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Multi-Period VaR-Constrained Portfolio Optimization with Applications to the Electric Power Sector

by Paul R. Kleindorfer (The Wharton School/OPIM, University of Pennsylvania, Philadelphia, PA, USA) and Lide Li (Exelon Corporation, Kennett Square, PA, USA)

Abstract

This paper considers the optimization of portfolios of real and contractual assets, including derivative instruments, subject to a Value-at-Risk (VaR) constraint, with special emphasis on applications in electric power. The focus is on translating VaR definitions for a longer period of time, say a year, to decisions on shorter periods of time, say a week or a month. Thus, if a VaR constraint is imposed on annual cash flows from a portfolio, translating this annual VaR constraint into appropriate risk management/VaR constraints for daily, weekly or monthly trades within the year must be accomplished. The paper first characterizes the multi-period VaR-constrained portfolio problem in the form $\text{Max } \{E - kV\}$ subject to a set of separable constraints over the decision variables (the level of assets of different instruments contained in the portfolio), where E and V are, respectively, the expected value and variance of multi-period cashflows from operations covered by the portfolio. Then, assuming the distribution of multi-period cashflows satisfies a certain regularity condition (which is a generalization of the standard Gaussian assumption underlying VaR), we derive computationally efficient methods for solving this problem that take the form of the standard quadratic programming formulations well-known in financial portfolio analysis.

Pages 27-50

Are Decline Rates Really Exponential? Evidence from the UK Continental Shelf

by A.G. Kemp and A.S. Kasim (Department of Economics, University of Aberdeen, Aberdeen, United Kingdom)

Abstract

Understanding of oil and gas production decline rates is important in order to predict future behaviour and give policy guidelines. Most studies propose exponential and/or hyperbolic decline rates. Econometric techniques are extensively used in the present study to establish that logistic decline rates best fit the UKCS data and that the majority of fields have experienced complex logistic decline. Newer fields with relatively smaller reserves were found to have higher annual mean decline and decline decelerating rates – a property that poses both a challenge and an opportunity for the industry.

Pages 51-82

Inscrutable OPEC? Behavioral Tests of the Cartel Hypothesis

by James L. Smith (Department of Finance, Southern Methodist University)

Abstract

Although OPEC is commonly viewed as a syndicate of producers engaged in cooperative efforts to restrict production and raise price, to date there is a surprising dearth of supporting statistical evidence to that effect. I show that standard statistical tests of OPEC behavior have very low power across a wide range of alternative hypotheses regarding market structure. Consequently, it is difficult, given the current availability and precision of data on demand and costs, to distinguish collusive from competitive behavior in the world oil market. I apply a new, production-based approach for examining alternative hypotheses and find strong evidence of cooperative behavior among OPEC members. My results also suggest that OPEC's formal quota mechanism, introduced in 1982 to replace a system based on posted prices, increased transactions costs within the organization. Statistical evidence is mixed on the question of whether Saudi Arabia and other core producers have played a special role within the cartel.

Pages 83-106

Combining Top-Down and Bottom-Up Approaches to Energy-Economy Modeling Using Discrete Choice Methods

by Nic Rivers (School of Resource and Environment Management, Simon Fraser University) and Mark Jaccard (School of Resource and Environmental Management, Simon Fraser University, Burnaby, BC, Canada)

Abstract

Recently, hybrid models of the energy-economy have been developed with the objective of combining the strengths of the traditional top-down and bottom-up approaches by simulating consumer and firm behavior at the technological level. We explore here the

application of discrete choice research and modeling to the empirical estimation of key behavioral parameters representing technology choice in hybrid models. We estimate a discrete choice model of the industrial steam generation technology decision from a survey of 259 industrial firms in Canada. The results provide behavioral parameters for the CIMS energy-economy model. We then conduct a policy analysis and show the relative effects of an information program, technology subsidy, and carbon dioxide tax on the uptake of alternative industrial steam generation technologies, including boilers and cogeneration systems. We also show how empirically derived estimates of parameter uncertainty can be propagated through the model to provide uncertainty estimates for major model outputs.

Pages 107-122

Implementing Kyoto in Canada: The Role of Nuclear Power

by Duane Bratt (Department of Policy Studies, Mount Royal College, Calgary, Alberta Canada)

Abstract

On December 7, 2002, Canada ratified the Kyoto Protocol, committing itself to reducing its greenhouse gas emissions by 6 percent of 1990 levels. This paper argues that nuclear power must be an indispensable component of Canada's Kyoto implementation strategy. This is because nuclear power, unlike other conventional energy sources of coal, natural gas, and oil, does not contribute to the emission of greenhouse gases. Nuclear power is frequently criticized for its environmental record (radiation, production of waste, reactor safety), but a comparison with the other major energy sources reveals the green advantages of nuclear power. One potential opportunity is using nuclear power in the Alberta oil sands which would contribute to Canada meeting its emission reduction targets while limiting the economic/political dislocation caused by implementing the Kyoto Protocol. The paper concludes by explaining why, despite the above advantages, the federal government has failed to properly utilize nuclear power in its strategy to meet its Kyoto commitments.

Pages 123-146

Electricity Restructuring in Ontario

by Michael J. Trebilcock (University of Toronto, Toronto, Ontario, Canada) and Roy Hrab (Toronto, Ontario, Canada)

Abstract

This paper examines the short-lived electricity sector restructuring initiative of the

province of Ontario, Canada's largest province. In May 2002, following years of planning and consultation Ontario opened its retail and wholesale electricity markets to competition. The summer of 2002 saw retail prices reach levels that consumers had never previously encountered. By December 2002, the provincial government froze retail electricity prices, covering approximately half of Ontario's electricity consumption. While the weather played a significant role in driving prices higher during the summer of 2002, other factors also played a major role. The other factors reviewed in this paper fall into two categories. The first category consists of market design problems, such as market rules (e.g., trading arrangements) and market structure (e.g., the degree of competition in the generation sector). The second category covers political economy problems, in particular the lack of political will to allow retail prices to reflect wholesale prices and to address effectively structural problems in the sector. Finally, this paper examines some of the new restructuring initiatives being pursued by the recently elected provincial government of Ontario as the province continues to struggle to bring order to its electricity sector.

BOOK REVIEW

Pages 147-153

Encyclopedia of Energy

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(Book Review by Robert L. Bradley Jr.)