Book Reviews

Energy Economics, Theory and Policy by Robert L. Pirog and Stephen C. Stamos, Jr. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1987, 328 pages.

There are more things wrong than right with this book. It is intended as an undergraduate text in energy economics, designed to meet the challenge of developing "a theoretical and analytical framework to analyze and explain the complex dynamics taking place in the nation's energy sectors . . . " Yet it is more a collection of nine disparate chapters by five authors than a unified approach to the subject. The book extracts economic principles haphazardly and in a way that is distinctly subsidiary to one or another energy topic under discussion. It also purports to air "a spectrum of competing energy perspectives: conservative, liberal, and alternative approaches to energy." Still, it is hard to escape the impression of a distinctly activist and left-of-center political thrust to much of the discussion. For example, the final chapter ("Energy Policy: The Choices Before Us") gives token "conservative" representation to Paul MacAvoy's defense of conservative free-market policies while lavishing the bulk of the space to the views of Richard Barnet, Lester Brown, Amory Lovins, Henry Kendall, and numerous others.

But given the professed purpose of the book, the need to balance off underlying ideologies is really beside the point. The question is whether a volume whose central aim is to introduce *economic* applications of energy topics ought to get so hung up on political battles in the first place. If it seemed useful to provoke the reader's interest and curiosity by introducing divergent perspectives, it would have been preferable to illustrate differences in judgment emerging from a common paradigmatic set of *economic* principles. In a nutshell, why do economists read numbers– on such things as, say, OPEC, long-term supply schedules, concentration, management of environmental spillover effects—differently? To be sure, the differences emerging from such a discussion would be narrower and subtler than those of the present volume, in which populist viewpoints are pitted against politically conservative ones, but the exercise would be more germane to the task at hand.

One must not minimize this task. Approaching energy in terms of underlying principles of markets, demand and supply schedules, regulatory efficiency, externalities, foreign trade, and other concepts poses a nontrivial challenge. Inevitably, authors face the dilemma of how much to stress about the field of application (e.g., thermodynamics, refinery slates, petroleum recovery), on the one hand, and pertinent economic constructs, on the other. It is not easy to find the best sequence for ordering the energy and economic topics.

The book handles these matters with mixed success. Several early chapters (a primer on economic analysis and one on petroleum and natural gas) meet the test quite well. The coal chapter presents useful materials on the organization of the industry. However, one must wonder why this chapter (coming after nearly two hundred pages of text) is the first introduction to Pareto optimality and the first chapter which pays systematic attention to externalities (this coming after the nuclear

chapter!). I would much have preferred a chapter on economic issues of electric utilities, showing how the nuclear industry fits into such a setting, rather than a treatment solely of nuclear power which bypasses a whole range of topics germane to the electric power business. The chapter on conversion and renewables, although containing intermittently helpful facts and figures, depart markedly from an economic-analytical framework. (In the renewables chapter, for example, the authors miss a nice opportunity to dissect the economics of ethanol-gasohol.)

A few less weighty points must be noted. There are numerous typos and a few inaccuracies. Footnote documentation is exhaustively copious in some chapters, totally sparse in others. There is no listing of tables and figures.

In sum, the objectives for this book (quoted in my opening paragraph) have, at best, been only partially achieved. But then, for reasons noted, pulling off a largely satisfying undergraduate energy economics text is an elusive task. *Energy Economics and Policy* by Griffin and Steele has some of the desirable features of such a volume. But entry into this part of the energy textbook market may still be opportune.

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Resources for the Future

Petroleum Rent Collection Around the World **by Alexander Kemp. Halifax, Nova Scotia: The Institute for Research on Public Policy, 1987, 363 pages.**

Alexander Kemp and the Institute for Research on Public Policy have produced a path-breaking study of petroleum rents and the various devices used by governments around the world in collecting them.

Rents are a tempting target for government revenue-seekers, since (if properly identified) their collection has no distorting impacts on production or consumption except for income effects, and therefore the tax collector will presumably encounter less resistance and fewer compensatory offsets than with other revenue instruments. Political resistance may be intense, of course, if other private parties have an established claim to the same rents; not even the most audacious taxing jurisdiction in the United States, for example, would move to confiscate landowners' royalties. But governments have a wide choice of instruments for rent collection, which vary considerably in effectiveness and precision for the stated purpose. These include bidding systems such as cash bonus bids, royalty bidding, net profit-sharing, and work-program or cost-sharing bids; and taxes including flat-rate royalties, severance taxes, income taxes, windfall-profits taxes and other resource-rent taxes, and excises. (The summary of these options on pages 87–103 is admirably terse.)

The outstanding contribution of this book is its measurement and analysis of these instruments as they have been used under greatly varying conditions in ten different countries ranging from Malaysia to Norway, and in several differentiated regions in

the United States and Canada. The empirical work necessitated prior estimates of discounted net present values of petroleum fields before development in most of these territories, and of the total resource rents including those that sometimes masquerade as costs. Kemp finds that almost none of the instruments in use in these various places capture rents without introducing disincentives and distortions by inflicting extra costs at the margin development and/or inefficiencies along the whole length of the supply function. The quasi-rents on developed properties have too often attracted rent-seeking governments, with predictable consequences. (Readers may find the graphs of these effects fascinating). As a general conclusion Kemp states, "A combination of bonus bids with a resource rent tax offers the best hope for the accurate collection of economic rents without introducing distortions" (p. 324). He offers negative appraisals of several other combinations such as fixed royalties and production taxes, and is able to demonstrate their concrete effects.

In a Postscript on "Canadian Policy Perspectives," Campbell Watkins makes some additional relevant comments on policy implications for Canada, in which he again notes that " . . . many measures aimed at pure rents end up by taxing quasi-rents" and suggests therefore that governments should not try to take all of the uncertain long-run rents but to be content with a preponderance of them. "In short, because identification of economic rents in the oil production sector can never be more than approximate, any intent to capture them should be supple rather than relentless" (pp. 327–8).

Correct identification of economic rents is of course a prerequisite to their capture, even though we have to be satisfied with approximations rather than exact measures. Kemp defines and analyzes economic rents in the petroleum industry in Chapter 2. This analysis is not as thorough or rigorous as it might have been. It does not distinguish adequately among Ricardian rents, scarcity rents, and monopoly rents. The well-developed literature on scarcity rents is skimpily cited and used. Monopoly rents are not identified, though they are obviously important in a world industry dominated by OPEC and in countries dominated by national oil companies. (A policy imperative for government capture of rents looks a bit different when those governments act as monopolists). The diagram of economic rents on page 9 depends on some unstated assumptions about replacement costs and equilibrium output which will be evident to economists but perhaps not to other readers such as tax officials. The treatment of uncertainty is not entirely satisfactory, and again does not make much use of the existing literature. But these are minor shortcomings; the general reader without previous knowledge of the subject will find this chapter most informative.

The study as a whole is a successful pioneering effort to develop methodology and findings for assessment of the means of rent capture and their diverse effects on economic efficiency. Its results are complex but easily understood. Those who make policy on petroleum taxes and the sale or lease of government petroleum resources, as well as those who feel the effects of such policies, would do well to read it carefully.

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Forecasting Natural Gas Demand in a Changing World by Adam Rose and David Kolk, Greenwich, CT, JAI Press, Inc., 1987, 152 pages, incl. index.

Advances in The Economics of Energy and Resources, John R. Moroney, ed., Vol. 6, Greenwich, CT, JAI Press, Inc., 1987, 220 pages, $31.75.

These books address energy modeling from different perspectives. The first is primarily concerned with understanding secondary (inter-industry) effects; while the various articles in the edited volume encompass models on productivity, capacity utilization, and industrial and consumer demand for energy, a petroleum/natural gas supply model, and, additionally, a paper on optimal extraction rates.

The Rose and Kolk (R&K) book presents a static input-output model, which is used to evaluate the impacts on natural gas demand of specific regulatory and technological changes, as well as the impact of subsidies intended to encourage conservation. (The region considered is the twelve-county service area of the Southern California Gas Company, and the models summarized are sponsored by SoCal). This is either a primer for decisionmakers in quantitative policy analysis, or one for students of modeling practice. The authors clearly explain the input-output (I-O) technique, highlighting the similarity between an I-O flow matrix and a business' income statement. They afford a knowledgeable, articulate explanation, including edification regarding the limitations of input-output models. For example, detailed information on inter-industry relationships can provide important insights into secondary impacts, but this advantage is offset by certain drawbacks. This list includes: the linear functional form, the use of national flows, the reliance on nonsurvey derived coefficients, the absence of behavioral response, the level of aggregation, and the lack of factor substitution.

Rose and Kolk illustrate pragmatic adjustment procedures to address the problems of fixed coefficients, an assumption which is particularly troublesome in the context of the evaluation of a changing economic environment, and that latter is the focus of this work. The issue pertains to the appropriate incorporation of potential changes, with questions being posed in a "scenario" format. A dynamic input-output model could explicitly handle structural responses to changing social, political and economic environments, but, as is explained here, at a much greater cost. The book is divided into three sections. In the first, issues specific to the natural gas industry and the theory and structure of input-output are presented. Next, various methodologies for modeling market incentives, and regulatory and technological change are outlined. These techniques include: production functions, "policy-cost indexes;" and "qualitative, extrapolative, and causal" methods. The final

section presents the aspects of a "changing world," and the specific methodologies which R&K address: (1) conservation subsidy programs; (2) incremental environmental regulations on petroleum refining, and (3) cogeneration technology adoption. These form the heart of the book, but no new ground is broken.

The "changes" that R&K consider are defined so that a minimum number of I-O coefficients will be affected. For example, in the case of subsidies for the purchase of energy-efficient capital, it is argued that this scheme, if properly designed and implemented, will affect "the modification of a single row of I-O coefficients--the gas-use coefficients" (p. 57). This restricted form of substitution is one wherein "the reduction in gas use does not involve any substitution of other fuels. . . [and when sectoral output does not change] there is no expansion effect," either (p. 57). To accomplish a desirable outcome of this kind, the natural gas producer has to be extremely selective in his subsidy program. Similarly, the issue of cogeneration is construed as relating to changes in the technical coefficients of the natural gas and electric utility rows only, and is not treated as a case of joint production. The "tightening of the regulations on petroleum refining" effects are taken to include only the expenditure on pollution control equipment, which is incorporated as a change in the "refining final demand," and the associated operating costs. This "increases certain structural coefficients" in that sector"s purchases of maintenance, chemicals, electricity, and value-added, but does not acknowledge the residuals of the production process as being integral to a transformation of raw materials into final products. The nature of this relationship would necessarily affect all of the I-O coefficients.

The first paper in the Moroney volume considers the effect of quasi-fixed capital and the assumption of "full static equilibrium" on productivity measures. Callan concludes that the use of the variable cost function, vis-a-vis the total cost function, provides a more accurate estimate, since optimality of the quasi-fixed factor is not assumed in regard to the variable cost function. Morrison's consideration of short-run restricted cost functions and of the "pattern of the firm's subequilibrium decisions," (p. 26) in the context of: (1) quasi-fixed productive capital, and (2) environmental regulation mandated capital, indicates that "capacity utilization drops when either P_E or P_L increase . . . although imposition of additional pollution abatement capital regulations increase observed capacity utilization" (pp. 55 and 57). "The [latter] response is the reverse of what would be [expected;] . . . costs, therefore, drop and the firm is better off" (p. 53). This issue of capital utilization, one which Berndt and Wood explore in their investigation of the energy price-induced effects, is important. The conclusion is that the traditional

measure of multifactor productivity, which ignores this price-induced effect, has understated productivity growth for quite some time, but that productivity growth in the U.S. still has declined since the 1973-74 OPEC-1 period. The Hanson and Lee paper concerns itself, as well, with the "lumpiness" of capital, but only in respect to the implications as relating to the optimal temporal path of the development of exhaustible resources. Hanson and Lee's consideration of irreversible capital investment suggests that changes in the initial conditions and the expected growth rate of the price of the resource result in two different development strategies: the first, when constant prices are assumed, is to "develop fully a profitable field immediately;" and the second, wherein "a higher price growth rate [is expected, is to] . . . invest gradually over time in field development and hence spread out resource production" (pp. 163-4). This is a different development strategy from the traditional Hotelling solution.

The emphasis of the volume shifts in Halvorsen's work. He posits a single equation, Koyck-type, dynamic-adjustment model and considers industrial total energy and petroleum products' use for twelve developing countries. The elasticity values derived are largely consistent with other studies, and the scenario forecasts presented suggest that the effects of any one-time energy shock relating to a price change will be quickly dissipated and have only a minimal long-run impact. With a 50 percent decline (increase) in energy prices, petroleum product expenditures stabilize at just over 5 (3) percent below (above) the base-case scenario. (That scenario assumes an annual growth rate of 2 percent for population, of 3 percent for per capita income, and of zero percent for energy prices.) These conclusions should be of interest to policymakers in developing countries. Conversely, the policy implications of the demographic and regional consumer demand elasticities for energy reported for the U.S. by Jorgenson, Slesnick, and Stoker, are unique in that all forms of energy considered (electricity, natural gas, fuel oil, and gasoline) exhibit highly elastic behavior--the range of these elasticity values being: -2.0 to -2.4; -1.4 to -1.6; -1.8 to -2.8; and -1.2 to -1.7, respectively, for the various fuels. Such results are in contrast with the literature generally, with conventional wisdom, and with common sense, and are very likely attributable to the 1972 Consumer Expenditure Survey data which are utilized, and also to the maintained hypotheses. According to these, the four fuels are weakly separable from the market-basket of consumption goods. Often, it seems, an attempt at detailed disaggregation "finds" spurious results.

The paper by Moroney and Bremmer presents an econometric, supply-side model of petroleum and natural gas exploration and development which is used to analyze different scenarios relating to the price of

oil and gas. The outcomes derived from this model are "that Texas oil and gas production will inexorably fall in the years to come" (p. 218); and that state revenues from these resources will very likely fall, also. While these results are hardly surprising, the model does present state policy-makers with some indication of the relative declines in tax revenues to be anticipated under alternative assumptions about the world-market price for oil. None of the outcomes is one to be applauded.

In summary, in the R&K book, the philosophy is that "changes in economic structure are important because of the large variation in energy intensities between sectors . . . however, prices are relegated to a secondary role" (p. xvii). The difficulty with handling "a changing world" by way of the methods adopted by Rose and Kolk is that, given that prices affect structure, such an approach vitiates the use of the input-output analysis. Its inherent advantages over other modeling methodologies are lost, because *ad hoc* adjustment procedures are employed which disregard the production relationships. A static input-output table is not intended to handle such questions. Still, the R&K book is recommended to analysts, is well written, and does address difficult questions which identify several problems in policy modeling. The attention in several of the works in the Moroney volume, directed as they are to productivity and capital utilization questions, suggests that, until better measures are developed, many of the insights derived from production-function modeling with respect to factor substitutability are suspect. Extensions of the flexible-functional-form modeling strategy to include market disequilibrium might be a useful orientation for production function analysis in the future. However, as Morrison observes, "the more general specifications [may] require too much from a minimal data set" (p. 47). Since policy decisions will be made regardless of imperfections in data and methods, informed decisions are to be preferred to those made without due consideration. Both these books provide substantial food for thought and prospects for new research.

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Responding to International Oil Crises by George Horwich and David Leo Weimer, eds., Washington, DC: American Enterprise Institute for Public Policy Research, 1988, 313 pp., $24.50.

This is by far the best volume in the American Enterprise Institute's series on emergency preparedness for oil supply disruptions. The title is misleading, however. The book is concerned for the most part with the International Energy Agency (IEA), an organization set up by the industrialized countries following the first oil shock, and the International Energy Program (IEP), the IEA's regulatory scheme for coping with oil supply disruptions. The book was occasioned by the tenth anniversary of United States ratification of membership in the IEA.

A distinguished group of energy economists has contributed chapters to the stated goal of the study: "a systematic assessment of the International Energy Program, which had not previously been undertaken by an outside independent team" (p. xvii). The resulting volume reflects the typical strengths and weaknesses of a multi-authored study. Several of the individual pieces are quite interesting, and the variety of approaches illustrates the choices and uses of techniques in energy economics today. There is a considerable amount of factual duplication, however, and the reader is left puzzled about the relationships to each other of the various approaches and models, and to the conclusions reached. Rather than comprising the elements of a systematic assessment, each individual chapter tends to take on the whole question. Each author makes a separate assessment based on his particular approach. The thoughtful policymaker (!), at whom AEI books tend to be aimed, is faced with a number of different approaches and conclusions without a clear sense of how to distinguish among them.

The first chapter, by Daniel Badger (a former IEA official), serves as a good overview of the IEA and IEP. Badger's support of the IEA is based partially on political, partially on economic considerations, but the lack of an analytical framework renders some of his arguments questionable.

The second chapter, by Rodney Smith, is the longest (close to 90 pages) and most detailed in the book. The first part expands on Chapter 1, providing a wealth of historical and institutional detail. The second part offers an analysis of the welfare effects of IEP regulations. Smith's approach is to construct a partial-equilibrium model of the oil market, estimate it econometrically, and simulate oil supply disruptions with and without the IEA emergency-sharing scheme. His conclusion is that the scheme reduces welfare. The welfare loss calculations are difficult to interpret, however, because the model estimated and the model used for the welfare analysis appear to be different.

This modeling approach merits comment because variants of it are employed by the authors of Chapters 3 through 6. A critical assumption made in all these chapters is that the oil market equilibrates instantaneously everywhere, or at least in all IEA countries. This assumption is standard in neoclassical economics, but quite unlikely to be appropriate here, for two reasons. First, the time-horizon for analyzing oil supply disruptions is the very short run. A disruption is a shock to the oil-trade system, and the essence of "responding to international oil crises" is quick analysis and action.

Second, oil trade is not conducted solely through the spot-auction markets pictured in textbooks. Important institutional features, such as vertical integration, long-term contracts, and longstanding informal relationships between buyers and sellers (e.g., the United States and Saudi Arabia) are neglected in these models, despite evidence that they matter in market adjustment (see Verleger 1982 a,b; Hubbard and Weiner 1985, 1986).

Adopting the assumption of simultaneous rapid market-clearing everywhere determines the conclusions reached. If markets work well even in major disruptions, then (given the models' treatment of the supply side of the oil market as competitive, itself a somewhat dubious proposition) of course *laissez-faire* will result in a higher welfare level than **any** non-market scheme, IEP or otherwise. The hard question of whether the IEP sharing scheme can enhance welfare can be answered trivially in the negative in this case.

Fortunately, one chapter of the book addresses the difficult but important question of how well markets actually work in disruptions. Joseph Anderson's piece is both interesting and unusual, and well worth reading by economists concerned with petroleum, quite apart from IEA issues. The author compares the prices paid for crude oil imported into the United States to other large, industrialized countries, for both disruptions and normal periods. He is careful to adjust for differences in the quality of oil imported. Regression methods are used to estimate the value of lower-sulfur and lighter grades of crude oil at each point in time. These "quality premia" are then used to adjust the price of imported crude oil.

The conclusion from this analysis is that the prices paid by the United States during disruptions differed from those paid by the other importing countries (although the differences were not large), which throws some doubt on the instantaneous-adjustment model discussed above. Anderson goes on to estimate structural models of the oil market similar to Smith's, and to test for structural change between normal and disruption periods. The models fit poorly, however, and little can be learned from this exercise.

The book concludes with two summary pieces. Richard Cooper offers a critique of the analytical framework used in Chapters 2-6, arguing that it is inappropriate for examining oil supply disruptions. Cooper's concerns are similar to those noted above, but are made in much more detail. These views provide particularly interesting reading, since Cooper has been both a practitioner, as a State Department official during the Iranian disruption, and distinguished academic economist.

The final chapter, written by the editors, is largely devoted to rebutting Cooper's point that institutional factors matter for oil-market functioning during supply disruptions. Their arguments have merit, but are not very convincing, in part because they rely on the weaker portion of Anderson's piece (while ignoring the stronger part, which lends support to Cooper), and on Hoffman et al (1982), a study which supports Cooper, in fact concluding the opposite of what is claimed here.

At the end of the volume Horwich and Weimer propose that the United States withdraw from the IEA's emergency-sharing scheme. They may well be correct, but readers of this book will find the supporting analysis for this position extremely weak. The pieces are simply not strong enough or related enough to add up to a systematic assessment of the IEA. The failure to attain this ambitious goal, however, should not deter energy economists from reading this interesting and thoughtful collection.

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Soviet Oil Exports by Margaret Chadwick, David Long, and Machiko Nissanke, England: Oxford University Press, 1987, 263 pp., distributed in the USA and Canada by Pennwell Books, Tulsa, Oklahoma, $54.95.

This book is a valuable update to earlier studies on the same topic such as Hewett's *Energy, Economics and Foreign Policy in the Soviet Union*. The aim of the book is to interpret Soviet export motivations and choices as a basis for predicting the future role of the USSR in world energy markets. It is an excellent study--informative, straightforward in exposition, sound and convincing in its analysis. Three sections, one by each of the authors, cover supply-side aspects, oil export decisions in relation to the overall Soviet foreign trade balance, and Soviet approaches to marketing oil in Western Europe.

The general theme is as follows. The USSR's energy exports generate about 80 percent of all its hard currency earnings (oil alone about 60 percent) and Soviet policymakers have limited maneuverability for substituting other hard-currency earners (such as gold and arms),. Latitude in the choice of export volume is further constrained by technical rigidities in oil production, inability to achieve conservation in domestic use, the constraint of Eastern European needs, and the relatively inflexible conditions of a refinery sector that cannot vary the composition of its output. Since the USSR is a price taker, its choice regarding the quantity to export to the West is uncomplicated by considerations of the effect on price. The book's hypothesis is that the main consideration governing short-term variations in the amount Soviet policymakers choose to export outside the communist world is the necessity to cover hard currency needs. This interpretation seems well supported by the evidence reviewed, and by an econometric study.

The need to earn hard currency, the authors argue, also drives production policy in the longer term. Maintaining exports imposes very high capital costs on the Soviet economy for output maintenance and expansion. Without conservation, the USSR is on a treadmill with few good options. Unless the Soviet Union can get out from under the investment requirements associated with its current energy policy, Gorbachev's plans for modernizing the Soviet economy through renovating the nation's capital stock seem unrealizable.

This line of argument is a convincing interpretation of Soviet behavior to date. The authors believe that the Russians will continue to export oil on a large scale, but also ask whether "the existence of . . . formidable technical and economic constraints, which are responsible for the soaring marginal cost of oil production (considering both extraction and investment costs) raises the interesting question of whether it is still an economically justifiable proposition for the Soviet Union to generate

and export a surplus of oil as a means of earning heard currency." Today there is a new appreciation among Soviet leaders of the urgency of conservation, and acceptance of the need for a dramatic domestic price increase for energy. (Some Soviet reformers suggest that a change by a factor of 2-3 would be appropriate.) New higher domestic prices that meet the test of a true shadow price would encourage conservation and thus free oil for export but would also signal the high opportunity cost of exports. Together with weak world market prices the comparison might provide the rationale for a decline in oil exports and output. A careful look at the cost structure that determines comparative advantage in Soviet trade, however, suggests that although better measurement of oil production costs would reduce the apparent gains in trade, it would not change the role of energy as the best export candidate the Russians have.

Other valuable contributions in the study are an unusually informative analysis of the Soviet refinery sector and a much fuller account of Soviet oil marketing practices than has appeared anywhere else.

To conclude, this is a well-informed, economically sound analysise of the behavior of an important player in the world oil market, whose share in world oil exports has risen from only four percent in the fairly recent past to eight percent today.

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