Book Reviews

Environmental Policy Viewed Macroeconomically

Environmental Regulation and the U.S. Economy. HENRY M. PESKIN, PAUL R. PORTNEY, and ALLEN V. KNEESE, Eds. Published for Resources for the Future by Johns Hopkins University Press, Baltimore, 1981. x, 164 pp. Paper, $5.95. Reprinted from *Natural Resources Journal*, vol. 21, no. 3.

Public debate about environmental policies has increasingly raised questions about the effects of such policies on productivity, trade, jobs, and inflation. The present volume, prepared by economists from Resources for the Future and their associates, studies these macroeconomic effects. The analysis is quantitative, and in three chapters large-scale multi-equation models are used.

Haveman and Christainsen review several important productivity studies and conclude that about one-tenth of the U.S. productivity slowdown is attributable to environmental regulation. The studies reviewed employ a diversity of analytic techniques, from the growth-accounting framework of Denison to the industry-specific econometric studies of Crandall and the macroeconomic models of Siegel and Data Resources, and all are consistent with the conclusion, though the authors properly stress its tentative nature.

International trade effects are among Bosworth's concerns. American weakness in world markets is concentrated in industries such as steel and automobiles whose competitive strength has eroded in recent years. Environmental regulation has contributed to the problem, but so has the fact that wages in steel and automobiles are over 50 percent higher than in manufacturing as a whole. Econometric results reported by Portney predict that environmental regulation will account for about one-third of the projected U.S. balance-of-trade deficit in the early 1980's. However, the reduction in total exports is projected to be less than 1 percent during this period and the increase in imports only about 1 percent.

Employment effects are also dealt with by Portney. He reviews the Chase model results, which predict slight increases in unemployment because of pollution control, and Data Resources results, which predict slight reductions in unemployment. Many scholars, however, would suppose that the aggregate level of employment is not appreciably or predictably affected at all by long-run changes in spending decisions among various sectors of the economy.

The Chase and Data Resources models predict that environmental regulation affects inflation by less than one percentage point per year, although they again differ in direction of change during some years. The models assume that inflation is caused by higher costs due to regulation being passed on in the form of higher prices for intermediate and final products. More skepticism might have been voiced that a significant causal relation exists between environmental regulation and inflation. The link between individual price changes and the monetary events that must be brought in to explain inflation is tenuous at best, and many would doubt that a link should be presumed.

Peskin considers the more interesting question of how to include the effects of environmental regulation in gross national product. The costs of regulation importantly take the form of increased inputs required to produce goods and services measured in GNP, whereas benefits take the form of health, aesthetic, and other additions to well-being that are less completely measured in GNP. Because costs may be more fully included than benefits, declines in measured GNP caused by regulation could conceptually be more than offset by the additions to well-being left out of measured GNP.

Peskin finds a range by applying alternative aggregate corrections to measured GNP. He finds that corrected GNP might have risen between 17 and 21 percent from 1972 to 1978, as contrasted to the rise in conventionally measured GNP of 19 percent. Thus it is ambiguous whether on net changes in environmental regulation during the period raised or lowered corrected GNP.

In further work, prominence could be given to two principles. First, GNP is not a measure of total welfare or utility, since it excludes nonmarket goods as well as surpluses from inframarginal units of market goods. GNP is at best useful for comparing differences or changes. The meaningfulness of attempting to include total benefits from the environment or total damages in a GNP measure can be questioned. To be consistent with the fundamental concept of GNP, only changes or differences in benefits minus costs should be included.

Second, the search for corrections should focus on finding just which changes in benefits and costs are not already included in measured GNP. Many of the benefits and costs are already included, particularly those connected with production in the business sector. It becomes a question how to disentangle those individual benefits and costs that do not show up in market accounts. For example, improved health and longevity may, with lags, increase human effort in the marketplace, thus eventually increasing measured GNP, but increases in the quantity and quality of life unconnected with market work will not show up in measured GNP. We believe the two principles would lead to an approach that at one level is conceptually more straightforward but at another level is conceptually more difficult and empirically more painstaking.

Ridker and Watson project the social cost of several environmental protection strategies to 2025. While control costs increase, damages for unabated pollution fall more than proportionately, even though the growth of population and economic activity put an increasing strain on limited resources. An index of per capita welfare for the various control policies does not reveal many differences between the policies, particularly after the year 2000, when the differences are only about 3 percent.

Harrington and Krupnick review the history of stationary-source pollution policy from the perspective of efficiency in the attainment of environmental objectives. They find that uniform technology-based standards are poorly suited to accomplish environmental objectives cost-effectively. They argue for incentive-generating reforms moving beyond EPA's modest bubbles, banking and offset provisions, to full-fledged marketable emission permits and effluent charges. For a variety of reasons, these devices, popular in the economics profession, have not gained substantial acceptance. A more practical way to lessen the worst effects of present uniform standards could be to establish permanent variances to national standards where justified by individual comparisons of benefits and costs. The variances could be coupled with tax incentives to devel-

op new pollution-abatement techniques. Large site-specific sources of inert pollutants would be eligible for consideration for variances. Blanket variances could be granted to an industry with numerous small sources of pollution in a limited geographic region.

Though the authors are to be applauded for their efforts, a basic question raised by the volume is whether, after all, estimates of macroeconomic effects have much to contribute to environmental policy. Basing environmental policy on macroeconomic effects implies inescapably that tradeoffs between the various effects are being weighed. But, to improve policy, comparisons should be made not at the macro level but in relation to specific controls. A challenge is to carry out adequate individual studies of the costs and beneficial effects of specific controls. When general equilibrium effects exist beyond immediately affected industries, they should be taken into account. Too often, estimation of general equilibrium effects is equated with use of macroeconomic models. A case can be made that general equilibrium effects are in fact more adequately estimated by the more individualized studies.

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Particle Physics

Techniques and Concepts of High-Energy Physics. Papers from an institute, St. Croix, Virgin Islands, July 1980. THOMAS FERBEL, Ed. Plenum, New York, 1981. xii, 542 pp., illus. $65. NATO Advanced Study Institutes Series B, vol. 66.

Keeping abreast of what is important in the field of high-energy physics is a difficult and many-faceted task. It is particularly bewildering for students and young researchers who are being immersed in the field at a time when experiments and theories are evolving from an almost innocent phase of discovery and classification of many types of particles and their interactions to investigations motivated by the sweeping promise of a unified theory of matter that may in the foreseeable future be (to quote from Chris Quigg's contribution to the volume under review) "so restrictive as to compel the existence of the universe as we find it . . . no more, and no less."

Such heady aspirations are characteristic of the deep and in some respects wrenching changes in the nature of high-energy physics research over the past decade. Grand unified theories are accompanied by experiments on a grand scale, carried out by multinational consortiums, with funding and resources concentrated at a relatively small number of vastly expensive accelerators and detector systems.

In this context the present volume is of considerable interest. Given an audience of recent Ph.D.'s and as their mentors a small group of skilled and influential theorists, experimenters, and machine builders, what are shown as the important threads in the tapestry of high-energy physics?

The lectures reproduced in the proceedings include not only up-to-date, textbook-quality treatment of the physics and technology issues that are at the fore but also articulate commentary on their roles in the forces of change at work in the field.

On the theoretical side, Jonathan Rosner's lectures on quark models treat the present view of the particle aspects of fundamental processes, with the quarks as tangible entities in a first-order theory of elementary-particle interactions. The color field and gluons are introduced with a concise connection between the Regge-pole description of particle spectroscopy (which dominates all but the most recent books) and the parameters of strings and bags in quantum chromodynamics (QCD). Potential model calculations and a detailed treatment of the light-quark particle spectrum lead to a discussion of heavy-quark spectroscopy (the "onia" of charm and beauty) and the speculative issues that engage current efforts in experiment and theory: additional heavy quarks, bound states of gluons, free quarks, and nucleon stability. A thorough pedagogical development is given to an introduction to gauge theories by Quigg. He begins with the implications of phase invariance in quantum electrodynamics as an introduction to non-Abelian gauge theories. These theories are carried through Yang-Mills theory and spontaneous symmetry breaking to the Weinberg-Salam model for leptons, incorporating hadrons in a local-color gauge theory. The lectures conclude with a discussion of the motivating ideas for grand unification of the gauge theories of strong, weak, and electromagnetic interactions. Aimed primarily at experimental particle physicists, the lectures on models and theory keep closely in touch with their implications for experimental programs.

The ideas and predictions of QCD calculations are confronted with data from a broad range of experiments at the world's high-energy accelerator facilities in reviews by Donald Perkins (probes of nucleon structure with deep-inelastic electron, muon, and neutrino scattering) and Maurice Jacob (jet phenomena in particle production at e^+e^- and proton-proton colliding beams).

Accelerator theory is taken up by Melvin Month, who illustrates some phenomena of relevance to the design and performance of proton-proton colliding-beam machines (specifically, the ISR at CERN and Isabelle at Brookhaven). Using idealized beam models he discusses beam-beam interaction, including discussion of the relationship of tune shift and luminosity, an example of a beam-induced (resistive-wall) instability, and a filling and stacking procedure for proton storage rings. The treatment is simplified but rigorous and nicely displays some of the theoretical methods underlying the machine-related jargon of the colliding-beam era.

In an approach to accelerator design on another tack, the financial, political, and entrepreneurial elements are emphasized in a design study session led by Robert Wilson, in which technical and strategic considerations are developed for a scheme to provide an electron-proton colliding-beam facility on a short time scale.

Konrad Kleinknecht presents a thorough and informative catalog of the techniques of particle detection in high-energy experiments, including an assessment of the size, complexity, and capabilities of some of the big detector systems currently in operation. Electronic techniques for dealing with the huge quantities of information that pour forth from these detector installations are discussed by Donald Hartill, who includes an introduction to the soon-to-be implemented Fastbus system of data acquisition.

For the most part, each of the contributors has provided a self-contained treatment of his subject, with extensive references and in some cases appendixes covering detailed calculational techniques as well as problem sets that are both illustrative and provocative. The volume has an index. It is an excellent supplement to the standard textbooks for advanced graduate students and a stimulating view of the landscape for all who labor in the field of high-energy physics.

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