

## **CHAPTER I**

---

### **INTRODUCTION**

---

---

---

---

Environmental and natural resources issues have risen to the top of the political ferment during the last two decades. Concerns about energy consumption and the degree to which national forests should be used for timber production or protected wilderness areas are examples of continuing resource policy issues. Environmental problems such as the *Exxon Valdez* oil spill, the depletion of the ozone layer, and the threat of global warming have focused national and international attention on environmental issues.

When analyzing public policy, decisionmakers often turn to the national accounts. If properly done, national accounting can be a useful instrument for economic analysis and policy evaluation. The accounts can indicate variations in economic activity, the amount of saving and investment, and the mix of industrial activities, among other patterns (see Box 1). Total indicators derived from the national accounts--such as gross domestic product (GDP), which measures the level of economic activity within the economy--shape perceptions about economic growth and well-being. Moreover, detailed data in the accounts can help to predict the effects on employment and output of actions ranging from a broad-based energy tax to restrictions on logging in national forests.

Although the national accounts provide useful information about economic activity, their ability to inform policy is limited. Total economic indicators from the accounts do not incorporate even the most basic changes in the natural environment. Ecological catastrophes can appear as short-term economic stimuli because many of the negative effects on recreation, wildlife, and future harvests of fish and timber, for example, are not recorded. The depletion of natural resources such as oil, gas, timber, and fish stocks count toward current income and profits, but the accounts do not indicate the potential loss of future income from overuse or exhaustion of these resources.

The national accounts were designed to help government understand the processes that produce current income and future wealth. It is generally acknowledged that natural systems interact with economic affairs. If the linkages between the two are not considered, the national accounts can provide distorted and potentially misleading measures of economic progress.

**BOX 1.**  
**THE BASIC FUNCTIONS OF THE U.S. NATIONAL ACCOUNTS**

The U.S. government organizes its national accounting system into four major components: the national and income and product accounts (NIPAs), which record transactions involving final goods and services; the input-output (I-O) tables, which record the flow of goods and services between industry sectors (intermediate goods) and flows between industries and final consumers; the flow of funds accounts, which record transactions between financial sectors; and balance sheet and revaluation accounts (hereafter referred to as balance sheets), which record changes and sources of changes in the value of tangible reproducible assets, land, and financial assets held by the private sector from the beginning to the end of each year.<sup>1</sup> Some documents of the Bureau of Economic Analysis also list the balance of payments as a separate account, although its information is mostly repeated in the foreign transactions section of the NIPAs.

The basic functions of the national accounts are to provide an economic interpretation of changes in the nation's assets and wealth, to provide measures of current economic activity and income based on the actual or imputed market value of goods and services, and to measure financial and input flows in the economy.

**Providing an Economic Interpretation of Changes in the Nation's Assets and Wealth:** The balance sheets serve this function by recording the value of national assets at a given point in time. Changes in national wealth are evaluated by determining the change in value of assets over the accounting period. Changes in the value of assets are attributed to the combined effects of capital consumption, capital formation, and revaluation due to capital gains (each component of change in value is recorded separately in the balance sheets). Capital consumption is an estimate of depreciation of the fixed capital stock caused by age, use in production, and accidental loss. It is an estimate of that part of current output that should be set aside to replace the physical capital that has worn out or was destroyed.

---

1. Department of Commerce, Bureau of Economic Analysis, *The Use of National Income and Product Accounts for Public Policy*, BEA:SP868043 (1986).

**Measuring Economic Activity and Income on the Basis of the Market Value of Goods and Services:** The NIPA is the most important set of accounts for this function. The most widely reported measure is gross domestic product (GDP), which measures the value of all final goods and services produced in the economy during a given period. As a rule, each product is valued at its market price and the values are added together, resulting in the total measure of GDP. Gross domestic product for 1993 totaled \$6,374 billion (advanced estimates in current dollars).

The production of GDP causes wear and tear on the existing capital stock; that is, machines wear out as they are used in production. If some resources recorded in current GDP were not used to maintain or replace the existing capital, GDP could not be kept at the current level. Net domestic product (NDP), as distinct from gross domestic product, deducts from the measure of gross production the consumption of the existing capital stock (from age, use in production, and accidental loss) over the course of a given period. Accordingly, NDP is a better measure of the amount of income (or consumption) that could be maintained over long periods, given the existing capital stock and labor force. During 1993, net domestic product totaled \$5,703 billion (advanced estimates in current dollars) and capital consumption was \$671 billion, about 11 percent of GDP.

**Measuring Financial and Input Flows in the Economy:** The flow of funds accounts and I-O tables are the most important components of the national accounts for measuring financial and input flows in the economy. The flow of funds accounts record financial transactions between households, nonfinancial businesses, governments, foreigners, and financial institutions. The I-O tables trace different delivery flows between the sectors of production in the economy. These accounts measure the unfinished goods and services (intermediate products) that each industry purchases to produce output and measure the amount each industry sells to all purchasers (other industries and final consumers). Among other things, input-output tables can be used to investigate the effects of different economic policies on production and employment by industry. Many researchers use data from the I-O tables as the basis of models attempting to trace the effects of policies on employment and output in different sectors. Information from the flow of funds accounts is commonly used to investigate the financial health of economic sectors or the economy as a whole. For example, these data are used in models that evaluate a credit crunch or the effect of regulatory changes on the financial system.

Some economists would like to merge environmental and natural resource concerns with mainstream economic policies, to give these assets "a seat at the table." The Congress's Joint Economic Committee held hearings in September 1991 on ways in which the accounts could be used to "shape effective and sustainable economic policies."<sup>1</sup> As a result of those hearings, the committee concluded that measures of national income produced by the national income accounts "are not a good measure of sustainable income." During his Earth Day speech in April 1993, President Clinton called for the Bureau of Economic Analysis to produce " 'Green GDP' measures [that] would incorporate changes in the natural environment into the calculations of national income and wealth."<sup>2</sup> International agencies have also responded to demands that the national accounts incorporate more information on natural resources and the environment. In 1989 the World Bank published an influential work entitled *Environmental Accounting for Sustainable Development*. The United Nations is currently trying to upgrade and standardize the guidelines for its widely used System of National Accounts (SNA). And as part of this effort, the U.N. is developing methods of incorporating nature into the SNA by using a separate System of Integrated Environmental-Economic Accounts.

#### IS THE TREATMENT OF NATURAL RESOURCES AND THE ENVIRONMENT IN THE NATIONAL ACCOUNTS MISLEADING?

---

Measures of economic activity in the national accounts can be misleading when important information about natural resources and the environment is either missing or mislabeled. First, the national accounts do not reflect changes in environmental quality and natural resource reserves. When compared, investment and depreciation data are supposed to tell decisionmakers whether the nation is maintaining its productive assets, but the data ignore most changes in natural resources and the environment. Second, summary measures of income and output in the national accounts exclude many of the services provided by natural resources and the environment, even though they have an impact on the quality of life. Interest in having the accounts produce an alternative measure of national income in the form of a "green" GDP represents an attempt to address these omissions.

---

1. Joint Economic Committee of Congress, "Making the Environment Count" (press release, September 11, 1991).

2. White House, "Earth Day Address" (press release, April 21, 1993).

Third, some important effects of natural resources and the environment on gross domestic product are hidden. The national accounts do not identify environmental services that are included in current measures or certain costs that are related to the reductions of damage by pollution.

### The Accounts Do Not Record Changes in Environmental Quality or Most Natural Resource Reserves

The desire to improve measurement of the effects of economic policies is responsible for much of the interest in adding more information to the accounts about natural resources and the environment. The growing interest in policies that promote "sustainable development," for example, has led to suggestions that natural resources and the environment be treated as capital assets providing services to the economy--so-called natural capital.

Natural capital contributes to production just as physical capital does. The absorptive capacity of the environment or the wood from harvested timber can contribute to production just as machines contribute to the manufacture of goods. Similarly, the environment or natural resources can depreciate just as machines do from wear and tear. Also, as with physical capital, investment can be made in some forms of natural capital as a means of maintaining or increasing its stock; for example, expenditures to maintain levels of environmental quality or to expand the stock of timber. Investment in either physical or natural capital requires that current consumption be sacrificed in expectation of a flow of income in the future.

GDP measures the value of nearly all marketed final goods and services produced in the economy, plus a few nonmarketed goods. Certain marketed goods and services--mostly illegal activities--are excluded, and the value of certain nonmarketed services--most notably the services of owner-occupied housing and financial institutions--are included. The price of nonmarketed services is based on imputed, or estimated, fair market prices.

Currently, such items as machinery and equipment are assigned value in the accounts as productive capital. The value of the change in the stock of these items, caused by use and accidental loss, is recorded as capital consumption and subtracted from gross domestic product in order to measure net domestic product (NDP).

NDP is what remains after enough has been set aside to maintain the capital stock; it constitutes a recognition that one cannot maintain a consumption level by drawing down the stock of capital. The accounts do not,

however, allow for the impact of output on the condition of mines, forests, soil, air, and water quality. The accounts are less reliable, therefore, for alerting decisionmakers to changes in these assets that may require new policy initiatives.

If changes in environmental quality and natural resource stocks were recorded, they could help the national accounts provide an economic interpretation of changes in the nation's assets. The balance sheets serve this function by recording the value of national assets at a given point in time. Many of the changes necessary to record changes in environmental quality and natural resources would appear in the balance sheets, although many changes would also appear in the national income and product accounts (NIPAs).

#### Current Measures of National Income Exclude Many of the Services Provided by Natural Resources and the Environment

Demands that the accounts measure a green GDP reflect a desire to include more of the final nonmarket services provided by natural resources and the environment in measures of national income. These items include non-health-related services such as recreation on public lands and aesthetic benefits, nonuse benefits (the benefit derived from knowing an amenity is available), and the potential benefits of biological diversity. Inclusion of these services in national income would increase both GDP and the contribution to GDP by natural resources and the environment. Those who advocate including these services argue that current GDP, by ignoring them, gives a misleading impression of the importance of natural resources and the environment to the standard of living.

Measuring a green GDP could also mean including the damage that pollution causes to human health that is not already measured through its effect on worker productivity. Thus, the effects of pollution-induced respiratory ailments on absenteeism are already counted to some extent in GDP, but the pain and suffering from these ailments are not. Such damages could be treated as health-related services that, if included as negative values, would reduce GDP.

Some proponents justify the inclusion of these services as a step toward a measure of national welfare. This goal is probably unattainable because assigning values to losses resulting from sickness and death and weighing such factors as literacy rates or the distribution of income (which many would argue should be evaluated as a part of national welfare) would be difficult to incorporate into the framework of the national accounts. Incorporating such

considerations would probably involve changing the metric of the accounts from an objective value measure to a subjective index of well-being, thereby detracting from the usefulness of summary measures.

Including more of the services of natural resources and the environment, however, could enhance the ability of the accounts to provide a measure of income that might indicate changes in the quality of life more accurately than conventional GDP. Measures such as a green GDP would be reported in the national income and product accounts. The NIPAs are the component in which most of the changes necessary to measure final services of natural resources and the environment would appear, although adjustments to the input-output (I-O) accounts could be made to correspond to changes made in the NIPAs.

**The Accounts Do Not Identify Environmental Services  
Included in Current Measures of National Income  
or the Costs of Reducing Pollution Damages**

The ability of models based on the I-O tables to predict the impact of environmental and natural resource policies on employment, output, and trade—or the impact of trade and employment policies on the environment—is limited by the information in the national accounts. The accounts do not show the value of either the environment's waste disposal services or of defensive expenditures to counter pollution. The environment disposes of waste by absorbing by-products of output and consumption. Because there are no market transactions in payment for these services, the accounts do not treat the environment as a factor of production. They implicitly assign a value of zero to these services. Actually, the value of environmental waste disposal services is currently subsumed under profits and rents in the accounts. Firms and households spend a lot to prevent, reverse, or avoid the effects of pollution. The so-called defensive expenditures against pollution are lumped together with other investments, such as pollution abatement equipment, or consumption expenditures, such as prescription medicines, air filters in the home, and so on.

If waste disposal services were separated from profits, and rents and defensive expenditures were also separated from investment and consumption expenditures, the ability of the national accounts to measure the effects of changing allowable emission levels on production could be enhanced. The separation would also make the benefits of improving environmental quality clearer. Many of the changes would appear in the input-output tables, which measure the flow of expenditures between individual industries and sectors.

---

## GREEN ACCOUNTING COULD BENEFIT DECISIONMAKERS

---

The notion of more fully incorporating the use of natural resources and the environment into the national accounts has been called "green accounting." An important benefit of this approach would be to increase the information available for analyzing policy issues. Among the key issues are the effect of environmental protection on economic growth, the distributional impacts of environmental and natural resource policies, and the link between trade and environmental and resource policies.

There are at least two more good reasons for incorporating environmental and natural resources into the national accounts. First, incorporating such information would result in a more comprehensive source of data for identifying the causes of economic problems related to the environment and natural resource management. Second, the process of compiling information for a single integrated data set could yield new and important insights.

### Environmental Protection and Economic Growth

The impact of environmental protection on the economy and employment is a matter of much debate. In the 1992 Presidential campaign, for example, efforts to preserve flora and fauna in the Pacific Northwest potentially affected loggers' jobs and became a matter of public debate. Supporters on both sides cited much anecdotal evidence concerning the impact of environmental protection on the employment and the economy.

Researchers also disagree about the effect of environmental policies on the economy. Since the extensive environmental legislation of the 1970s, interest has arisen in evaluating the economic and employment effects of environmental regulations. Many of the studies of the effects of environmental protection conclude that statutory limits on pollution reduce economic growth. For example, economist Edward Denison--whose model relied extensively on data from the national accounts--estimated that for the 1973-1982 period U.S. government regulations for pollution abatement reduced measured national output growth by 0.09 percent a year.<sup>3</sup> In 1990, Dale Jorgenson and Peter Wilcoxon used a general-equilibrium model to estimate the impact of environmental regulation on the economy by

---

3. Edward F. Denison, *Trends in American Economic Growth 1929-1982* (Washington, D.C.: Brookings Institution, 1985), p. 111.

simulating its growth between 1973 and 1985 with and without regulation.<sup>4</sup> The results indicate that environmental regulation reduced the annual growth rate of GNP by 0.19 percent a year from 1973 through 1985. Jorgenson's and Wilcoxon's estimates indicate that GNP was about 2.5 percent lower in 1985 than it would have been otherwise.

Rather than employing simulation models, some researchers use statistical methods on historical data to assess the effects of regulation. A 1992 study finds empirical evidence to indicate a positive relationship between environmental protection and economic growth. This study, conducted by economist Stephen Meyer, examines such a positive relationship at the state level.<sup>5</sup> Meyer statistically tested the hypothesis that undertaking policies to protect the environment hinders economic growth and job creation. His data cover the period between 1973 and 1989. He finds no evidence to support a negative relationship between environmental regulation and economic growth. In fact, his results showed just the opposite: states with ambitious programs to protect the environment had the highest levels of economic growth and job creation over the period. Meyer's results do not, however, prove a causal relationship between environmental regulations and economic growth.

Both simulation and statistical models can be based on relationships derived from national accounting data. But the accounts do not link environmental quality to output. Unless obtained independently, models based on data from the accounts will not have any of the feedback effects of environmental changes on productivity. In essence these models assume that environmental quality would be the same without federal legislation. Very different answers could be produced if the feedback effects of the environment on output were included in such models.

Given current models, it is not clear what the net impact of such programs might be and whether significant differences in growth rates exist in the relative impact of one program over another. It is clear, however, that more detailed information is needed about the relationship between policy, expenditures on final and intermediate products, and environmental and natural resources. Information generated by an expanded set of accounts could provide important pieces of the puzzle.

---

4. Dale W. Jorgenson and Peter J. Wilcoxon, "Environmental Regulation and U.S. Economic Growth," *Rand Journal*, vol. 21, no. 2 (Summer 1990), pp. 315 and 327.

5. Stephen Meyer, "Environmentalism and Economic Prosperity: Testing the Environmental Impact Hypothesis" (working paper, Massachusetts Institute of Technology, Project on Environmental Politics and Policy, Cambridge, Mass., October 1992).

### Distributional Impacts of Environmental and Natural Resource Policies

The benefits and costs of environmental and resources policies fall more heavily on some industries or income groups than on others. Improved water quality especially seems to favor higher income groups since most of the improvement is in nonurban recreation sites. Employment in industries that pollute more, such as chemical and paper manufacturing, could be most affected by tighter air quality standards.<sup>6</sup> Such a perception--whether correct or not--can cause political resistance to new initiatives that might result in policy improvements.

The input-output accounts can be especially useful for analyzing the impact of legislation on different industries. Detailed models of the payments sector in I-O tables have also been developed to predict the effect of policies on income distribution. The Forest Service has incorporated one such simulation in its regional planning model, IMPLAN (Impact Analysis System for Planning).<sup>7</sup> One way of improving information about the distributional effects of environmental and natural resource policies is to incorporate data on environmental and natural resources service flows into the accounts.

### Links Between Trade and Environmental and Natural Resource Policies

Policymakers have come to appreciate the notion that nations cannot make policy without considering what is happening in other countries. Concern about the effects of the North American Free Trade Agreement on the environment, for example, was an important consideration during negotiations and required working out a separate side agreement on environmental issues before the Administration was willing to submit the final agreement to the Congress. National accounting systems that include environmental and natural resources could provide useful information during negotiations over the nation's commitments to restore or maintain natural capital.

A traditional justification for trade measures and sanctions is that they retaliate for activities that place the United States at a competitive disadvantage. A case could be made that pollutants that cross boundaries have this effect. Discharges of pollutants by other countries may not only affect production costs in the United States, but could affect them differently

---

6. William J. Baumol and Wallace E. Oates, *The Theory of Environmental Policy* (New York: Cambridge University Press, 1988), pp. 245-253.

7. For a description, see Adam Rose, Brandt Stevens, and Gregg Davis, *Natural Resource Policy and Income Distribution* (Baltimore: Johns Hopkins Press, 1988).

than in the home country. For example, the effects of greenhouse gases on local climate patterns vary depending on latitude, size of land mass, and so on.

Trade restrictions have not been used when a country's production and processing methods result in excessive discharges of pollutants such as carbon, sulfur or nitrogen oxides, or chlorofluorocarbons across national boundaries. One reason is the difficulty of determining the effect of transboundary pollutants on industry costs. Expanding the input-output tables to include the use of waste disposal services and identify abatement costs could help in identifying primary and secondary costs of transboundary pollutants.

The Clinton Administration has recently expressed an interest in assessing the effect of environmental policies on trade.<sup>8</sup> The intent is to give decisionmakers a sense of the trade impacts of an environmental policy before it is carried out. Some researchers have expressed concern over ways in which such assessments would be conducted because there is currently no effective way of measuring the myriad trade impacts of environmental policies. Incorporating information on natural resources and the environment into the national accounts could provide useful information for models assessing these impacts.

#### **PRICE AND QUANTITY DATA ON ENVIRONMENTAL AND NATURAL RESOURCES ARE DIFFICULT TO DETERMINE**

---

Is it possible to incorporate the value of natural resources and the environment into measures of income and wealth so that the information could contribute to policy analysis? A primary advantage of using accounting systems for policy decisions is that they measure disparate goods and services with a common metric. But defining different items in economic terms rather than by some physical measurement is only worthwhile if these values are consistent and reliable.

#### **Uncertainties and Problems in Valuing Nonmarketed Flows**

As a rule, a value is assigned to each product in the accounts by multiplying its market price by the quantity produced. Goods or services that do not pass from seller to buyer in a legitimate market are difficult to price. For example,

---

8. "Administration to Assess Trade Impact on All Environmental Policies," *Environmental Policy Alert* (Inside Washington Publishers, Washington, D.C., September 29, 1993), pp. 41-42.

there is no single way of placing a value on the services of a stay-at-home spouse, or the services of the police force and the government. Conventional accounts currently include some of these services. In some cases, cost or some imputed measure is used as a proxy for price. Government services are priced at cost, so the wages of government employees are taken to represent their contribution to GDP. The price of services from owner-occupied housing (which does not involve direct market transactions) is imputed from rates on rental housing. Others of these hard-to-measure activities, such as the services of a stay-at-home spouse, are omitted from GDP.

The issue of valuation is especially important in incorporating environmental and natural resources because so many of the goods and services of these assets are not traded in markets. The principal problems of measurement are (1) identifying the most appropriate way of gauging physical changes in environmental and natural resource reserves; and (2) identifying reliable and consistent methods of estimating value and depreciation. Measuring environmental quality is difficult because the effects of pollution on health, recreation, and ecosystems are uncertain. Measuring resource availability is difficult because future demand is uncertain and existing supplies are hard to determine. Questions about the accuracy and precision of these measurements raise doubts about the usefulness of information from the accounts in guiding public policy.

Many of the goods and services of natural capital are either not sold in markets or are sold under conditions that make market-generated values inappropriate for estimating depreciation. The lack of organized markets is especially problematic in pricing service flows associated with the effects of changes in environmental quality on health. Techniques for imputing prices are at an early stage of development and in some cases, such as the assignment of value to human life, there may never be agreement.

### Conclusions

Green accounting includes all or some part of the following: expanding the set of assets, expanding the set of services derived from those assets, and reclassifying the current set of services included in the accounts. If green accounting is to be useful for the analysis of policy issues, techniques that are used to incorporate natural resources and the environment into the accounts must be consistent with current accounting procedures. The basic accounting and economic identities underlying the accounts should be preserved wherever possible.