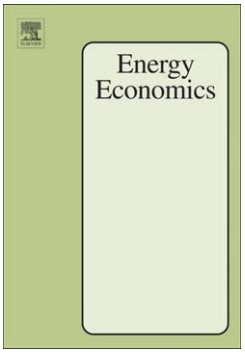

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Francisco D. Munoz, Adriaan Hendrik van der Weijde, Benjamin F. Hobbs, Jean-Paul Watson

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Does Risk Aversion Affect Transmission and Generation Planning? A Western North America Case Study

Francisco D. Munoz[a,*], Adriaan Hendrik van der Weijde[b], Benjamin F. Hobbs[c], Jean-Paul Watson[d]

[a] *Facultad de Ingeniería y Ciencias, Universidad Adolfo Ibáñez, Diagonal Las Torres 2640, Peñalolén, Santiago, Chile.*
[b] *School of Engineering, The University of Edinburgh, The King's Buildings, Mayfield Road, Edinburgh EH9 2JL, UK.*
[c] *Whiting School of Engineering, Johns Hopkins University, 3400 N Charles St, Baltimore, MD 21218, USA.*
[d] *Department of Discrete Math and Optimization, Sandia National Laboratories, P.O. Box 5800, MS 1326, Albuquerque, NM 87185-1326, USA.*

Abstract

We investigate the effects of risk aversion on optimal transmission and generation expansion planning in a competitive and complete market. To do so, we formulate a stochastic model that minimizes a weighted average of expected transmission and generation costs and their conditional value at risk (CVaR). We show that the solution of this optimization problem is equivalent to the solution of a perfectly competitive risk-averse Stackelberg equilibrium, in which a risk-averse transmission planner maximizes welfare after which risk-averse generators maximize profits. This model is then applied to a 240-bus representation of the Western Electricity Coordinating Council, in which we examine the impact of risk aversion on levels and spatial patterns of generation and transmission investment. Although the impact of risk aversion remains small at an aggregate level, state-level impacts on generation and transmission investment can be significant, which emphasizes the importance of explicit consideration of risk aversion in planning models.

Keywords: risk aversion, stochastic programming, transmission and generation planning, investment

1. Introduction

Transmission planners in liberalized electricity markets face large amounts of uncertainty. This includes short-term uncertainty about demand, intermittent generation, and equipment outages, but more importantly, long-term fuel prices, load growth, construction cost, and policy uncertainty. The amount of

*Corresponding author. E-mail: fdmunoz@uai.cl