SUPPLY AND DEMAND CURVES OF THE ELECTRICITY SPOT MARKET

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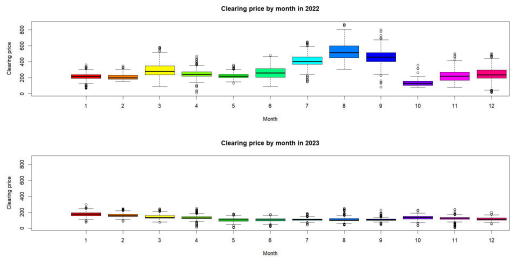
KEY PRELIMINARY QUESTIONS

- What is the trend of the **clearing price** through different hours, days, months, and years?
- How can we model the **offer and demand curves** for the Italian electricity market?
- Is there a relationship between clearing price and other **external variables**?
- Does there exist a way to **predict** the clearing price for the future?

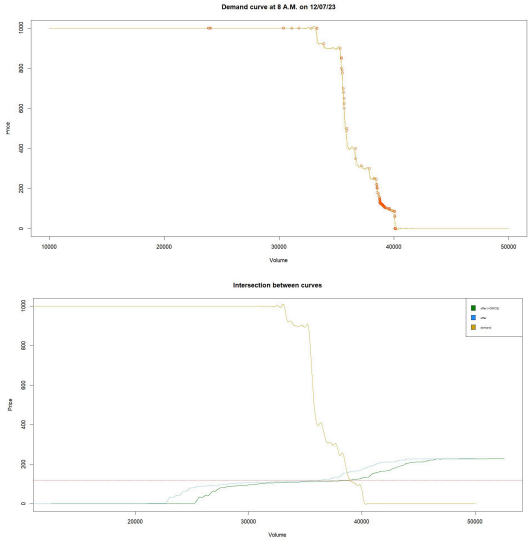
EDA



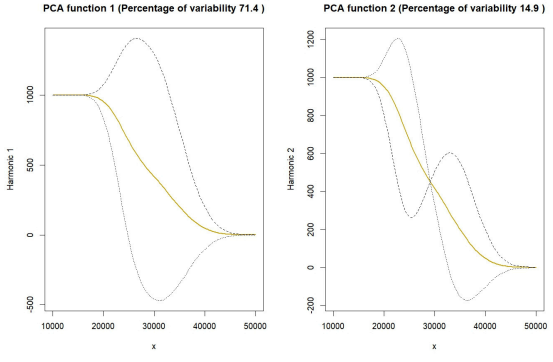
- Same analysis repeated for hours, days and weekdays.
- Prices in 2022 are much higher (with a peak in August).
- Peaks in different months concerning different years.

SMOOTHING

- Regression smoothing with 150 b-spline basis.
- Same basis for both offer and demand.
- Error for the clearing price of a few euros at most.



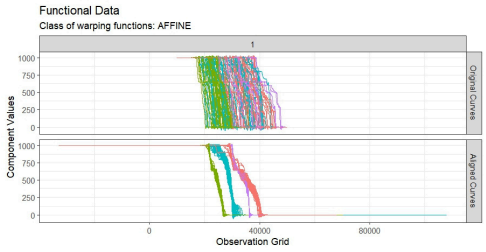
FPCA

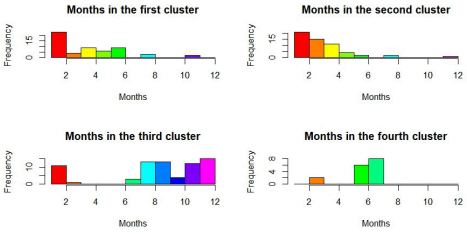


PCA on demand curves of 2023

- Only the first 2 PCs are chosen, according to the elbow rule.
- PCs calculated for both demand and offer including both years.

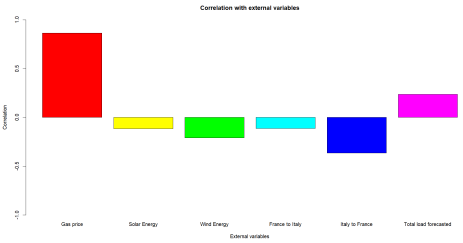
CLUSTERING AND ALIGNMENT





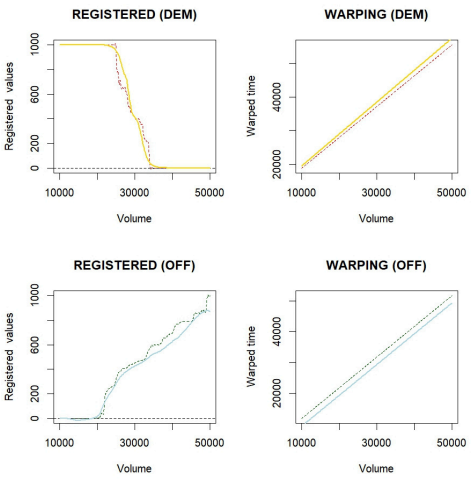
- Functional k-mean alignment on 200 sample curves.

CORRELATION WITH EXT. VAR.



- Very high correlation with gas price.
- Strong correlation with the total load.
- Negative correlation with load transfers.

FUNCTIONAL REGRESSION



- Regression was performed separately for amplitude and phase (warping functions).
- PCA on the external variables to avoid collinearity.