far from being a comprehensive practical system.

In this paper, we propose an alternative approach of green accounting. The following section introduces a methodology based on environmentally adjusted value added.

4. Environmentally Modified Aggregate Accounts

It is well known that conventional gross domestic product is equal to the sum over all public and private firms of their value added. That is,

$$(1) \quad \text{GDP} = \text{VA}$$

where GDP is the conventional gross domestic product and VA is aggregated value added.

The above aggregate is generally regarded as a proxy for national income. The rationale for this is that the value added gives rise to factor payments to the national factors of production owners. As argued earlier, however, this conventional measure cannot be a reliable indicator of well being. An improved version of the identity given by equation (1) has to account for changes in the environmental capital stock. The main problem with this identity is related to the fact the value added commonly used in national accounting is generally a biased estimation of the true "social" value added. Indeed, a firm's value added is defined as the excess of revenues over the amount paid to other firms to intermediate goods. So, if every value added by each firm is given by a separate VA^i ($i=1\dots n$), then VA^i would be:

$$(2) \quad \text{VA}^i = \text{R}^i - \text{I}^i$$

where R^i and I^i are dollar revenues and amounts paid to intermediate goods, respectively.

From this perspective, if in the process of production, a firm pays \$1 to another firm for the services of an intermediate capital good, that dollar will be charged against GDP. But if it uses a free of charge environmental service (which might be as essential an input of production as other inputs acquired from the market), it would have zero impact on the value added and zero impact on GDP, later on when national accounting is done. So, if two firms spend exactly the same amounts of intermediate goods and generate equal revenues, they will show equal value added on national accounting sheets regardless of the likelihood that one of them might be

dumping toxic waste and the other planting trees that contribute to a better quality of air in the neighbourhood. Our proposal of a modified GDP concept calls for recording the damage when there is one. That is, record the social cost that is jointly produced with the market good. In which case, the individual firm value added would be:

$$(3) \quad \text{EVA}^i = R^i - (I^i + \text{NEC}^i)$$

where EVA^i is the environmental adjusted value added for firm i , and NEC^i represents the net environmental cost produced by firm i in the course of production. The reason for having "net" cost in the above specification stems from the possibility that businesses might produce some environmental benefit which would have to be charged against the cost. Following equation (3), the environmentally modified GDP would be:

$$(4) \quad \text{EGDP} = \text{EVA} = \text{GDP} - \text{NEC}$$

where, EGDP = environmentally modified GDP
 EVA = environmentally modified VA
 NEC = aggregate net environmental cost

This implies that the environment is treated as a form of social capital. It is certainly a type of capital for which the management is not performed by the market. But it is still a capital that is essentially similar to other types of tangible and human capital. Because income originates from capital (of all forms), failure to internalise variations in environmental capital would certainly produce an income that does not reflect the true opportunity cost to the society, which cannot be an accurate measure of well-being.

In the absence of a careful appraisal, the definition given by equation (4) could be perceived as conducive to double counting. The possible basis for the argument would be that environmental degradations are already accounted for in the conventional way of measuring GDP, and thus should not be identified as separate social costs of production. After all, an environmental damage produced by one firm generally translates into a productivity and sales losses for another firm. This would obviously lead to a reduction of the value added of the latter. From this perspective, reforming national accounts in the way proposed by equation (4) would only lead to double counting of the environmental damage.

However, the argument outlined above is only partially correct. Reduced sales are not the only adverse effects of environmental degradation. For example, if toxic waste is damaging a river, some damage will show up in reduced sales of fish. But on top of this, there would also be losses of opportunities for recreational activities for people who derive welfare from swimming in the river. There might even be a cost to the society in terms of human suffering by the people who become ill from the waste. Such costs will obviously not be accounted for within the conventional system of national accounts.

While we believe that the GDP specification given by equation (4) would produce an improved measure of social well being, we realise that it would be substantially more difficult to calculate than conventional GDP. The main reason relates to the fact that the above proposed definition would require measurements of information on matters such as the quantities of toxic waste and polluted air emitted by each production activity. What makes such a task even more difficult is the need to go beyond physical information (e.g. the mere quantities of toxic waste and polluted air). The main difficulty is the valuation of the damage (rather than how much damage). For valuation purposes, economists have been used to "price times quantity". But as discussed earlier, the environment is a stock of capital not managed by the market. So there is no market cost or price for a damage that for example leads to ruining a recreational resort.

Various valuation methods for environmental damage or benefits can help in this regard. Such methods have been proposed in the literature to assess the pros and cons of environmental and non-environmental programmes or projects. One of these methods is direct valuation which would make it possible to assess a variety of factors, including:

1. losses or gains in productivity from environmental impacts on the resource base of production (for example, losses of fish catch in polluted water);
2. losses of earnings from health effects (including fatalities), for example, of contamination with pollutants; and
3. actual defensive expenditures as a minimum estimate of environmental benefits (by demonstrated willingness to pay).

Techniques like contingent valuation methods can also be used in this process. But it might be unavoidable to have to use approximations of the type that consists of setting certain targets of environmental quality and later on estimating the cost of achieving them. The environmental damage would then be approximated by those cost figures.

Other approximations can be conceived with a newly established tradition of environmental reporting. This would be possible if the private sector is willing to disclose environmental information associated with the production activity, as it discloses information about value added. But businesses do not usually voluntarily disclose information beyond that serving their strategic choices. For this reason, it is our belief that a system that compels companies to legally provide a periodical environmental report has to be established for national accounting to be reformed. As a general principle, this arrangement would require companies to identify and characterise the flows of waste material they generate in each step of their production processes. A detailed composition of these flows would in this case be reported (e.g. levels of CO₂ emissions, toxic waste, etc...). The information acquired could later on be used by national accountants to foster more reliable approximations of the impact. We realise that with such a system, there would always be the administrative cost, and also risk of false reporting. But the administrative cost of collecting taxes and risk of tax evasion never stopped countries from having efficient tax systems. Likewise, it is conceivable that reliable means of environmental reporting could in the long-term be fostered.

5. Conclusions

This paper identified some problems with conventional accounting. It was argued that accounting for changes in a nation's natural resource base and its welfare impacts should be included in national accounting to provide an improved measure of well-being. Alternative approaches by other scholars (e.g. Peskin, 1994; Daly, 1989) researching better links of the economic activity and environmental activity were briefly discussed. Internalizing the externalities was the proposed method in this paper of reflecting the values of physical impacts of production on the current supporting environmental system in national accounting.

The accounting approach proposed here, if adopted, in addition to providing improved welfare indicators, would also in the long-term produce more adequate macro information pertaining to sustainability, as it would reflect more accurate measurements of a country's production and consumption of its natural resources in an aggregate assessment. That is, the true carrying capacity of the natural systems as bases of the economic system would be better explored in the green accounting framework we proposed, simultaneously with the goals of long-term economic growth. The information content of numbers reflecting the true opportunity costs to the society would certainly be an improved data. On this ground, environmentally adjusted accounting would provide what Power (1992) considers to be our hope in finding administrative solutions to the ecological and environmental crisis.

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