Oregon State UNIVERSITY OSU

# SCHOOL OF PUBLIC POLICY

ECONOMICS – POLITICAL SCIENCE - SOCIOLOGY

# "A Bayesian Approach to Energy R&D Portfolio Analysis"

by


## Christopher Guo

University of California Santa Barbara



**Abstract**: This paper concerns the value of learning-by-investing in an energy technology R&D program. It analyzes a portfolio choice problem that is not addressed by portfolio theory: how does an R&D policymaker optimally invest in diverse technologies with uncertain potentials? It introduces a new approach, which recognizes the informational return from experimental investments (the value of learning-by-investing), assuming the amount the investor learns about the potential of a new technology will depend on how much he invested in that technology. In order to characterize the value of this endogenous learning, I develop a dynamic portfolio optimization model of investment as an information acquisition activity, incorporated with a Bayesian linear regression as the expectation revision mechanism, and solved with stochastic dynamic programming. Motivated by funding in energy R&D at the national level, the model is demonstrated using technology benefit estimates and risk assessments merged with historical U.S. Department of Energy budget data. This paper contributes to R&D portfolio theory and energy policy, and in so doing, rethinks performance metrics for evaluating energy R&D projects, calls into question status quo federal energy R&D policy, and ultimately reshapes the way economists analyze a certain class of portfolio investment. One analytical result shows that Modern Portfolio Theory can lead to a suboptimal portfolio choice because it ignores the expected value of learning from an investment. However, if the decision maker follows the Bayesian approach, both theoretical insight and illustrative numerical simulations indicate the gains may be substantial.


## Thursday, January 19, 2012
## 4:00 – 5:30 pm
## Wilkinson Hall Room 108