TECHNISCHE UNIVERSITÄT MÜNCHEN
Fakultät für Wirtschaftswissenschaften

Seminar in Finance and Accounting
im Sommersemester 2012:

Pricing, Hedging und Risikomanagement auf Energiemärkten

Themenübersicht

1. Einführung

- Energiemärkte: Stylized Facts und Unterschiede zu Finanzmärkten
- Kontrakte im Energiesektor
  - Futures, Standard Optionen
  - Swing Optionen, Flexibility
  - Swaps, Spreads
  - Vertragsmanagement (Take-or-Pay)
  - Bepreisung von Erzeugungsressourcen
- Bepreisungsansätze
  - No-Arbitrage Pricing
  - Alternative Ansätze
- No-Arbitrage Pricing in a Nutshell
- No Arbitrage Bedingung als Erfüllbarkeit des dualen Hedging Problems.
- Vollständige Märkte, Fundamental Theorem of Asset Pricing
- Die Black-Scholes Formel: Model und Limitationen
- Energiemärkte und Continuous Finance: Chancen und Probleme.

2. Preismodellierung in Energiemärkten

- Seasonalität.
- Mean Reversion und Sprünge
- Convenience Yield und Cost-of-Carry.
- Spotpreismodelle
- Futurepreismodelle

3. No-Arbitrage Pricing in Energiemärkten

- Put- und Call-Optionen
- Spread Options (calendar spreads, location spreads, spark spread)
- Flexibilität und Swing Optionen
- Bepreisung von Speichern

4. Alternative Ansätze

- Least-Square Monte-Carlo und Realoptionstheorie.
- Stochastische dynamische Optimierung.

5. **Risikomanagement für Energie-Derivate**
   - Hedging und Residualprofile.
   - Value-at-Risk (VaR)
     - Delta-VaR
     - Delta-Gamma VaR (Approximationen höherer Ordnung)
     - Historischer VaR
   - Kreditrisiko

Seminarthemen

1. **Spotmärkte für Elektrizität: Die Finance-Sicht**
   - Blanco, C., Choi, S., Soronow, D., 2001. Energy price processes used for derivatives pricing & risk management. Commodities Now March, 74–80.
   - Blanco, C., Soronow, D., September 2001a. Jump diffusion processes – energy price processes used for derivatives pricing & risk management. Commodities Now, 83–87.
   - Blanco, C., Soronow, D., September 2001b. Mean reverting processes – energy price processes used for derivatives pricing & risk management. Commodities Now, 68–72.
   - Lucia, J., Schwartz, E., 2002. Electricity prices and power derivatives: Evidence from the nordic power exchange. Review of Derivatives Research 5 (1), 5–50.

2. **Spotmärkte für Elektrizität: Ökonometrische Modelle**
   - Boogert, A., Dupont, D., 2008. When supply meets demand: The case of hourly spot electricity prices. IEEE Transactions on Power Systems 23 (2), 389–398.
   - Conejo, A. J., Contreras, J., Espinola, R., Plazas, M., 2005. Forecasting electricity prices for a day-ahead pool-based electric energy market. International Journal of Forecasting 21 (3), 435–462.
   - Kovacevic, R., Wozabal, D., 2012. A semiparametric model for electricity spot prices. Working Paper.

3. **Forward-Preise auf Energiemärkten: Die Finance-Sicht**
   - Clewlow, L., Strickland, C., 2000. Energy derivatives: pricing and risk management. Lacima Publications. Kapitel 4.
   - Clewlow, L., Strickland, C., 2000. Energy derivatives: pricing and risk management. Lacima Publications. Kapitel 8.
   - Koekebakker, S., Ollmar, F., 2005. Forward curve dynamics in the nordic electricity market. Managerial Finance 31 (6), 73–94.

4. **Forward-Preise auf Energiemärkten: Ökonometrische Modelle**
   - Fleten, S.-E., Lemming, J., 2003. Constructing forward price curves in electricity markets. Energy Economics 25 (5), 409–424.
   - Povh, M., Fleten, S.-E., 2009. Modeling long-term electricity forward prices. IEEE Transactions on Power Systems 24 (4), 1649–1656.

5. **Integration von Windenergie in Elektrizitätsnetze und Auswirkungen auf den Spotpreis**
   - Armstrong, M., Iezhova, V., Galli, A., 2011. Assessing the impact of wind power on day-ahead electricity prices in France, Cerna Working Paper.
   - Nicolosi, M., Fürsch, M., 2009. The impact of an increasing share of res-e on the conventional power market — the example of germany. Zeitschrift für Energiewirtschaft 33, 246–254.
   - Weigt, H., 2009. Germany's wind energy: The potential for fossil capacity replacement and cost saving. Applied Energy 86 (10), 1857–1863.

6. **Bewertung von Gasspeichern: Klassische Ansätze**
   - Breslin, J., Clewlow, L., Elbert, T., Kwok, C., Strickland, C., November 2008. Gas storage: overview and static valuation. Energy Risk, 62–68.
   - Breslin, J., Clewlow, L., Elbert, T., Kwok, C., Strickland, C., van der Zee, D., January 2009. Gas storage: rolling intrinsic valuation. Energy Risk, 61–65.
   - Eydeland, A., Wolyniec, K., 2003. Energy and power risk management: new developments in modeling, pricing, and hedging. Wiley Finance. Wiley. Kapitel 8.
   - Sadeghi, A., November 2011. Hedging the extrinsic value of a natural gas storage. Energy Risk, 64–69.

7. **Bewertung von Gasspeichern: Sampling basierte Ansätze**
   - Boogert, A., de Jong, C., 2008. Gas storage valuation using a Monte Carlo method. The Journal of Derivatives 15 (3), 81–98.
   - Boogert, A., de Jong, C., 2012. Gas storage valuation using a multifactor price process. Journal of Energy Markets 4 (4), 29–52.
   - Longstaff, F., Schwartz, E., 2001. Valuing american options by simulation: a simple least-squares approach. Review of Financial Studies 14 (1), 113–147.

8. **Speicherbewirtschaftung und -bewertung in Elektrizitätsmärkten**
   - Löhndorf, N., Wozabal, D., Minner, S., 2011. Optimal bidding of electricity storage using approximate dynamic programming, Working Paper.
   - Pereira, M. V. F., Pinto, L. M. V. G., 1991. Multi-stage stochastic optimization applied to energy planning. Mathematical Programming 52, 359–375.

9. **Bepreisung von SWING-Optionen**
   - Haarbrücker, G., Kuhn, D., 2009. Valuation of electricity swing options by multistage stochastic programming. Automatica 45 (4), 889–899.
   - Pflug, G., Broussev, N., 2009. Electricity swing options: Behavioral models and pricing. European Journal of Operational Research 197 (3), 1041–1050
   - Eydeland, A., Wolyniec, K., 2003. Energy and power risk management: new developments in modeling, pricing, and hedging. Wiley Finance. Wiley. Kapitel 8.

10. **Realoptionsansätze in der Kraftwerksplanung**
    - Cassano, M., Sick, G., 2012. Valuation of a spark spread: an lm6000 power plant. The European Journal of Finance Online First.
    - Fertig, E., Heggedal, A., Doorman, G., Apt, J., 2011. Optimal timing and capacity choice for pumped hydropower storage, Working Paper.