Price Volatility and the Efficient Energy Portfolio for the United States

Katarzyna Janczura

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Abstract The current energy portfolio of the United States is exposed to significant risk, which depends on the price volatility of the energy sources. This paper focuses on the composition of energy portfolios for the energy sector of the United States and possible solutions to optimize this investment. The study utilizes the modern portfolio theory mean-variance approach, a risk-return analysis, to compose the efficient frontier of portfolios in which the risk is minimized for a given return. The performance of each energy portfolio, consisting of oil, coal, natural gas, nuclear energy, and renewable energy, is measured using the Sharpe Ratio and compared to the existing portfolio. Using future prices of fuels and accounting for external costs, the study provides further evidence that the current energy portfolio of the United States is not efficient. In addition, the study shows how including the cost of pollution, measured by the intensity of carbon emissions, changes the energy source allocation within the portfolio by including less carbon-intensive substances. The study implies that further diversification of the energy sector by including investment in hydroelectric energy generation technologies may decrease our dependence on more volatile sources of energy and consequently reduce the possibility of energy supply interruption from commodity price volatility. This proposes that the government focus on implementing a strategy to facilitate the introduction of renewable energy into our energy portfolio. The shift away from an infrastructure heavily dependent on fossil fuels towards one with more investment in renewable energy can be achieved by granting subsidies for renewable energy technologies and by implementing appropriate emissions prices to account for external energy generation costs.

Keywords Modern portfolio theory · Mean-variance analysis · Energy investment · Carbon dioxide emission tax · Carbon dioxide cap and trade

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K. Janczura (✉)
Department of Economics, New York University, New York, NY, USA
e-mail: kaj261@nyu.edu