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Nature's Numbers: Expanding the National Economic Accounts to Include the Environment

Edited by William D. Nordhaus and Edward C. Kokkelenberg

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Economists have long recognized that the National Income and Products Accounts (NIPA) do not do a very good job of describing a nation's economic performance. They have too many holes. Valuable services such as childcare by parents are not included in the accounts and assets such as human capital are inadequately portrayed. In recent years there has been substantial attention to one particular set of these omissions, the economic role of natural resources and environment. The logic behind including natural resources in the national accounts is straightforward. As Repetto et al. (1989) summarize,

A country could exhaust its mineral resources, cut down its forests, erode its soils, pollute its aquifers, and hunt its wildlife and fisheries to extinction, but measured income would not be affected as these assets disappeared (p. 3).

In 1992, the U.S. Department of Commerce's Bureau of Economic Analysis (BEA) began work on a set of satellite accounts that attempted to capture the economic impact of natural resources, focusing primarily on subsoil mineral resources. Preliminary results in this area were published in 1994 (Landefeld and Carson 1994a, 1994b). In that same year, however, Congress mandated that the Commerce Department halt all work in this area and have an external committee review the BEA's work. *Nature's Numbers* is the report of that committee.

The main conclusion of the report is that expanding the scope of the NIPA to include natural resources and the environment is "an important goal." The fact that they reached this conclusion is not surprising when one looks at the committee's members, many of

whom are among those most closely associated with the development and promotion of environmental accounting (EA). William Nordhaus, the committee's chair was one of the first economists to attempt an expansive measurement of economic activity (Nordhaus and Tobin, 1972), and Robert Eisner contributed substantially to this literature (e.g., 1989). Martin Weitzman developed the formal theoretical foundation upon which EA has been constructed (Weitzman 1976). Henry Peskin and Robert Repetto have both supervised independent EA studies (Grambsch, Michaels, and Peskin 1993, Repetto; et al. 1989). Dale Jorgenson has made use of information that would be included in extended national accounts to evaluate U.S. economic growth (Jorgenson and Wilcoxon 1990). Brian Newson is working on the development of EA for the statistical office of the European Union. The rest of the committee and study staff adds depth but little balance to the committee's apparent predisposition toward accepting EA.

It would be unfair, however, to imply that the committee was manipulated to promote the interests of some of its members. The fact that no prominent counter-opinions are present on the committee reflects the reality that the most fundamental question asked of the committee has only one reasonable answer: Yes, EA can be a useful part of our measurement of economic progress and, since the environment is an important part of the economy, it should be pursued.

The questions that I consider in this review are threefold: How well do the authors make the basic point that EA should be reintroduced in the U.S.? What are their conclusions regarding the many smaller issues sur-

rounding how the BEA should develop such accounts? Do they present their analysis and conclusions in a manner that will be of interest to readers of this journal?

SHOULD EA BE RE-ADOPTED BY THE BEA?

The authors of *Nature's Numbers* make a compelling case for the use of EA. The NIPA are routinely used to assess the nation's economic status over time and compared to other nations, and to evaluate the relative performance of different segments of the economy. However, the NIPA only include economic activities that are "reflected in the sales and purchase transactions of the market economy" (U.S. Department of Commerce 1954). Because of this limitation, many valuable economic activities are not included in the accounts including home production, leisure time, informal education, and the value of research-and-development capital. The benefits and costs of environmental improvements and degradation and the depreciation of natural-resource assets are also excluded from these accounts, and it is on these areas that the report puts its attention.

Because of the incomplete and inconsistent treatment of natural resources and the environment, the NIPA generate signals that can misrepresent macroeconomic performance and result in erroneous economic policy. The authors point out three main deficiencies in the accounts. First, the NIPA can give perverse signals of economic well being. For example, resource extraction that is essentially capital consumption is treated as production. Similarly, pollution clean-up expenditures increase measured output, even though they only offset damage that otherwise would have been imposed on the economy. Second, the accounts treat sources of wealth inconsistently. While the depreciation of factories and machinery show up in the accounts, there is no equivalent treatment of natural resource assets that would suggest that these productive assets are diminishing in value. Finally, the accounts give an incomplete picture of the scope of economic activity. For example, the values of Yellowstone National Park and Disney World are treated

very differently in the accounts. Hence, the accounts give a skewed representation of economic benefits and policy based on such signals may be similarly misguided.

Their argument is strengthened by some nice examples where EA can yield tangible benefits. For example, the BEA's estimates of pollution control and abatement expenditures helped explain the decline in productivity after 1973. In the future, keeping track of carbon stocks might substantially reduce the cost of satisfying the United States's commitments under the Kyoto Protocol.

In summary, the authors make a very good case for the development of satellite accounts that track the environment and natural resources. Given that their primary audience is the congressional representatives who must approve funding for such activities, this is the most important argument of the report and it is stated prominently and unambiguously:

Environmental and natural resource accounts would provide useful data on resource trends and help governments, businesses, and individuals better plan their economic activities and investments. (2)

Nonetheless, the amendment that called for a halt to BEA's activities did not question the importance of such accounts but did question the methodology and objectivity of EA. Hence, the second major task was to make detailed recommendations regarding how EA should be implemented and evaluate the efforts to date by the BEA.

IMPLEMENTATION ISSUES

It is not difficult to argue that there would be much to gain by expanding the NIPA to address their environmental deficiencies. The difficulties arise when one turns to the details. Should physical accounts be employed without valuation or should valuation be an essential part of any EA system? How should nonmarket values be calculated? How should the change in the value of natural resource assets be quantified? These and many other questions must be answered before a system of EA can be implemented. *Nature's Numbers* does a fair job at answering them.

The first question that must be resolved is

whether EA should involve monetary measures or be limited to physical indicators. In a short but important portion of the text, the authors take a firm stand that improved physical accounting is a critical part of EA, but that physical accounts alone cannot achieve the goals of EA. Among the report's recommendations is a call for greater interagency cooperation to develop a more complete record of the physical changes in the nation's environment and natural resources. Such an integrated database would be of great value to policymakers. However, they argue that there are two critical weaknesses to physical accounting alone. First, there are frequently problems with the choice of units because of the multifaceted characteristics of many resources. For example, forest resources might be measured based on acres or volume—neither of which would adequately address the issue of quality. Second, it is difficult to characterize the benefit of multiple-use resources using physical accounts. Converting to dollars, while difficult, at least establishes a common unit of measurement.

Having opted for a system in which valuation will play a critical role, the report discusses issues surrounding the actual valuation of these changes. Two chapters are dedicated to these issues, the first discussing the valuation of subsoil minerals and the second discussing the valuation of environmental resources. Substantial attention to subsoil resources is justified given that they were the primary focus of the BEA's early efforts in EA, they have been studied in a number of other nations, and they have received the most theoretical attention. Moreover, on the surface at least, it would appear that non-renewable resources would be the most straightforward case since measurement of physical reductions in the stock can be easily quantified and all production is currently captured in the NIPA. Still, there are a number of complicating issues and unresolved questions about the proper treatment of such resources.

The report clearly explains the difficulties that arise in the accounting for subsoil resources. There is a discussion of the economic value of mineral resources that are not economically viable, how price changes af-

fect the value of a nation's mineral assets and a detailed explanation of a number of techniques that might be used to value such resources. However, the committee comes to no strong conclusions about how to proceed. The BEA used six different approaches in its early valuation effort and the committee's only recommendation is that they might "consider modifying or eliminating some of its procedures" (103). The fact that such a distinguished panel of economists could arrive at nothing more than a familiar call for more research is a disappointing reflection on the progress that has been made in EA.

Compared to the valuation of mineral resources, quantifying the economic value of environmental services, or changes in those services, is enormously difficult. A number of difficulties are highlighted. First, simply quantifying the physical changes in the environment can be difficult. Second, the impact on humans is often the subject of great uncertainty. Third, the value that is placed on the environment is typically not captured in markets and, therefore, requires nonmarket valuation methods in order to obtain a dollar value. Finally, since most environmental services have public good characteristics, obtaining the correct measure of their value for a national accounting exercise does not follow immediately from typical valuation studies.

The book provides a lengthy discussion of the difficulties associated with quantifying the economic value of environmental assets and arrives at a few strong conclusions. The committee criticizes the BEA's previous use of replacement cost methods for some of its initial valuation and describes contingent valuation as "of limited value for environmental accounting" (131), leaving open the use of market and near-market methods such as the travel cost and hedonic pricing approaches.

A critical omission from this discussion, however, is the issue of benefits transfer. The authors seem to suggest that each environmental change, each wetland lost, or pollution improvement achieved, would be valued based on its own thorough economic study. This is, of course, unreasonable and the only practical means for incorporating en-

vironmental services in a national system of accounts would require the inference of values based on previous studies. There are great difficulties and uncertainties associated with such benefits transfers (Brouwer 2000) and these issues must be considered before credible environmental accounts can be developed.

The chapter on environmental resources has three additional conclusions that deserve highlighting. First, they argue that air quality concerns, though quite difficult to quantify and value, are among the most important nationally and deserve attention. Second, they discuss in some detail the methods for valuing renewable resources that are fully traded in the market (timber) and present a new technique for valuation. Finally, they emphasize the importance of improving the physical accounts of the environment as a partial but important step toward improving the knowledge base for economic planning.

IS NATURE'S NUMBERS LIKELY TO BE OF INTEREST TO THE READERS OF LAND ECONOMICS

In reading *Nature's Numbers*, one is repeatedly reminded that the book is a report for Congress and the apparent audience is made up of policymakers that might vote to reauthorize the BEA's EA activities. For that audience, I believe the book is likely to be relatively successful for they make a convincing case for EA. The authors estimate that developing a complete set of accounts would cost approximately \$10 million per year for up a decade or more. To justify such an outlay of funds, it is not surprising that the authors felt compelled to deliver a 200-page defense of EA.

Perhaps because the book is written for a target audience of congressional representatives, however, details that might turn off such policy makers are avoided. This results in a watered-down discussion that is neither particularly palatable nor substantive, severely diminishing the book's attractiveness for virtually any other reader.

For the casual reader or student interested in the idea of EA, the book lacks the anecdotes and clever writing that would make it

attractive. Works such as Repetto et al. (1989) or Solow (1993) are better suited for these readers.

For the economist studying the area of EA, the book provides neither a careful summary of the underpinnings of accounting as a measure of sustainable welfare nor does it offer anything new in this direction. For example, although the derivation of the relationship between national accounting and sustainability requires growth theoretic models, the appendix on sustainability and economic accounting includes three equations and no integrals. If you are looking for a careful development of why EA might give us insights on sustainable welfare, you will need to look elsewhere (e.g., Aronsson, Johansson and Löfgren 1997; Hartwick 1990, 2000). In some cases, the absence of mathematical detail leads to statements that might be easily misinterpreted. For example, they repeatedly mention that since prices that are used in the rest of the NIPA are marginal values, environmental values used in EA should also be marginal values. However, they are not careful as to the margin on which these values should be determined. They suggest that "the marginal value for an open-access beach or forest with no fee may be zero" (128). I see no reason why adding another beach would yield zero value—is it possible they are confusing the marginal value of additional trips for an individual with that of additional units of the resource?

For the national accountant or others interested in specific guidance on how EA might be implemented, the book gives us little specific guidance on how prices should be calculated or how environmental services should be measured. The authors recommend that the "BEA rely primarily on market values or proxies of market values" (150). However, there is little guidance as to what techniques should be used, no sweeping recommendations regarding the characteristics of high quality studies and few references that would guide a reader interested in delving into these issues in further detail. One table lists twenty-nine studies of forest value but, rather than providing the full references, the report refers the reader to a draft FAO report. The one area in which the book seems to cover

some new ground is in the accounting for forest assets. The five-page appendix summarizes an approach recently proposed by Jeffrey Vincent for the value of timber assets, but a reader interested in the details would need to consult the Vincent paper (Vincent 1999).

In conclusion, I am hopeful that *Nature's Numbers* will play an important role in the history of EA for it should provide the justification for renewed BEA efforts in this area. However, in terms of the development of the theory and methods of EA, the book offers little new and is unlikely to help either students or practitioners of environmental accounting.

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