

Managing Transmission Risk: The Theory of Spatial Hedging and Arbitrage¹

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Abstract

The spatial variation in electricity spot prices in competitive markets is complex and counter-intuitive, and qualitatively different from other commodity markets. Even when transmission is only congested between two locations, it can result in price variations all over the system. In theory, market participants could use futures markets to eliminate the financial risks that arise from spatial price variations. In practice however, while physical spot markets for electricity will exist at many locations in the power system, liquid futures markets will exist at only a small fraction of these locations. This report shows how one may manage or eliminate transmission risk using relatively few liquid futures markets. Locational hedging portfolios and synthetic locational futures contracts can be constructed by taking a precisely determined position at time 0 in all the futures markets, and taking another precisely determined position at a later time in the spot markets. The same idea is also used to realize arbitrage opportunities if such opportunities exist. While this is a well known risk management strategy for other commodities, it is non-trivial for electricity because of the requirements imposed by network flows. Based on rigorous formulas, the report presents simple risk management rules of thumb to detect opportunities for hedging and arbitrage.

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