Technische Universität München
School of Management

Prof. Dr. David Wozabal
Arcisstraße 21
80333 München
+49 (0) 89-289-25479
david.wozabal@tum.de

August 18, 2016

Topics in Energy Trading
Previously Derivatives II

Course Type	Lectures / Case work
Course Level	Master
ECTS / SWS	6 /4
When & where	Wednesday 9:45-11:15, Room 0544
Lecturer	Prof. Dr. David Wozabal
Language	English

General Information

The course is a continuation of the course *Energy Finance* in the summer term and introduces derivatives in energy markets. More specifically, students will learn about specific challenges in pricing, hedging, and risk management connected with trading on energy markets. The content includes material on forward and futures trading, specification and estimation of models for price dynamics, pricing of derivative instruments, and risk management techniques.

- futures and forwards in commodity markets and their relations
- determinants of futures and forward markets
- construction of futures curves from observed data
- modelling futures prices as random process
- estimation of multi-factor future curve models
- pricing of derivatives on futures contracts
- Greeks for risk management
- Value-at-Risk in energy trading

Participation & Registration

The course is open to all master students who specialize in *Finance & Accounting* or have BWL as a minor studying at TUM. The number of participants is limited to 30 and a registration is required. Registration is done via TUMOnline. Seats are awarded on a *first-come-first-serve* basis.

Prerequisites

Knowledge of basic finance (instruments, no-arbitrage pricing, market modelling) as for example acquired through the course *Derivates*. Interest in mathematical modelling, quantitative analysis, and working with data. Proficiency in MATLAB or a similar high level programming language is an advantage.

Teaching and learning methods

The course combines several learning methods. To facilitate a better understanding of the subject the course is divided into lectures and work on case studies.

In the lectures theory is presented which is subsequently applied by students in the work on case studies. Students work on the case studies in groups, hand in a short write-up of their work, and present their results in the class. In private reading, students will complement the knowledge from the lecture with additional methods relevant for solving the cases. Students will reflect on the theory and their applicability in class and during class discussion. By working on real world energy finance problems, handling actual market data, and designing numerical solution approaches as well as attending presentations of the other students and engaging in discussions of their projects, participants will get in-depth knowledge about energy finance.

Assessment & Grading

The examination consists of presentations of the results obtained for the case studies, including three short written reports (7-10 pages each, 70%) and in-class presentations containing a discussion of the cases (30%). The paper is a means to assess students' understanding of theories and methods, their ability to apply those to real world problems, and their critical reflection of the results and possible limitations of the theory. The presentations measure students' ability to structure and present their results, connect them with state-of-the-art methods and theories, and present them in a scientific way. Students' reactions to questions and their critical reflection of their work reflect their ability to defend the results obtained based on rigorous scientific reasoning.

Learning Objectives

After the successful completion of this module, students will be able to

1. understand challenges of trading in energy markets such as forward curve modelling and the theoretical foundations of energy finance,
2. be able to analyze standard pricing, planning, and risk management problems such as Value-at-Risk based trading arising on a energy trading floor,
3. create solution approaches for real-world case studies,

4. communicate the results to a scientific audience in written and oral form and to defend them if necessary.

Tentative Schedule

Date	Topic	Reading
19.10.2016	Futures / Forwards	[3], Chapter 2 & 3
26.10.2016	Case Study 1 (Group Work)	
02.11.2016	Case Study 1 (Group Work)	
09.11.2016	Case Study 1 (Presentation)	
16.11.2016	Dynamics of the Futures Curve I	[1], Chapter 8
23.11.2016	Case Study 2 (Group Work)	
30.11.2016	Case Study 2 (Group Work)	
07.12.2016	Case Study 2 (Presentation)	
14.12.2016	Risk Management I	[1], Chapter 9 & 10
21.12.2016	Case Study 3 (Group Work)	
28.12.2016	Holidays	
04.01.2017	Holidays	
11.01.2017	Case Study 3 (Group Work)	
18.01.2017	Case Study 3 (Presentation)	
25.01.2017		
01.02.2017		

Literature

[1] L. Clewlow and C. Strickland. *Energy Derivatives: Pricing and Risk Management*. Lacima Publications, 2000.

[2] J.C. Cox, J.E. Ingersoll, and S.A. Ross. The relation between forward prices and futures prices. *Journal of Financial Economics*, 9, 1981.

[3] H. Geman. *Commodities and Commodity Derivatives: Modeling and Pricing for Agriculturals, Metals and Energy*. The Wiley Finance Series. Wiley, 2009.

[4] J. Hull. *Options, Futures, and Other Derivatives*. Prentice Hall, 2012.

[5] S. Shreve. *Stochastic Calculus for Finance II: Continuous-Time Models*. Springer Finance / Springer Finance Textbooks. Springer New York, 2010.

[6] S. Shreve. *Stochastic Calculus for Finance I: The Binomial Asset Pricing Model*. Springer Finance. Springer, 2012.