Imperial College London

EDF

Blowing in the Wind

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EPSRC Engineering and Physical Sciences Research Council

Centre for Doctoral Training

Mathematics of Planet Earth

Motivation

- Climate change.
- 2020 targets.

- **Renewable energy sources.**
- Unpredictable, weather-dependent.

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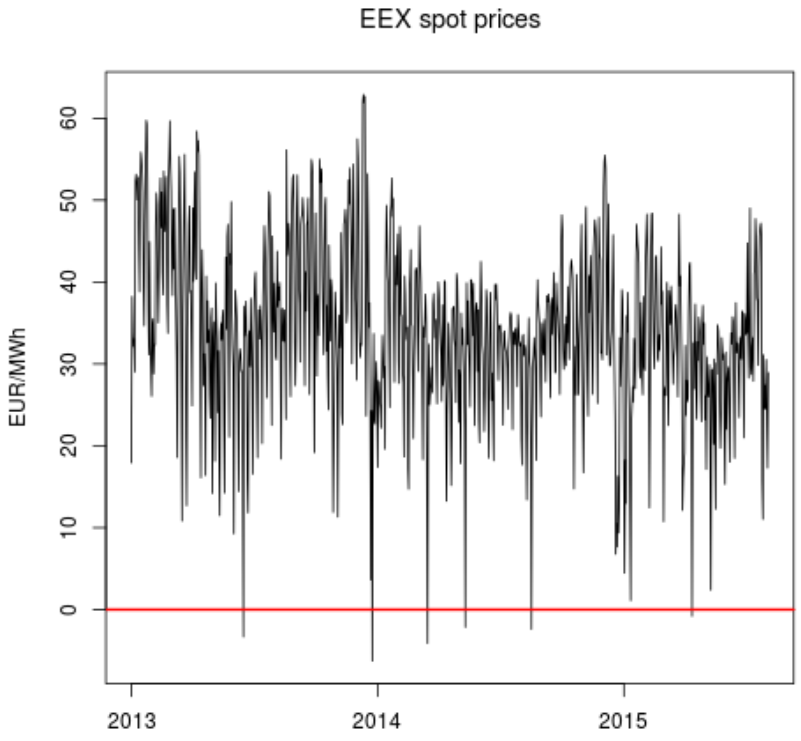
Electricity spot prices

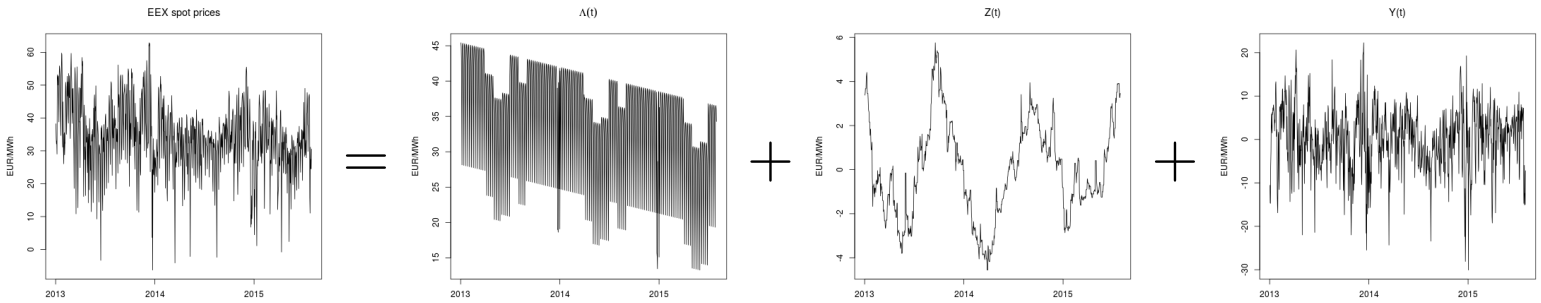
- Non-storability.
- High variability.
- Negative values.
- Mean reversion.
- Seasonality.
- Periodic behaviour.



My model

Arithmetic model

$$S(t) = \Lambda(t) + Z(t) + Y(t).$$



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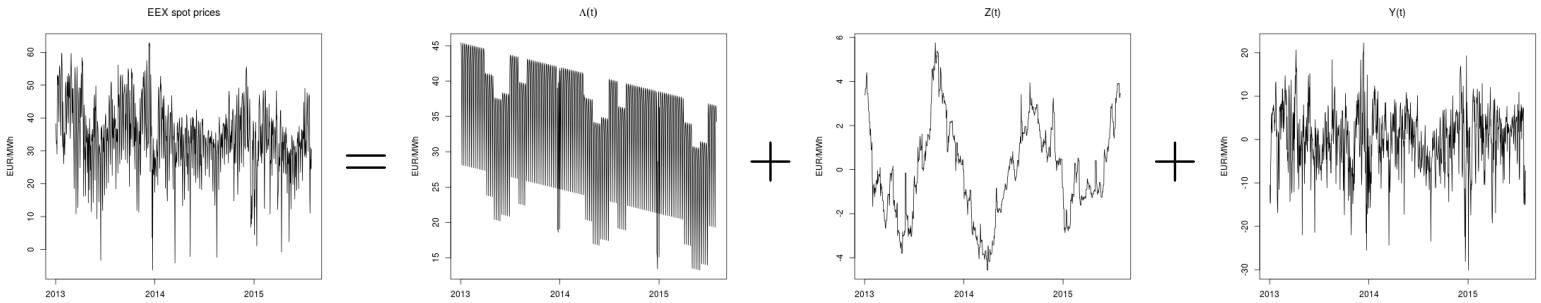

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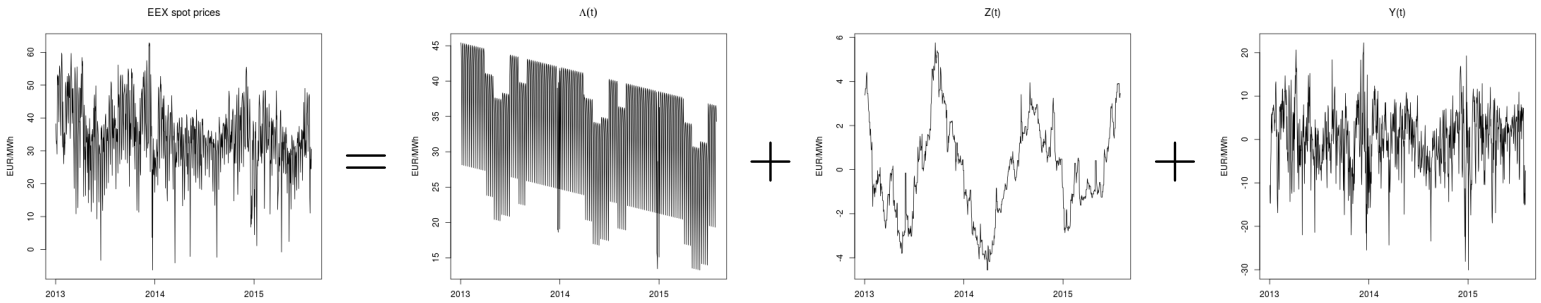

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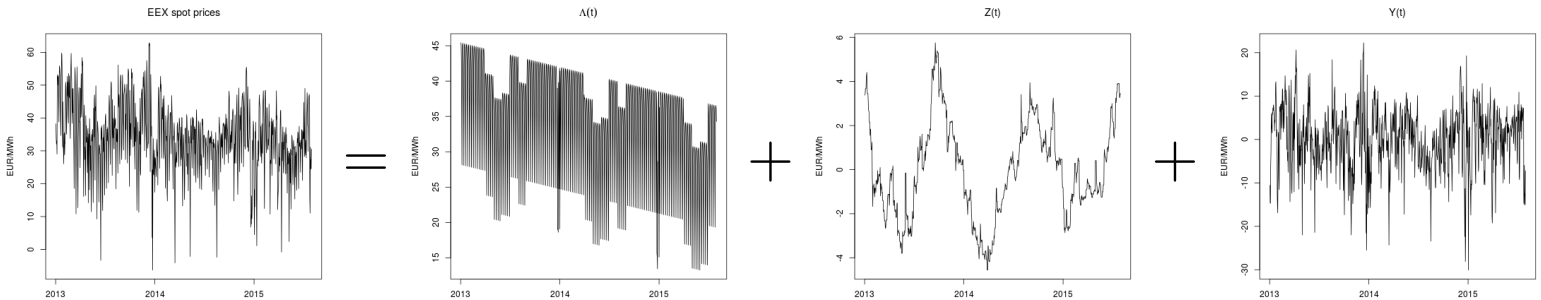
My model

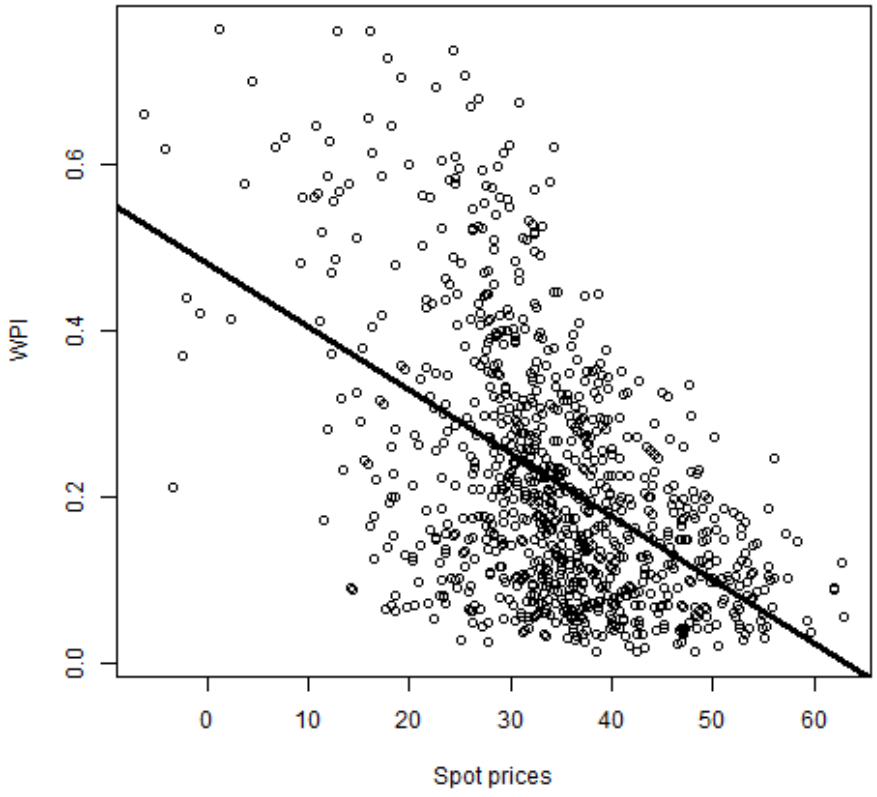
Arithmetic model

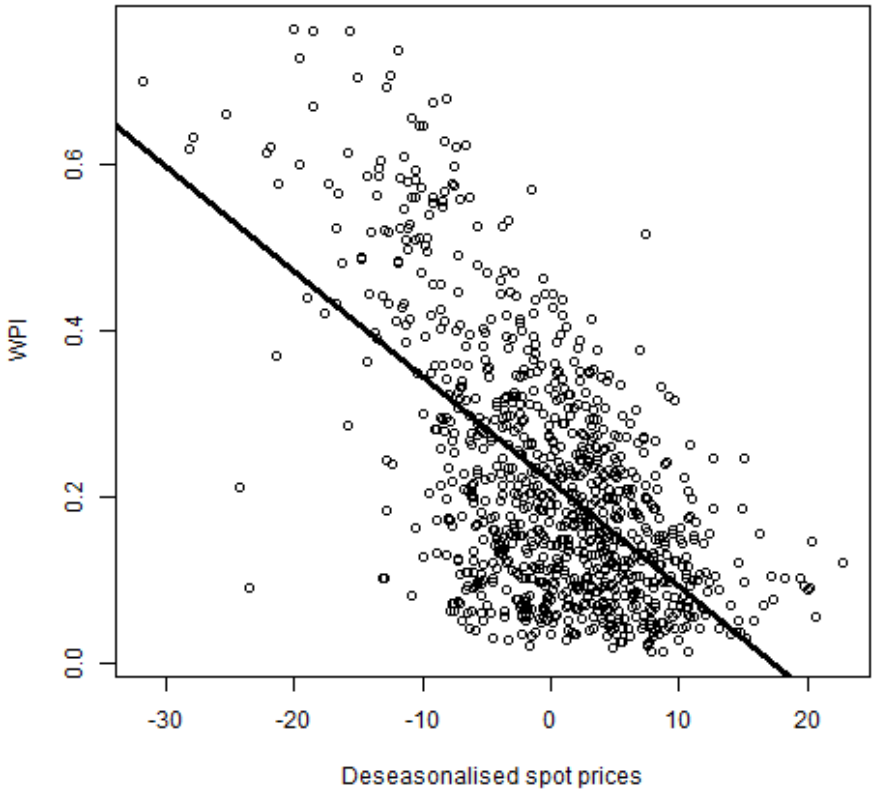
$$S(t) = \Lambda(t) + Z(t) + Y(t).$$

- Seasonality and trend (deterministic).
- Long-term (stochastic).
- Short-term (stochastic): influenced by **wind energy**!



Blowing in the wind?





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Modified models

- $\Lambda(t)$ and $Z(t)$ unchanged.
- $Y(t)$: regress on wind data and fit CARMA(2,1) to the residuals.

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Modified models

- $\Lambda(t)$ and $Z(t)$ unchanged.
- $Y(t)$: regress on wind data and fit CARMA(2,1) to the residuals.

And the loser is...

The model without any wind data!

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Main contributions

- Include the influence of wind energy generation on the prices.
- Allow for the stochastic volatility in the short-term process.
- Investigate problems related to CARMA(2,1) estimation.

What's next?

- **Model wind energy generation directly.**
- Study other types of renewables.
- Forecast electricity prices.

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Thank you for your attention!

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