Mat-2.177 Project work seminar

Project plan 15.2.2005

Electricity Forward Curve Generation

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1 INTRODUCTION

This document is the project plan for a project in the Helsinki University of Technology course Mat-2.177 Project work seminar.

Electricity markets differ from conventional commodity markets in several ways because of the fact that electricity cannot be stored. Electricity is traded in centralized electricity exchanges, such as NordPool and European Electricity Exchange (EEX) that offer markets for day-ahead electricity as well as financial products over longer time spans. These products include financially settled electricity forward contracts, options and contracts for difference (swaps). The day-ahead market price is usually established hourly and called the SPOT price. The forward contracts are typically valuated against the SPOT price. In European electricity markets, a forward curve (FC), calculated over suitable time spans and time step from hourly to yearly using financial forward products and mathematical models, has become an indispensable tool for offers and valuation of electricity contracts and derivatives. There are different algorithms to calculate the FC that take into account effects such as overlapping or missing contract periods and seasonality. The algorithms are based on e.g. least-squares fitting of a profile or a theoretical model. In this project, the construction of such a forward curve using market price data, is considered.

2 PROJECT OBJECTIVES

The project objectives are to invent and test an algorithm to make forward price curves out of market price data, mainly forward products. The emphasis is foremost on electricity markets but some features of other commodity markets may be considered as well.

In concrete terms, the aim of this project is to make the following activities:

1. Literature survey of
    i. Financial electricity market, forward curve and forward products. Case NOPO & EEX.
    ii. forward price curve construction and

iii. electricity forward and spot price models and their relationship.

2. Comparison of models and algorithms

3. Construction of an algorithm to calculate a forward curve based on market price time series of forward products

    i. Handling of over-lapping delivery periods and weighting of different forward products

    ii. Handling of periods with no forward price information

    iii. Handling of several correlated reference prices for forwards based on contracts for differences. (Pricing of CfDs left out of scope).

2. Seasonality and profilizing the forward curve to hourly-level. Yearly, weekly, daily and holidays seasonality.

4. Construction of an algorithm to estimate forward price model(s) parameters based on market price data

Optionally:

Calculation of characteristic values for the data and forward curve, e.g. goodness of fit, volatility.

As a result of these activities, an Excel tool that implements the chosen algorithm and models is built. The tool as well as the literature survey and other activites are documented in a project final report.

3 PROJECT RESTRICTIONS

The project scope excludes energy derivative valuation, SPOT or forward price forecasting (other than that provided by calibrated models), analysis of bottom-up models (i.e. models based on supply and demand of commodities) of SPOT and forward prices.

4 PROJECT DELIVERABLES

Project deliverables are in addition to this project plan, an Excel tool to build forward curves and the final report of the project at the end of April

2005. In addition, an intermediate report will be prepared to report project status in March 2005.

5 PROJECT PHASES AND PROJECT SCHEDULE

The kick-off meeting of the project was held already on 28th January, 2005. The project includes the phases and activities summarized below:

Table 1. Project phases and activities

Phase I: Initial phase

Activity	Start	Finish	Status
Project kick-off	28.1.2005	28.1.2005	Done
Project plan preparation	28.1.2005	20.2.2005	Done
Literature survey of FW curve algorithm and models	28.1.2005	20.2.2005	In progress
Project plan presentation	25.2.2005	25.2.2005	Not started

Phase II: 1st phase

Activity	Start	Finish	Status
Literature survey, on an as-needed basis	26.2.2005	29.3.2005	Not started
Data analysis, comparison of models and algorithms	26.2.2005	6.3.2005	Not started
Construction of an algorithm to build FW curves	7.3.2005	15.3.2005	Not started
Intermediate report preparation	20.3.2005	29.3.2005	Not started
Intermediate report presentation	1.4.2005	1.4.2005	Not started

Phase III: 2nd phase

Activity	Start	Finish	Status
Implementation of the algorithm in Excel	15.3.2005	27.3.2005	Not started
Implementation of chosen price process models in Excel	27.3.2005	5.4.2005	Not started
Testing of the algorithm and models	1.4.2005	10.4.2005	Not started
Fitting a model with market data	1.4.2005	15.4.2005	Not started
Optionally: Calculation of characteristic values	15.4.2005	25.4.2005	Not started
Final report preparation	26.2.2005	28.4.2005	Not started
Project end presentation	29.4.2005	29.4.2005	Not started

6 PROJECT ORGANISATION

Project Manager: Otso Ojanen

Group member: Pekka Mild

Group member: Marko Tuominen

Group member: Kim Green

This project does not use a project steering board. Instead, the project group is steered by Process Vision's project responsibles, including Otso Ojanen.

7 PROJECT WORK AMOUNT ESTIMATE

The work amount estimate for the project is based on one hand side on the scope of the Helsinki University of Technology course (120h / 160h for Project Manager) and on the other hand on the problem at hand. Thus, it is assumed that the total work amount will be about 500 hours. The actual work amount of each project participant is followed-up using an Excel sheet for work hours.

The work amount estimate is divided between different tasks as presented in project schedule

8 PROJECT RISK MANAGEMENT

The following are identified as risks in this project as presented in Table 2.

Table 2. Project risks

Risk	Impact	Likelihood	Preventive actions
No well-founded method to build FW algorithm is found in literature	Medium	Low	Significant effort put in literature survey. Project group holds dedicated work-shop sessions to go through literature findings and own inventions and adapt them to this relevant problem
Project results do not match the project objectives	High	Low	Project manager can make re-orientation of the research directions in the first phase if needed.
The project time resources are not adequate to finish the project in time	Medium	Low	The project time table is strictly followed during the project. Scope will be adapted if significant discrepancy between available time and project scope arise.
Project group aptitudes do not match the requirements of the project,	Medium	Medium	The project group makes some preliminary work on the design of the Excel worksheet and algorithms to have sufficient time to learn the programming needs of the problem. As a last resort, the option to change to another tool than

especially VBA programming			Excel is kept open.
The problem is not feasibly solved using Excel	High	Low	The project group gathers similar analyses results done in Excel. Optimisation problem scope is reduced if Excel solver efficiency or capability is not sufficient. As a last resort, the option to change to another tool than Excel is kept open.

Project risk management is conducted by regular meetings among the project group, Process Vision and the course supervisors. These meetings include also a follow-up of the identified risks as well as identification of any newly appeared risks.

9 PROJECT CHANGE PROCEDURE

No formal change procedure is applied in this project due to its limited scope Project scope will be flexibly re-oriented, widened or limited as the first results from the project become available.

10 SOURCES OF INFORMATION

The main sources of information to be used will be scientific journals, related commercial product brochures available in the market as well as web sources.

11 OPEN QUESTIONS

At the current point, it is still an open question, how much of the optional scope will actually fit in the project. This will mainly depend on the work load on the main scope of the project that will be implemented first.