A method for interpreting a probabilistic wind forecast to minimize trading losses

DAVID HAMILTON
DAVID McMILLAN
VICTORIA CATTERSON

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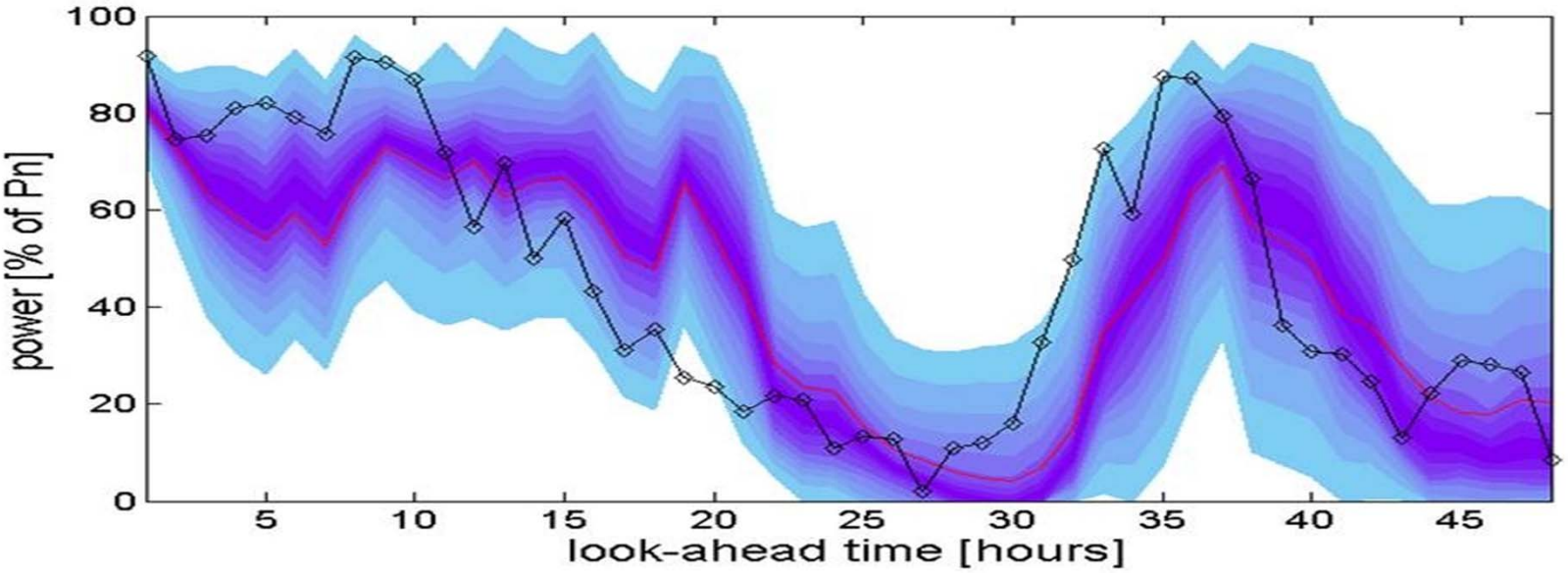
- Wind Power Forecasting
- Electricity Markets
- Selection of an Optimal Trading Quantile
- Reduce the cost of wind energy

Wind Power Forecasting

- Probabilistic Forecast



- Error

Electricity Markets

- UK Electricity Market day
  - 48 Settlement period.
  - 30 minutes in each period.

- Supply and Demand curves set the price
- Real time market
- Imbalance prices set by the volume of imbalances and the sign of the imbalance.

11am day before delivery

1 hour before delivery

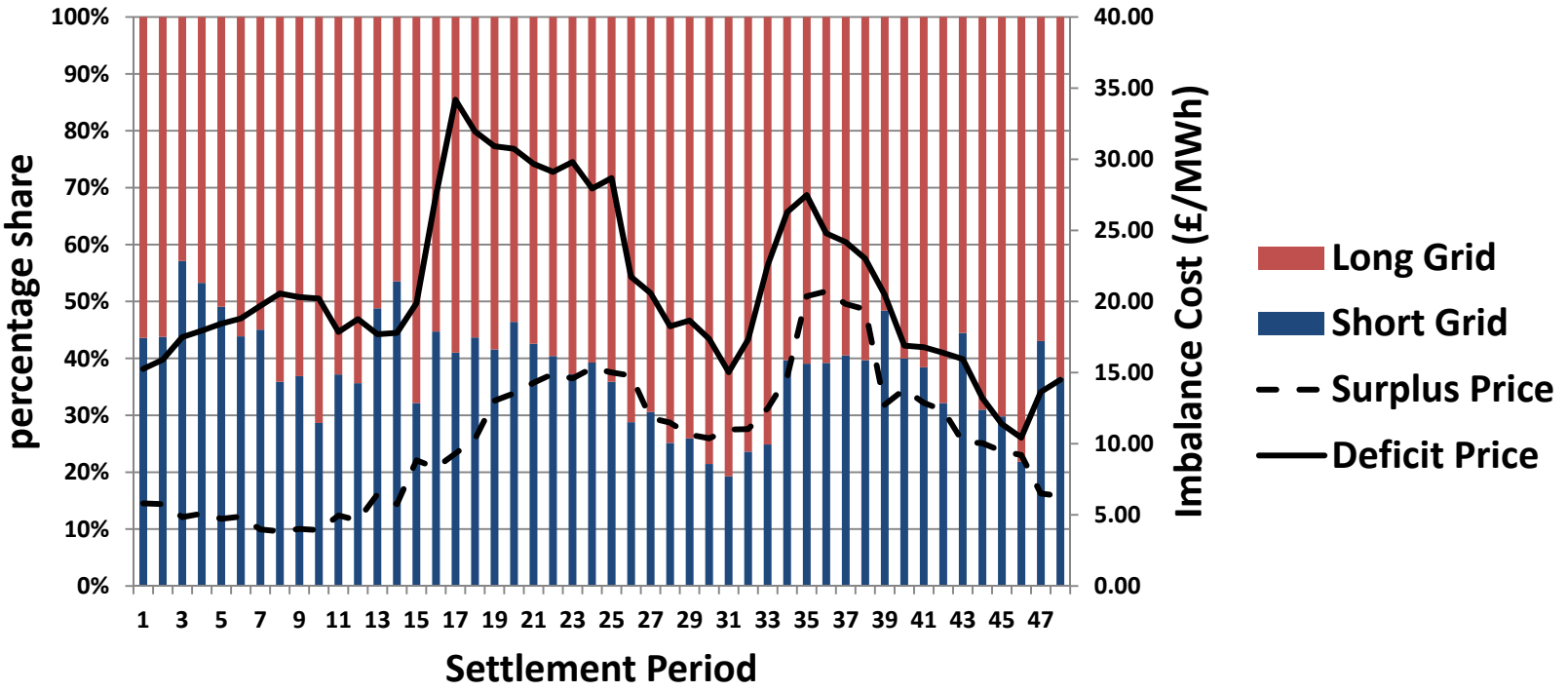
Imbalance Prices

- System Buy Price (SBP)
  - The price a generator ***pays*** to make up for the deficit between delivered and contracted volume.
- System Sell Price (SSP)
  - The price the generator ***is paid*** for surplus generation over contracted volume.

- Dual Pricing method
- Single Pricing method

Imbalance Type	Grid State	
	Long	Short
Deficit	SBP uses reverse pricing method SBP = PX Deficit Price = SBP – PX = 0	SBP uses main pricing method SBP > PX Deficit Price = SBP – PX
Surplus	SSP uses main pricing method SSP < PX Surplus Price = PX – SSP	SSP uses reverse pricing method SSP = PX Surplus Price = PX – SSP = 0

Interpreting a probabilistic forecast.



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Interpreting a probabilistic forecast.

- Define the error in a forecast by the expected cost per transaction.
  - Terms
    - U – Wind speed
    - q – quantile
    - p_s – probability of a short Grid
    - P_l – probability of a long Grid
    - C_s – surplus cost
    - C_d – deficit cost
  - *Cost Equation*

Cost contribution of a surplus

Cost contribution of a deficit

- $C(U) = (1-q)(1-p_s)C_s(U) + q(1-p_l)C_d(U)$

Interpreting a probabilistic forecast.

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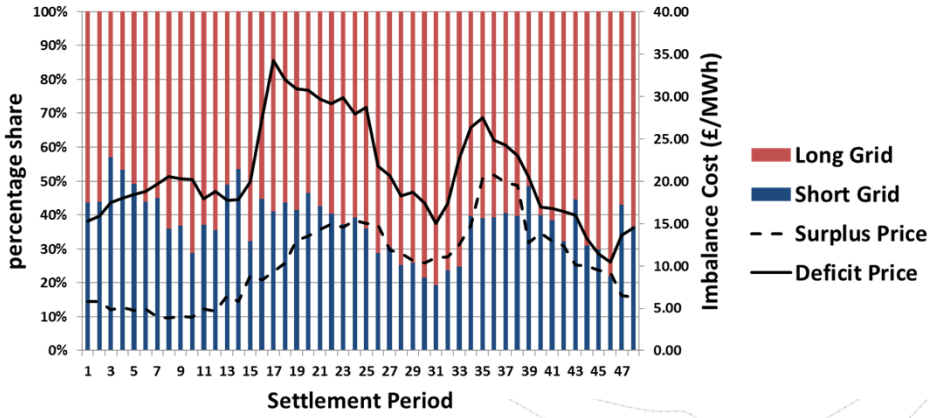
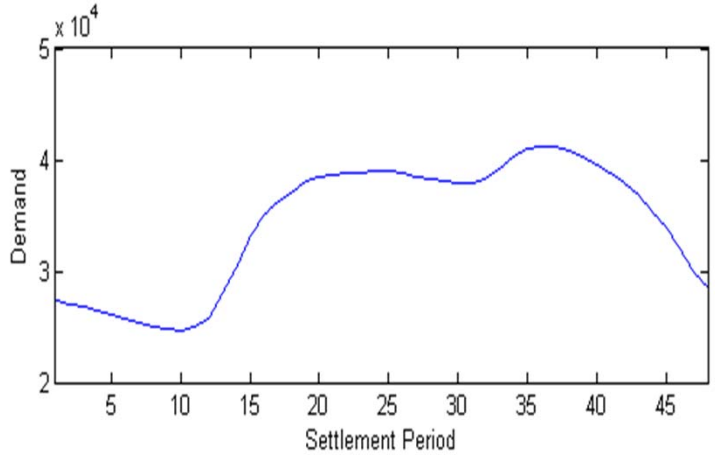
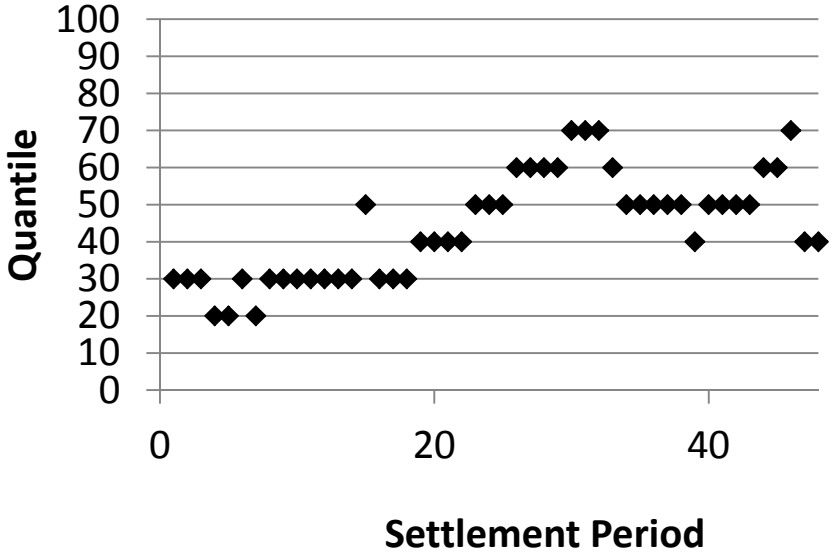


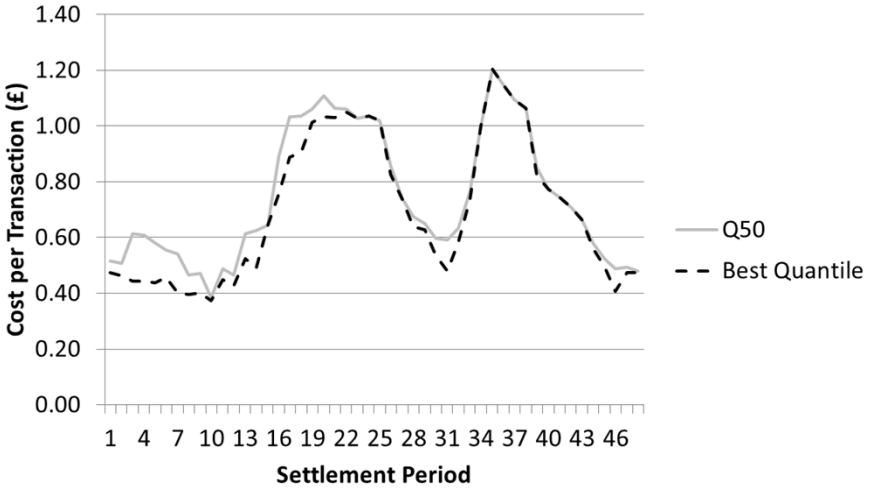
- Cost per Transaction
  - $C = \frac{1}{2}\int C(U)f(U)\,dU$

Interpreting a probabilistic forecast.



Best Quantile





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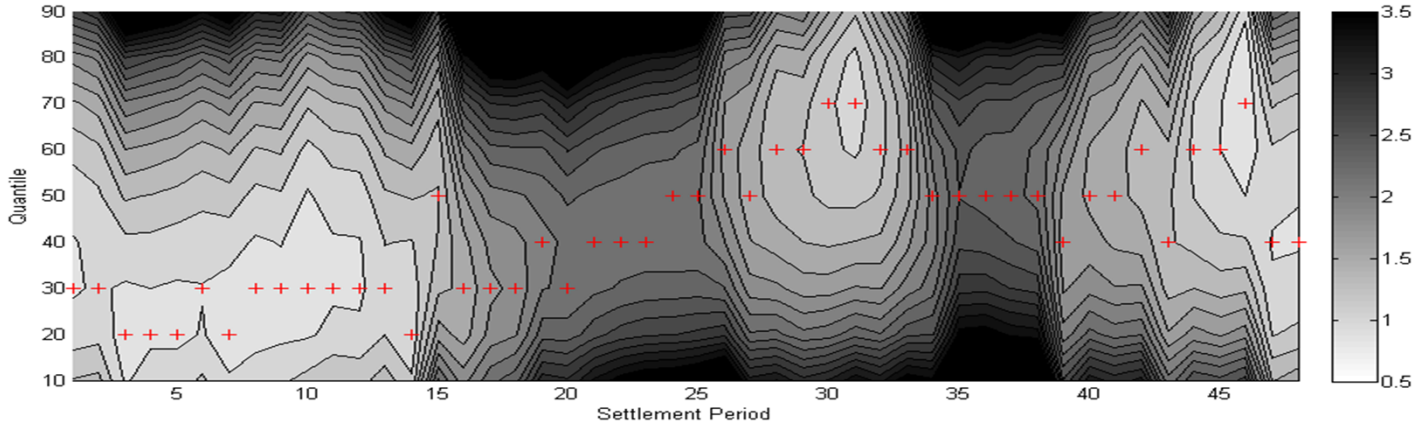
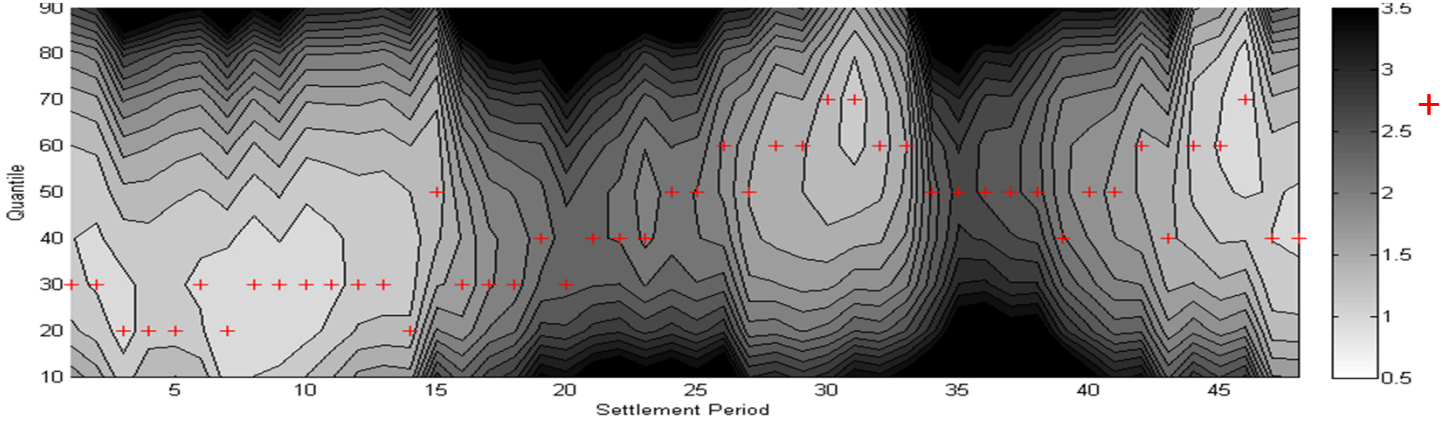
Cost of Trading

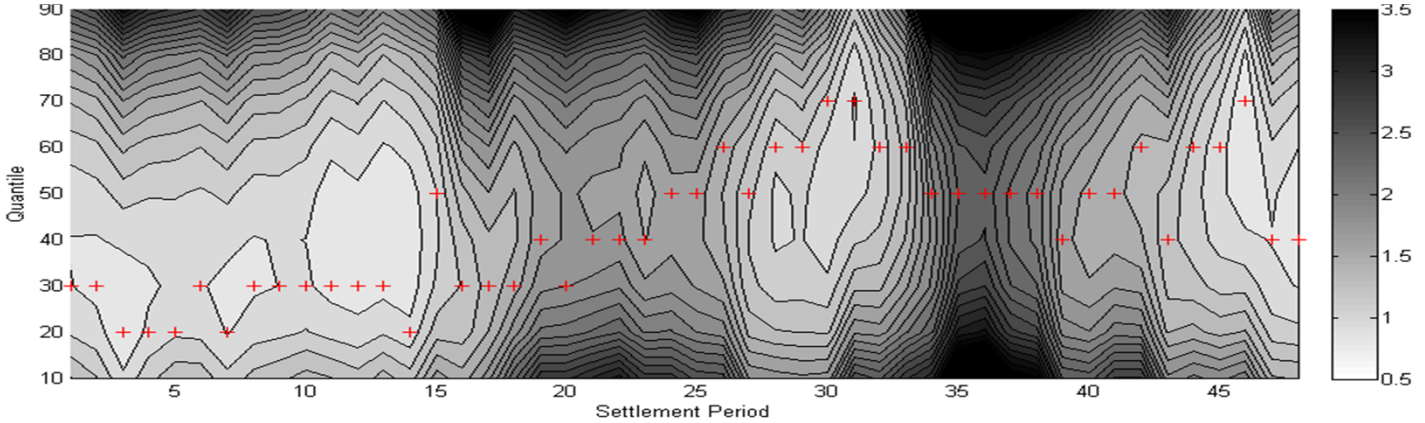
2012



2013



2014



\+ 2012 recommended quantile

- Some savings can be made.
- Easy to analyse and implement
- Adaptable to other situations
  - Single Imbalance Price
  - Day Ahead -> Spot Market
  - Day Ahead -> Imbalance
- Other Work
  - Forecasting the State of the Grid.

Questions

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