

Hedging volumetric risks using put options in commodity markets

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Let us consider an energy company that sells fluctuating volume V of energy units at random price S per unit and obtains the income $X = VS$. Markets today do not provide simple instruments that can be used for hedging volumetric risk. A short survey of current literature for the volumetric risk hedging problem and optimal hedging results for the utility-based optimization framework can be found in [1].

Traditional measure of risk which is widely used in practice is V@R. We consider the problem of V@R minimization in incomplete markets using put options. We try to find the optimal strategy in $h \in \mathbb{R}$ that solves the following problem:

$$V@R\left(V * S + h((K - S)^+ - EP(K))\right) \rightarrow \min_{h \in \mathbb{R}, K \in \mathbb{R}_+},$$

Unfortunately, due to incompleteness of commodity markets we could not make a perfect hedge. Also usually we can not use put options with many different strikes. In [2] this task is solved for the cases when price has lognormal distribution and volume takes no more than 2 values.

Here we introduce the solution of finding optimal number of put options bought with strike K to minimize V@R in the case of some continuous distributions and prove the fact that if volume distribution has an atom in this minimum then there exists such λ_0 that for $\lambda < \lambda_0$ for minimizing V@R it is optimal to buy this minimum number of put options. Also we consider the task of finding the optimal strike of put option to buy in different models and make some numeric calculations.

In some cases when volume and price are negatively correlated we have the situation of so called "natural hedging". Here we consider some of such situations.

References

- [1] *Y. Oum, S. Oren, S. Deng.* Hedging quantity risks with standard power options in a competitive wholesale electricity market. *Naval Res. Logist.* **53** (2006), No. 7, p. 697–712.
- [2] *N. Valedinskaya.* Value at risk minimization for a model with options and volumetric risk. Diploma project at Moscow State University, (2011).

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