ENVIRONMENTAL ACCOUNTING - CONCEPT, RESOURCES AND LDCS

INTRODUCTION

National income accounting or Social accounting is an important concept that follows the procedure of adding different values. On the one hand it is a flow of income accrued to different factors of production such as land lab our, capital and entrepreneur who receive income for their contribution to production in the form of wages, rents, interest and profit, on the other hand it is flow of goods and services i.e. product flow. This concept is significant for categorizing different countries as developed or developing. It also shows that how the country is performing economically. This concept of national income accounting does not take into account the exertion exploitation and depletion of natural resources. However for the study of environmental and development issues we must incorporate the natural resources of all types so as to know less of environmental and the extent of adverse consequences of exploiting natural resources beyond limit.

Hence the accounting of income to be developed accommodating all the resources, including the use and abuse of renewable and non-renewable resources. That is all about sustainable accounting. Only with such an accounting system are the linkages between environment and development better understood.

The concept of resource accounting started almost three decades back, at the end of the development methodologies for project evaluation in the early 1970. The procedure has been evolved gradually after identifying the gaps in the system of national accounts (SNA). SNA has one basic deficiency that it can take note of only such production and consumption processes where there is a market price.

Talking of sustainable accounting, two additional difficulties are to be noted. First non-imputation of the values of environmental good and services use in production processes, and second absence of any

allowance for depreciation, degradation, or depletion of natural resources. Improvement in the methods of SNA were debated in the 1992 United Nations conference on environmental and development (UNCED) held at, Rio de Janeiro. Which recommended all nations and the United Nations in particular to develop a system of Integrated Environmental and Economic Accounting (IEEA)

What is Economic Accounting?

The conventional system of national account (SNA) was first started in the United States of America in 1942. The starting point for such accounting is an identity, all valued in market prices.

Aggregate demand = Aggregate supply or ,

Domestic production + imports = intermediate use in production processes + private consumption expenditure + public consumption expenditure + gross investment + export

using the input = output transactions framework, the gross domestic product (GDP) is defined as :

GDP = Domestic production - Intermediate use consumption

= Private consumption + public consumption + gross investment + exports - imports.

For any accounting year, some further adjustments such as adjusting for changes in the stocks of goods may become necessary. The method of SNA is basically arithmetic, tracing all flows of incomes or goods and services in the economy in an accounting year.

An added element to SNA is the statement on the man-made capital stocks in the economy. The accounting identity for this is:

Closing stock = Initial stock + investments during the accounting period - capital depreciation

According to Hicks National income accounting is providing the basic principle to define income as a welfare indicator. He allocated the inclusion of all current consumptions that do not impoverish future consumptions. He also pointed out that the man-made capital is important since it contributes to national income, but its depreciation over a time (e.g. machine) should be subtracted from national income in order to get net nation income of product (NNP) Hence we have (NDP) = GDP-D Where D is a depreciation

An environmentally adjusted NNP would be conceptually expressed as follows

NNP = GDP - dm -dn

Where NNPe represents the environmentally adjusted net national income and dm is depreciation of physical capital and dn is the depreciation of natural capital assets.

INTEGRATED ENVIRONMENTAL AND ECONOMIC ACCOUNTING

The main objective of environmental and economic accounting is to expand existing systems of national economic accounts in order to integrate environment and social dimensions in the accounting framework. Alternatively, at least satellite system of accounts for natural resources be developed to arrive at what is currently being coined as Green GNP.

One of the first questions to answer is, can the logic of depreciation be extended to exhaustible resources? The answer is no. The case of exhaustible resources is of course different. Extracting it now can in no way assure constancy or improved welfare in the future. In non substituting society, therefore, the Hicksian measure of income from the extraction of an exhaustible resource is subtracting the value of all such extractions. The incomes of the countries that are heavily dependent on extractive activities for instance, if a country's income were coming only from crude oil extractions, then it would imply that

its national income would have to be treated as zero ! The only solution to this puzzle was given by the modified Hart wick rule defined earlier, which suggests that along the equilibrium path as long as the rental income from the resource is reinvested the future income stream will remain constant. This also makes investing on capital formation and resource development legitimate expenditure towards welfare.

Take the case of forest resources. Forests are part of the natural capital of a country. Can one develop an accounting for it as easily as for man-made capital? The answer is 'yes' in theory, but difficult in practice. (1) The major difficulty arises from the distinction between depreciation and depletion. In the case of depreciation, it can remain as a national value judgment. The same cannot be said about natural resources when they actually degrade and deplete (2) Second accounting for additions to forest stock in not easy. It takes place both through natural regeneration and plantation for each of these one ought to have good data and information about the survival rates. In other words, it is not as simple as accounting for capital formation in the usual national income accounting sense. (3) Third, the flow from forest stocks is only partially accounted as legal extractions; much of it is not. Then there are several natural phenomena such as forest fires landslides, earthquakes, floods etc. On account of which there are changes in this natural capital. In short, physical accounting of forest stock and flows is a complex task.

Consider another example that of air quality an environmental resource for sure.

Its accounting will have to take note of the pollution added by the industries the carbon sequestration done by the forestry sector, additional defensive and preventive investments done by individuals and the government to prevent hazards from degrading air quality, externality costs such as medical expenses incurred by individuals due to degraded air quality and many more. A short cut to these actual

accountings is to assume an optimal pollution abatement strategy and account for its costs. The figure given here shows an analytical method of deriving the optimum pollution level and the polluter pay price for it. MEB is the marginal benefit from abatement where as MEC is the marginal cost of abatement. The level of social tolerance of pollution is ow* whose social value is oc* to be charged as polluter pay charge.

Next is the question about non-market values of natural and environmental goods and services in the accounts. This raises the question of linking valuation natural resources with income accounting. Weitzman (1976) and Hart Wick (1990) among offers developed analytical models linking valuation of capital and other resources with income accounting.

An alternative satellite accounting was developed by UN agencies (UN - 1993). Under this alternative stock and flow changes in environmental resources be treated in a separate table, leaving the basic SNA uncharged.

As far as integrated income accounting is concerned, some progress has been made at least on the empirical side. Parikh (1992), UNDP (1993), UNEP (1993), Perkin (1989), among many others have suggested methods of gracing national income accounting by going back to the basic structure of the macro economy seen in terms of an input - output transactions table. This basis comes from Leontief (1966) and Stone (1961). The approach starts with identifying all such sectors which are environmentally and natural resource wise significant. Flows of outputs or services from those natural and environmental resources (or factors) used as inputs by others are to be identified. Additional columns of consumption, to account for flows from natural and environmental resources directly in the form of final use, are also incorporated. The modified input-output table can be used to define the adjusted value added as well as final consumption, accounting for environmental and natural resource uses. In this manner one would

have accounted for the use of natural resources both as intermediate inputs as well as final use consumption. The method is quite appealing, simple in description, but is equally complicated to implement. Economist need not be reminded about the complexities in estimating even the regular input-output tables of an economy.

Parikh and Parikh (1997) have further elaborated on the system of Environmental and Economy Accounting (SEEA) as developed by the United Nations. They provide a definition of Green Net National Product (NNP) shown in the following box.

Box : Input-Output based SEEA

Net National Product = value of consumption of normal goods and services

+ value of production of nature collected (such as fuel, wood biomass)

+ value of environmental amenities provided by environmental resource stocks (such as clean air, top soil)

+ value of leisure enjoyed (say in enjoying aesthetic beauty of wildlife - resource

+ value of net additions to production capital

+ value of net additions to natural capital stocks (such as plantations in forests or depletion of exhaustible resources)

+ value of additions to stock of defensive capital (such as water purifier)

ISSUES OF SUSTAINABLE INCOME ACCOUNTING

In relation to sustainable income accounting there are number of issues both at the theoretical and empirical levels which can be analyzed as under:

(1) The issue of defensive expenses

In sustainable income accounting this issue needs to be carefully delt with. These expenses are incurred by the society as precautionary expenses against facing the externality effect of environmental degradation. For example the purchase of a water purifier to protect against deteriorating water quality. How to treat this cost incurred by the society for sustainable income accounting? How to put this within the framework of SNA. Similarly expenses incurred to get clean air, and other natural resource depletion costs, have also the same problem of their entry into sustainable income accounting. However there are two ways in which defensive expense can be considered as part of consumption Expenditure. Alternatively, they can be treated as a negative regeneration, that is, substitution instead of regeneration.

The alternative method of treating defensive expenses as negative regeneration with the sustainable income accounting methodology can be useful in understanding implications of public investments on environment related defensive expenses (e.g. urban solid waste incineration plant).

(2) Maintaining balance in account

Income accounting is a balance between income and expenditure. It is not enough to account for externality only at the level of expenditures. There has to be a balancing account at the income or value added levels. How does one deal with income earned from working with environmental management programs? For instance a pollution abatement program creates value added in terms of wages and profits, but from the expenditure side, it does not improve the welfare of people paying for it. This disequilibrium impasse can be resolved by assuming a full employment situation, where labour deployed in pollution abatement is considered to be a transfer from normal goods production, with no change in welfare and value added.

(3) Issue at the stage of estimation

As a starting point, depending on data availability, only a few of the natural resources are perhaps accountable. The question of the validity of dealing with only a select list of natural resources for accounting and integrating with the SNA, when the natural resource endowments of an economy consist of many more such resources. The notable ones that are normally left are renewable resources and biodiversity.

(4) Long term consideration

SNA is a flow income accounting system. Welfare benefits from preservation of natural resources have a long stream of benefits. In a strict theoretical sense, such benefits cannot be easily written off under current income or welfare streams. This issue gets more complicated particularly because of the fact that preservation can be costless. But it involves sacrifice of current consumption from developmental use of natural resources. Therefore, care should be taken to spread preservation benefits over a long term horizon.

(5) The issue of double counting

The double counting is a very common problem in national income accounting. The same environmental services are doubly counted. For instance, timber after falling from the forest has a price reflecting its use or utility value. But it has emerged out of carbon sequestration function of the forest, abating global climate change (having a non use value). Now how does one segregate its use and non-use values? To further complicate matters what is to be done if the security value of forests is also to be accounted along with the timber and non-timber values? A practical approach is to treat part of the use value as additional option value or non-use value.

(6) The issue of integrating the values of natural resources with national income accounting.

This has one theoretical problem. The value of environmental resources are elicited, broadly based on two methods, namely 'revealed

preference' values and 'stated preference' values. Values derived from market prices refer to revealed preferences. Many others are based on stated preferences (‘non-use' values or even 'use' values for non-marketed goods and services deduced from say a contingent valuation method). It is here that an inconsistency can arise when all such values are to be aggregated knowing that different valuation methods follow different pricing systems. Only some empirical norms of adding such revealed and stated preference values have been developed.

Therefore, the task of bringing valuation and income accounting closer is still far from complete. On a theoretical basis, there is no guarantee of an integration of these two, so as to arrive at a system of adjusted national income accounts (UN, 1993)

Taking all these issues into consideration can one at least conceptually define an integrated sustainable income? The steps involved in deriving such an adjusted income measure are shown in the following box.

Box - A Conceptual Model of Integrated Environmental and Economic Accounting

Adjusted Net Domestic product = The usual UN definition of net domestic product minus adjustment for exhaustion of deflectable natural resources (with appropriate shadow prices) minus social cost of degradation of environmental quality and quantity (again in appropriate shadow prices) plus preservation benefits enjoyed by the society (after deriving its annual benefit streams, for which perhaps no payment is made by the society) plus employment benefit of labour employed in preservation activities (valued in terms of its own opportunity costs) plus regeneration cost incurred (valued in shadow prices)

Environmental accounting - An algebraic presentation

Towards environmentally adjusted national income accounts

$GDP = C + Ig \qquad (1)$

GDP = gross domestic product

Ig = gross investment

C = Private and public consumption

The equation shows the expenditure flow.

By subtracting depreciation on capitation from GDP we get Net National product (NNP)

NNP = GDP-dm (2)

dm = represents value for the depreciation allowance for capital

An environmentally adjusted NNP would be conceptually expressed as follows:

NNPe = GDP - dm-dn (3)

Where dn is the allowance for the depreciation of natural assets (overfishing, deforestation, overgrazing, excessive soil erosion etc.)

Environmentally Adjusted 'Sustainable'

National income accounting (green accounting)

At the macroeconomic level this can be interpreted as the maximum amount that can be spent by nation during the give year, while making, sure that capital assets remain intact so that productivity in the future is not compromised by lack of sufficient capital. This concept of income is clearly consistent with the weak sustainability. Thus using weak sustainability as a tool, we reinterpret identity (3) as follows

NNPe = GDP - dm-dn (3)

NNPe = (C + Ig) - dm-dn (3)a

In summary, the two conditions for an environmentally adjusted sustainable flow of national income can be stated as :

1. NNPe shown in above equation, indicates the amount a given nation can produce or consume without undermining its capacity to produce the same amount in the future.

2. Furthermore, for the above condition to hold, nations are expected to reinvest their saving in such a way that their productive capacity will remain intact.

The environmentally adjusted net domestic product (EDP)

The 1992 Earth Summit in Rio de Janeiro declared sustainable development to be the key to integrating social, economic and environmental dimensions of development into planning and policy making. Its Action plan, Agenda 21, considered combined environmental and economic accounting as 'a first step towards the integration of sustainability into economic management.'

This development led to the creation of the system of Integrated Environmental and Economic Accounting (SEEA). Its primary purpose is to provide a systematically organized set of aggregate environmental and economic information for which indicators of performance can be derived. The SEEA was revised in 2003, although without much structural change. Structurally, the SEEA comprises four major categories of account: flow accounts for pollution, energy and materials; environmental protection and resource expenditure accounts; natural resource asset accounts; and valuation of non-market flow and environmentally adjusted aggregates.

Despite many difficulties, using SEEA database has now become common practice to measure (EDP) on a country - by- country basis.

The EDP per capita is computed by deducting environmental costs from net domestic product and dividing it by the total population of the nature under consideration.

EDP/P = (NDP-E)/P -------(4)

Where Ec and P respectively represent environmental costs and population. The environmental costs include: expenditure on environmental damage controls, the depletion of exhaustible resource, and the degradation of environmental assets.

Genuine Savings (GS)

The concept of environmentally adjusted indicator of sustainability was developed under the sponsorship of World Bank (WB) and has been utilized by many countries as a policy guide for their sustainability initiatives. The indicator operates within the general framework of the SNA and uses environmental statistics from the satellite accounts of SEEA. The main idea behind the genuine savings as an indicator of sustainability is straight forward and it is imputed using the following formula :

GS = (GDP-C) - dm - dn + he - ed

Where

GDP = C+ Ig, as defined in eg. (1)

GDP - C = gross domestic investment, Ig

dm = the depreciation of human-made (produced) capital

dn = value of resource depletion

he = the value of investment in human capital

ed = imputed value of environmental degradation

The Index of sustainable economic welfare (ISEW)

Herman Daly (an economist) and John Cobb (a theologian) conceived the basic idea of what is now know as the index of sustainable economic welfare (ISEW) in their book for the common good (1989). The aim of this index has been to combine the economic, ecological and social aspects of human endeavors, which are often separated. Furthermore the ISEW is used as an indicator of economic performance

in the way as GDP, EDP and GS, but has the added benefit of being used as a yardstick for measuring economic well being.

How to compute ISEW?

step - 1 Starts with the personal consumption expenditure (PCF)

step - 2 weight the PCE, with an index of income inequality (i.e. give coefficient)

step - 3 Estimate the rate of consumption of consumer durables (by finding the difference between the cost of consumer durables and the service annually yielded by previously purchased consumer durables.

step - 4 determining the annual rate of consumption of publicly provided capital, e.g. high ways, schools, national park etc.

step - 5 impute the value of the services of unpaid household labor

In summary, ISEW per capital is computed by the following way:

ISEW / P = [a(PCF)+D] / P

PCE = personal consumption expenditure

a = parameter of PCE to inequality

P = population

D = The difference between the expenditure on consumer durables and service flows from consumer durables + services obtained from the portion of publicly provided capital goods + the services provided by unpaid domestic labor - the defensive social and environmental costs - the sum of the allowances for the depletion of exhaustible resources, the overuse of renewable resources, and the external costs to future generations arising from long term environmental damages. It is important to note that for the ISEW to meet the condition of sustainability, capital stock needs to be intact

Summary

Modifying national income accounting systems to promote an understanding of the links between the economy and the environment is a first step towards the integration of sustainability into performance indicators of national economics. With this in mind here we have explored the recent advances in the development of environmentally adjusted indicators of sustainability within the general framework of the system of national income account (SNA)

The idea that conventional SNA does not explicitly consider the costs of natural resource depletion and environmental degradation has been firmly established for some time. Hence, to the extent that the SNA has this well- recognized shortcoming, it renders GDP to be ineffective indicators of environmental sustainability.

Thus the two major challenges facing international effort to develop a green national income accounting that is anchored within the general framework of the SNA have been :

1. The restructuring of the SNA at a fundamental level so that it well include the needed environmental data, and

2. The development of valuation techniques such that the environmental data are monetized as much as possible.

It was to this end in 1993 (a year after Earth summit in Rio) the SNA was revised so that, for the first time, it incorporated a ' satellite system' for organizing hard data and other information pertaining to natural resources and the environment.