Special Issue to Acknowledge the Contribution of Campbell Watkins to Energy Economics

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Reserve Prices and Mineral Resource Theory

By M.A. Adelman (Professor of Economics, Emeritus, MIT, Cambridge, MA) and G.C. Watkins

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Perspectives on Nonparametric and Semiparametric Modeling

By Adonis Yatchew (Department of Economics, University of Toronto, Toronto, Ontario, Canada)

Abstract

Nonparametric regression techniques hold out the promise of more flexible modeling of data in many areas of physical, biological and social sciences. However, their use is hampered by the "curse of dimensionality" which imposes enormous data requirements as the number of explanatory variables increases. After summarizing two of the most commonly used methods for mitigating the "curse", this paper outlines a new approach which exploits data on derivatives. In economics, such circumstances arise in the joint estimation of cost and factor demand functions, or when production function data are combined with data on factor prices. The ideas are illustrated using empirical examples from energy economics.

Pages 31-42

Modeling Energy Use and Technological Change for Policy Makers: Campbell Watkins' Contribution as a Researcher-practitioner

By Mark Jaccard (School of Resource and Environmental Mgmt., Simon Fraser University, Vancouver, Canada)

Abstract

As an energy-economics modeler, who collaborated with academics while also consulting to government and industry, Campbell Watkins was especially interested in the empirical relationship between energy inputs and economic output. His skills were perfectly suited to this pressing research issue, which first emerged in the mid-1970s as the "energy-capital substitution" controversy. As his publication record shows, he worked with leading researchers in the development and econometric testing of dynamic specifications of this relationship. But he conducted this work always with a concern for how the research might be useful for immediate policy decisions. Today, the key policy question is the extent to which humanity can reduce its energy-related greenhouse gas emissions at reasonable cost. A new generation of "hybrid, topdown/ bottom-up" models attempts to address the objectives Campbell listed in his widely circulated 1992 book chapter, particularly his point that technological change should not be treated as completely exogenous, but at least in part as a very long-run response to price changes and policies. But while current energy models are increasingly constructed to incorporate this feedback effect – notably those models used for simulating climate policies – the empirical estimation of their key parameters is still in its infancy. As Campbell noted in his characteristic dry humor, the scope for research remains "undiminished." More hard-nosed researcher-practitioners like Campbell would certainly help.

Pages 43-62

Managing a Portfolio of Real Options: Sequential Exploration of Dependent Prospects

By James L. Smith (Department of Finance, Edwin L. Cox School of Business, Southern Methodist University, Dallas, TX) and Rex Thompson (Department of Finance, Edwin L. Cox School of Business, Southern Methodist University, Dallas, TX)

Abstract

We consider the impact of sequential investment and active management on the value of a portfolio of real options. The options are assumed to be

interdependent, in that exercise of any one is assumed to produce, in addition to some intrinsic value based on an underlying asset, further information regarding the values of other options based on related assets. We couch the problem in terms of oil exploration, where a discrete number of related geological prospects are available for drilling, and management's objective is to maximize the expected value of the combined exploration campaign. Management's task is complex because the expected value of the investment sequence depends on the order in which options are exercised.

A basic conclusion is that, although dependence increases the variance of potential outcomes, it also increases the expected value of the embedded portfolio of options and magnifies the value of optimal management. Stochastic dynamic programming techniques may be used to establish the optimal sequence of investment. Given plausible restrictions on the information structure, however, we demonstrate that the optimal dynamic program can be identified and implemented by policies that are relatively simple to execute. In other words, we provide sufficient conditions for the optimality of intuitive decision rules, like "biggest first," "most likely first," or "greatest intrinsic value first." We also develop exact analytic expressions for the implied value of the portfolio, which permits the value of active management to be assessed directly.

Pages 63-76

New Entrant and Closure Provisions: How Do They Distort?

By Danny Ellerman (Massachusetts Institute of Technology, Université de Paris)

Abstract

Provisions to endow new entrants with free allowances and to require closed facilities to forfeit allowance endowments are ubiquitous in the EU Emissions Trading Scheme, but a new design feature in cap-and-trade systems. This essay seeks to explore, within a comparative statics framework, the effect of these provisions on agent behavior in output and emissions markets assuming profit maximization. The main conclusion is that the principal effect is on capacity. The effect of the resulting over-capacity on output markets is to reduce output price and to increase output. The effect on emissions markets is more ambiguous in that it depends on the emission characteristics of the new capacity, existing capacity, and the capacity not retired, and the distribution of the excess capacity among these categories.

Pages 77-98

A Resource Whose Time Has Come? The Alberta Oil Sands As An Economic Resource

By Frank. J. Atkins and Alan J. MacFadyen (Department of Economics, The University of Calgary, Calgary, Alberta, Canada)

Abstract

The Alberta oil sands, which comprise over 170 billion barrels of proven recoverable reserves, are a resource of an order of magnitude similar to many estimates of ultimate world conventional oil reserves. Campbell Watkins maintained a long-standing emphasis on the essential economic component of any meaningful definition of the world's natural resources. The fact is that the Alberta oil sands have had a very shaky economic foundation until only recently. The intention of this paper is to examine this emerging resource from an economic perspective; one, it is hoped, similar to that which Watkins evinced, in order to fully assess the extent to which the Alberta oil sands may be regarded as being no different in any meaningful way from other oil resources.

Pages 99-134

A Least-Cost Optimisation Model of CO_2 Capture Applied to Major UK Power Plants Within the EU-ETS Framework

By *A.G. Kemp (*Professor of Petroleum Economics, Department of Economics, University of Aberdeen Business School*) and A. S. Kasim*

Abstract

Concerns about the cost of CO_2 capture and sequestration, and the effectiveness of carbon abatement policies loom large in discussions on climate change mitigation. Several writers address the issue from various perspectives. This paper attempts to add relative realism to discussions on CO_2 capture costs, and, the deployment of carbon capture technology in the UK by using publicly available company data on the long term capacity expansion and CO_2 capture investment programmes of selected power plants in the UK. With an estimated £8 billion plan to install a generation capacity
of 11 GW and capture capability of 44 $MtCO_2$/year, it is imperative to optimise this huge potential investment. A least-cost optimisation model was formulated and solved with the LP algorithm available in GAMS. The model was then applied to address a number of issues, including the choice of an optimal carbon abatement policy

within the EU-ETS framework. The major findings of the study include (a) the long term total cost curve of CO_2 capture has three phases – rising, plateau, rising; (b) alternative capture technologies do not have permanent relative cost advantages or disadvantages; (c) Government incentives encourage carbon capture and the avoidance of emission penalty charges; and (d) the goals of EU-ETS are more effectively realised with deeper cuts in the EUA ratios than merely hiking the emission penalty, as proposed in EU-ETS Phase II.

Pages 135-158

On Hyperbolic Discounting in Energy Models: An Application to Natural Gas Allocation in Canada

By John Rowse (Department of Economics, The University of Calgary, Calgary, Alberta)

Abstract

Recent work on time discounting involves hyperbolic discounting, in which the marginal discount rate shrinks over time. This work examines hyperbolic discounting and energy resource allocation utilizing a complex dynamic optimization model of natural gas allocation for British Columbia, Canada. Four hyperbolic and three conventional (constant annual) discount rate paths are considered. Focus is placed on the consequences: of using one hyperbolic discount rate path when another hyperbolic path is appropriate, of using conventional discounting when hyperbolic discounting is appropriate, and of using hyperbolic discounting when conventional discounting is appropriate. The generality and implications of the findings are also considered.