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# Short-Term Forecasting in Intraday Electricity Markets Using Machine Learning Models

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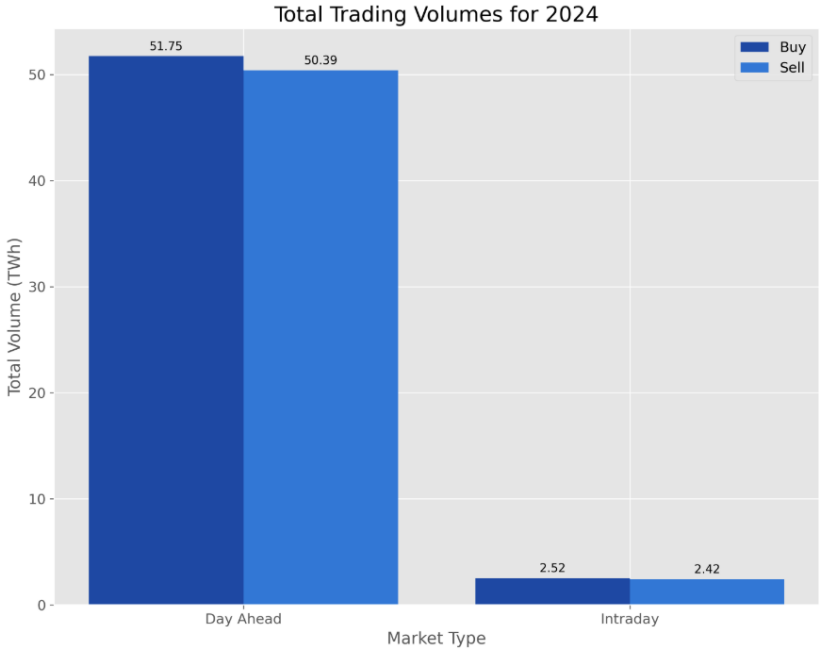
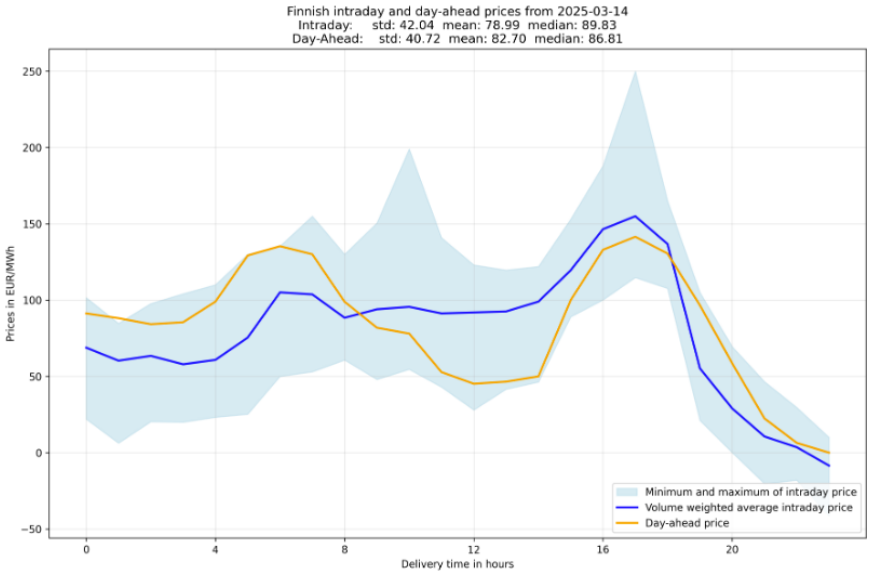
# Intraday markets enable participants to adjust positions closer to delivery

- Additional markets to day-ahead markets to buy and sell electricity
- Intraday markets allow participants to adjust their positions closer to delivery, helping last-minute balancing of supply and demand.
- Failing to meet day-ahead commitments may result in additional imbalance costs.

# Intraday market in Finland is still small but volatile market compared to day-ahead

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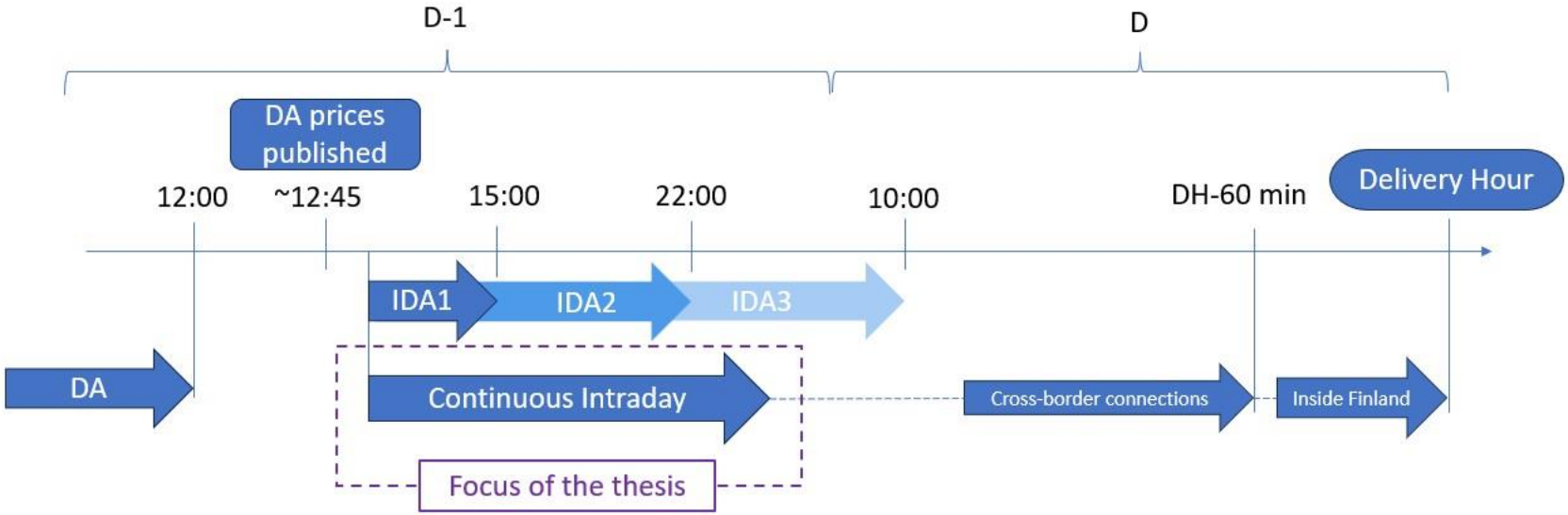
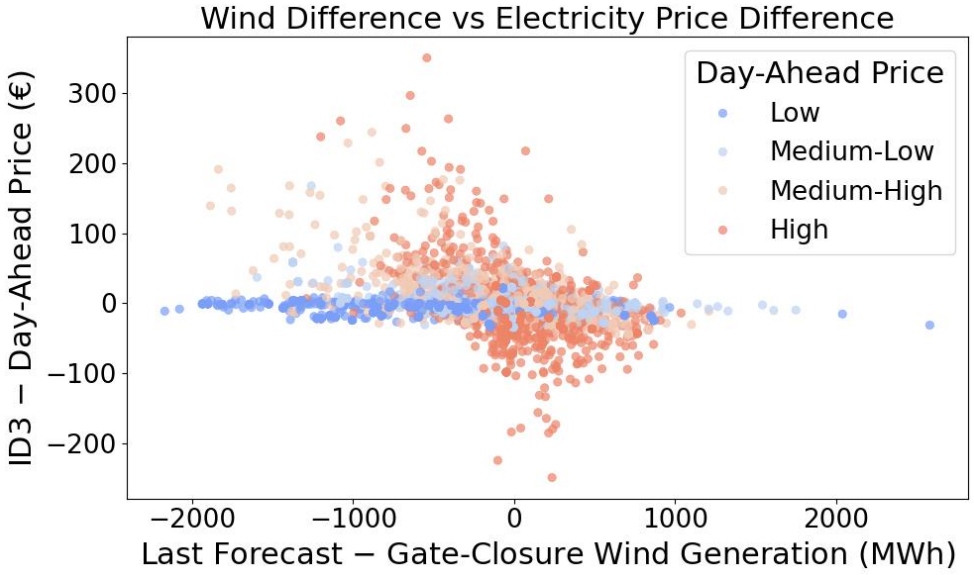
# Intraday trading operates in three auctions and a continuous market



# Changes in wind generation forecast affects the difference between intraday and day-ahead prices

- These differences tend to be larger when day-ahead prices are high.
- The direction of the forecast change determines whether the intraday or day-ahead price is higher.
- ID3 refers to the volume weighted average price in the last three hours before delivery



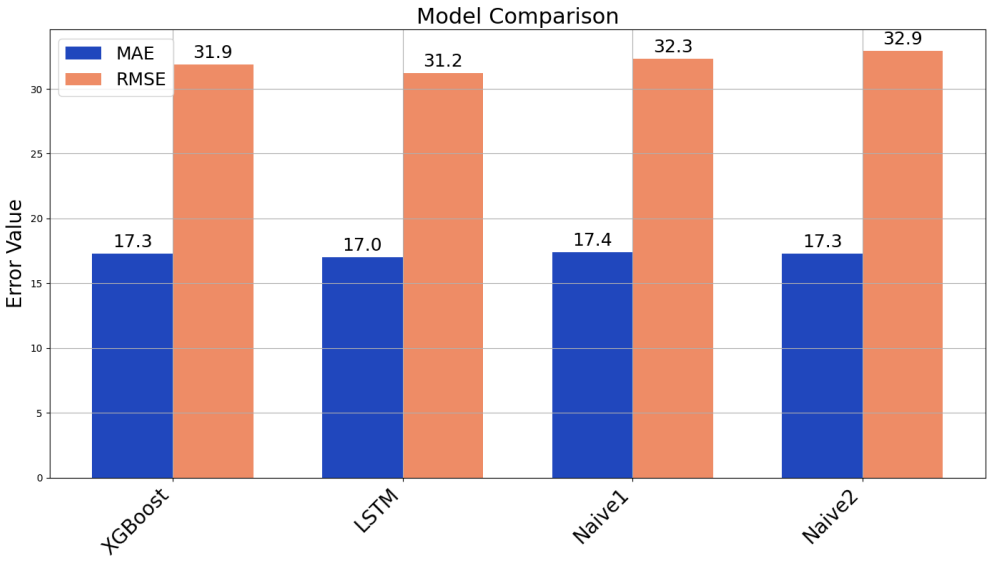
# Feature analysis reveals strong correlation between earlier intraday prices and ID3

# Comparing forecasting models: XGBoost, LSTM and naive methods

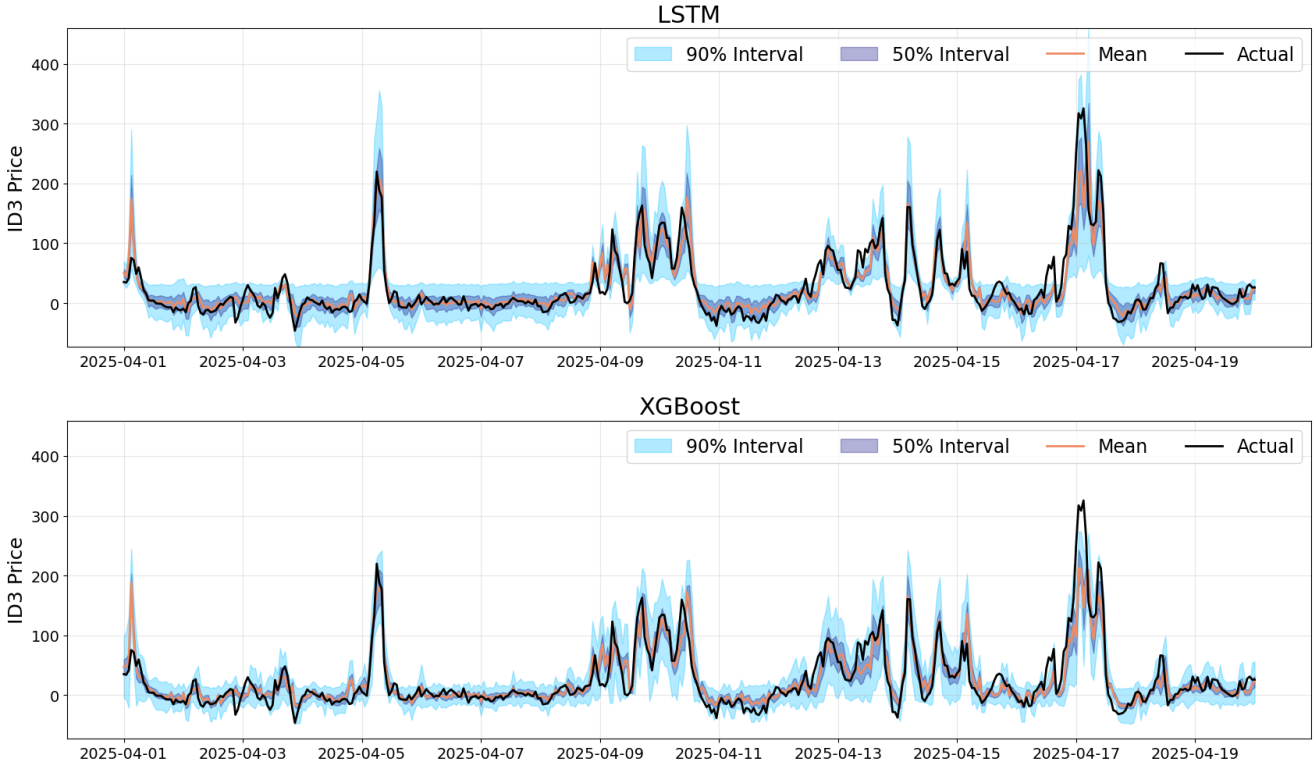
- Extreme Gradient Boosting (XGBoost), tree ensemble model
  - Used as a simpler machine learning model
- Long Short-Term Memory (LSTM), a type of artificial recurrent neural network model
  - Used as a more complex model to challenge XGBoost
- Naive approaches, use historical values as direct predictors
  - Used as reference models in point forecasting
  - Naive1: the latest trade price
  - Naive2: the volume weighted average price 30 minutes prior to forecasting

# Small performance differences among forecasting models

- LSTM performed best in both MAE and RMSE
- Performance differences across models were relatively small
- Naive models captured future price trends well

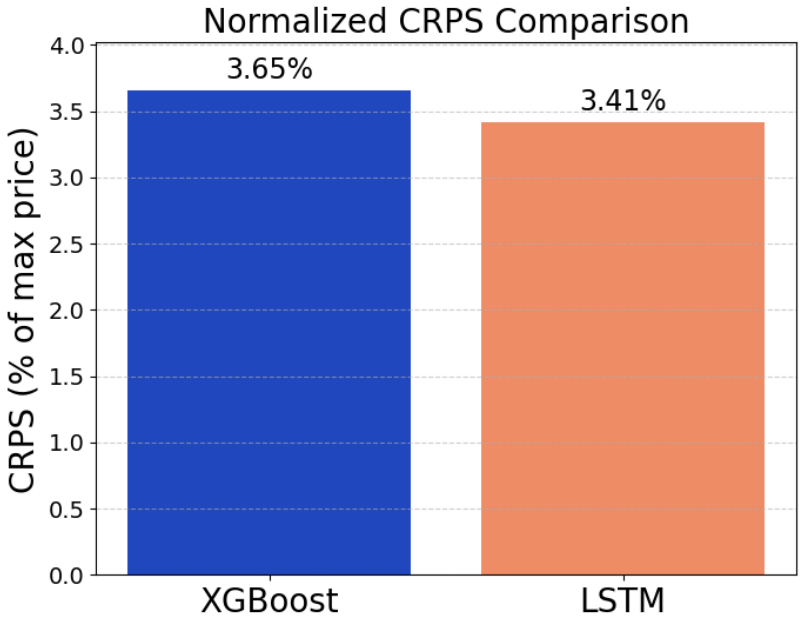


# Probabilistic forecasts captured prices well, with some differences across models



# LSTM performs slightly better in CRPS evaluation

- The CRPS takes into account both reliability and sharpness
- It was normalized using the maximum observed price to allow comparison across time and quantile levels.
- While model differences were small, LSTM showed slightly better performance.



# Conclusions

- ID3 prices are strongly influenced by the most recent intraday trades
- Difficult to significantly outperform naive models
- Probabilistic forecasts provide useful uncertainty estimates for decision-making

# Sources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