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Pages 1-27

Optimal Oil Producer Behavior Considering Macrofeedbacks

by Harry D. Saunders (Tosco Corporation, 10100 Santa Monica Blvd., Los Angeles, Calif.)

Oil producer decisions on oil pricing and production can affect consumer countries' economies in ways directly affecting producers' interests. The short- and long-term evolution of oil demand in consumer economies is, of course, strongly affected by producer actions. But so also may be returns on assets that producers hold in these economies. If we are to believe the "supply-side shock" theorists such as Mork and Hall (1980), macrofeedback links are strong enough to cause recession in consuming countries. Recession disturbs capital markets and simultaneously softens the short-run demand for energy - having an impact on producer investments held abroad, and revenues from the sale of their oil. Additionally, longer-term macrofeedbacks to oil demand and to capital markets can arise out of gradual substitution away from (or toward) energy as a factor of production. These macrofeedback considerations all affect optimal oil producer behavior. The standard approach to the problem of optimal oil producer behavior takes the producer's objective to be one of maximizing the discounted stream of future oil revenues. This approach has no difficulty, in principle, dealing with even complex macrofeedbacks to oil demand, since it presupposes only an accurate description of the relationship between oil price and oil quantity. For the simulation runs reported here, for instance, such a description is obtained from a simple macroeconomic model of the OECD which accounts for both short-run recessionary macrofeedbacks to oil demand and long-run substitution macrofeedbacks to oil demand. But this solves only part of the problem. This paper seeks an answer to the question of how an oil producer should set his prices over time if his pricing decisions affect the rate of return on his assets. It is hoped that the particular approach chosen succeeds in moving the analysis of optimal oil producer behavior one step toward greater realism. The question itself is highly relevant to OPEC oil producers, who invest a substantial portion of their revenues in claims on Western economies, and whose pricing decisions affect the well-being of (and hence the return to capital in) the same economies. But while the approach may be hoped to add realism in one sense, it requires certain simplifications that may not be wholly satisfactory either, such as the assumption that OPEC is a monolithic monopolist. The approach calls for restating the problem as a portfolio management problem. Briefly, producers are thought of as managing a portfolio of three types of assets: oil in the ground; domestic capital stock; and investments held in consumer countries. Their objective is to manage this portfolio in such a way as to provide maximum impetus to their internal economic development.

Pages 29-35

Comment and Reply on "0ptimal Oil Producer Behavior Considering Macrofeebacks"

by Knut Anton Mork (Owen Graduate School of Management, Vanderbilt University, Nashville, Tennessee)

Harry Saunders's paper on the above subject in this issue of the Journal raises a very interesting point. As is well known, oil-exporting countries now hold major assets in the Western economies. Furthermore, the sensitivity of these economies to abrupt changes in oil prices seems widely accepted. It then seems reasonable to expect oil exporters' pricing decisions to be influenced by concerns about the rate of return on their assets. In particular, Saunders argues that oil exporters would want to avoid abrupt price changes because the ensuing shock effects would tend to reduce the rate of return on capital. While I entirely agree that oil exporters have reason to be concerned about the wider effects of their pricing decisions, I am not convinced that an oil price shock always reduces the real return to capital. While a downward movement can be expected for the short run, it may be reversed in the somewhat longer run as capital becomes more scarce after decreased investment activity following the shock. Such a mechanism may, for example, have been responsible for the rising trend of real interest rates in the OECD countries after the oil price shocks of the 1970. This point can easily be made with the two-level CES production function that Saunders adapts from Hogan and Manne (1977), as stated in Appendix D of his paper.

Pages 37-52

The Rate of Return Earned by Lessees under Cash Bonus Bidding for OCS Oil and Gas Leases

by Walter J. Mead, Asbjorn Moseidjord, (Department of Economics, University of California at Santa Barbara, Santa Barbara, Calif.) and Philip E. Sorensen (Florida State University)

The remaining oil and gas reserves and resources of the Outer Continental Shelf (OCS) represent one of America's largest publicly owned assets. Through 1980, OCS oil and gas leases had produced $62.8 billion in gross revenue and $41.3 billion in bonus, royalty, and rental payments to the federal government (U.S. Geological Survey, 1981). Policies and procedures for managing OCS oil and gas resources were established by Congress by the Outer Continental Shelf Lands Act of 1953. This act provides for leasing of OCS lands based on cash bonus bidding with a fixed royalty rate of not less than 12.5 percent of wellhead value (or quantity), or royalty bidding with a fixed bonus payment. Through 1978, nearly all leases were issued via cash bonus bidding with a 16_-percent royalty rate. Consumer activists, led by a lobbying group called Energy Action, have asserted that bidding under this leasing method has not been effectively competitive and that big

companies have enjoyed an unfair advantage in the lease sale market. This advantage is alleged to arise out of the fact that bonus bidding, as practiced, requires a heavy "front-end payment" as a means of deciding (1) who is to be issued a lease and (2) how much is to be paid to the government.

Pages 53-65

Oil and Gas Supply Modeling under Uncertainty: Puffing DOE Midterm Forecasts in Perspective

by Carl M. Harris (Department of Engineering Science and Systems, School of Engineering and Applied Science, University of Virginia, Charlottesville, Virginia)

Introduction

The original purpose of this study was to examine the midterm projections of oil and gas production generated by the 1979 version of the Department of Energy's Midterm Oil and Gas Supply Modeling System (MOGSMS) for the 1979 *Annual Report to Congress*. These forecasts applied to conventional oil and gas, onshore and offshore, in the lower 48 states from 1985 to 1995, inclusive. The specific objective of the work was to quantify the sensitivity of these projections to potential uncertainty in some of the model's key elements. But more generally, this exercise is viewed as but one good example of how to estimate the uncertainty in forecasts coming from a large computer-based model. Accordingly, two distinct statistical experiments were designed for detailed sensitivity work. Experiment I was a probabilistic simulation analysis (of the Monte Carlo type) of the United States Geological Survey (USGS) Circular 725 estimates of possible variability in regional undiscovered oil and gas resources and their impact on MOGSMS exploration finding rates and ultimate forecasts. Experiment 2 was then a second Monte Carlo simulation analysis of two other selected key elements (oil resource recovery factors and production decline rates) and their impacts on MOGSMS predictions.

Pages 67-80

Nationalizing Oil in the 1970s

by Dean Goodermote and Richard B. Mancke (Fletcher School of Law and Diplomacy, Tufts University, Medford, Mass.)

National oil companies emerged during the 1970s as an important force within both oil-exporting and oil-importing countries. By 1980 they were producing and marketing well over half the crude oil available for sale on world markets. These oil companies prospered within oil-exporting countries as events increasingly confirmed that the principal source of economic power in the oil business was sovereign control over oil reserves rather than private control over technical, managerial, and capital resources. During the 1970s, many oil-exporting countries sought to exploit their new-found market strength and exercise

greater control over their oil industry either by building up existing government-owned oil companies or by seizing the opportunity to create new ones. While exploding oil prices were giving the oil-exporting countries huge profit increases, oil-importing countries faced the unpleasant reality that the international oil companies could no longer guarantee either price stability or assured access to essential oil supplies. In consequence, the governments of these countries came under strong pressure to establish new institutional mechanisms that would somehow help stabilize oil markets. Many of these governments seized on national oil companies as providing the mechanism that would, at least, create the appearance that they were solving their nations' oil supply problems. Today the United States remains alone as the only major importing or exporting country without a national oil company. We question whether the United States has suffered from this lack of a state-owned company. Debate over the wisdom of creating national oil companies tends to be primarily ideological rather than substantive.

Pages 81-86

Individual Purchase Criteria for Energy-Related Durables: The Misuse of Life Cycle Cost

by Harry Chernoff (Economist, Science Applications, Inc., 1710 Goodridge Drive, McLean, Virginia)

Introduction

Life cycle cost is one of the most widely advocated methods for evaluating energy-related durables. The analysis method, its standard assumptions, and its rationale are well known. The costs and benefits of a durable are calculated over its lifetime and discounted at a market rate of interest for the individual. The investment with the lowest life cycle cost is preferred to all others. Although life cycle costing is standard among economists, the results of most analyses bear no relationship to the behavior of individuals. Discount rates inferred from observations of purchases are much higher than routinely assumed by economists. This note contends that the disparity between life cycle decisionmaking and individual decisionmaking is not the result of irrational behavior by individuals but the result of inappropriate assumptions about individual discount rates by economists. The most important component of a life cycle analysis is the discount rate. This rate is variously called the individual discount rate, the market discount rate, the implied discount rate, and the implicit discount rate. Regardless of nomenclature, this rate measures (or should measure) the individual's financial requirements and the sum of market imperfections and risks the individual faces or perceives. Most life cycle analysts, however, ignore the imperfections and risks and assume a discount rate based on the individual's interest rate for borrowing or lending (Ruegg, 1975; Sedmak and Zampelli, 1979; Reid et al., 1977; Lunde, 1982). Such a rate assumes that buying an energy-related durable is as safe and secure as putting money in a perfectly liquid, perfectly controllable, insured bank account.

Pages 87-90

The Real Price of Imported Oil Revisited

by Michael J. Coda and John E. Jankowski, Jr. (Resources for the Future, Inc., 1755 Massachusetts Ave., N.W., Washington, D.C.)

In a 1980 Energy Journal article, an examination was made of the effects of inflation and exchange rate adjustments on imported oil prices in some selected countries (Dunkerley and Jankowski, 1980). This showed that "real" inflation and exchange-rate adjusted prices, after rising threefold between 1973 and 1974, generally declined between 1974 and 1978. This decline was due to high rates of inflation and in some cases the weakness of the dollar in terms of local currency. A similar examination of the period following the second oil price rise between 1978 and 1980 shows somewhat different results. In this period, despite relative stability in nominal prices, the real prices of imported oil continued to rise through mid-1982. The movement in real prices of imported oil is given in Table 1 for 14 oil-importing countries, seven OECD members, and seven developing countries. These indices were derived by converting the average dollar price of Saudi Arabian oil (f.o.b. Ras Tanura) for each year to national currencies at the average exchange rates prevailing during that year. These prices were deflated by the Consumer Price Index in each oil-importing country. The same calculations were done for May 1982, the last month for which data were available. The resulting prices are listed in index form with 1974 equal to 100. Countries are ordered from top to bottom according to how much oil import prices have increased since 1974, with those facing the largest real price increases at the top. Not surprisingly, changes in the indices reflect the general movement of world oil prices with steep increases in 1974 and 1979-80. However, real oil import prices have increased much more rapidly in some countries than others, with Korea experiencing a 66.7-percent price increase since 1974 compared with India's 157.4-percent rise. In addition, other contrasts are reflected in the column showing the percentage change since 1978. Some countries - for example, Turkey, Kenya, and West Germany - have been hit with price increases approximately twice the size of those felt in such nations as the Philippines and Jamaica during this period. Many of those in the first group faced declining real prices after the first oil price rise.

Pages 91-94

Comment on International Energy Agency's World Energy Outlook

by David M. Kline and John P. Weyant (Energy Modeling Forum, Terman Engineering Center, Stanford University, Stanford, Calif.)

The International Energy Agency's *World Energy Outlook* (1982) reports on the results of an ambitious and comprehensive international energy study. The report represents a major step forward in the coordination and communication of energy policy analyses among the 21 IEA member countries. A major conclusion of the study is that the current softness of the world oil market is not likely to last out the current decade, particularly without fundamentally

new policy initiatives on the part of the major oil importers. One could argue with the various assumptions and analyses that are employed to arrive at this conclusion, but on the whole the IEA's analysis appears to be carefully and consistently done, particularly for a study involving a high degree of cooperation between analysts from countries who are basically allies, but often have goals and objectives that differ in particular areas. Although we are in broad agreement with the conclusions of the analysis that is at the foundation of the World Energy Outlook, in our opinion the policy recommendations that are drawn from them are incomplete. The IEA argues that since the world oil market will eventually tighten, policy measures designed to reduce the level of oil imports should be high on the energy policy agenda of the member nations. Nowhere though, is an attempt made to evaluate these import reductions, and thus important questions remain unanswered. If fewer oil imports are better, are none best? Are all import reductions equally desirable? The concept of an import premium could have been exploited to focus the discussion on import-reduction policies and provide some guidance for national policy in this area. As defined by Kline (1981), for example, the import premium measures the difference between the total cost of oil to importing countries and the world price. Estimates of the premium value thus provide guidance in how far governments should be willing to go in encouraging import-reducing activities. The IEA report is unnecessarily vague in this regard.