WEATHER EFFECTS IN ENERGY SEASONAL ADJUSTMENT:

An application to France energy consumption

MOTIVATION

Reducing energy consumption is key for European countries to meet emissions targets. One key element of Energy demand is the non-linear link to temperature variations (Bessec, 2008). Policymakers require accurate seasonal adjustments to assess the impact of public policies, as they can influence on socio-economics elements but not directly on the weather.

HEATING DEGREE DAYS

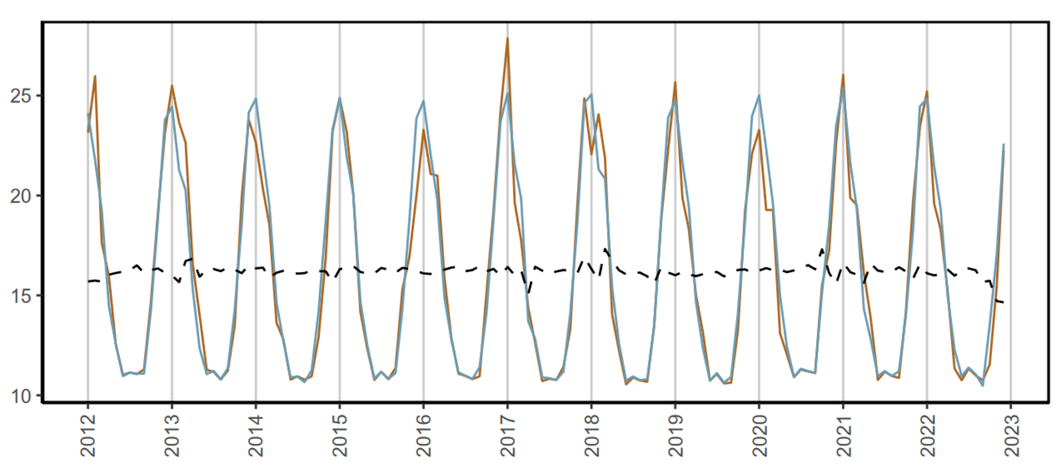
The concept of **Heating Degree Days** (HDD) rely on the **base temperature,** defined as the outside temperature at which agents decide to heat their premises.

RESEARCH QUESTIONS

- How to **empirically define** the optimal **base temperature ?**
- Is temperature the only meteorological component linked to energy demand?
- Is the concept of HDD homogenous (Dell M. et al, 2014):
  Over time ; Over space; Over economic sectors

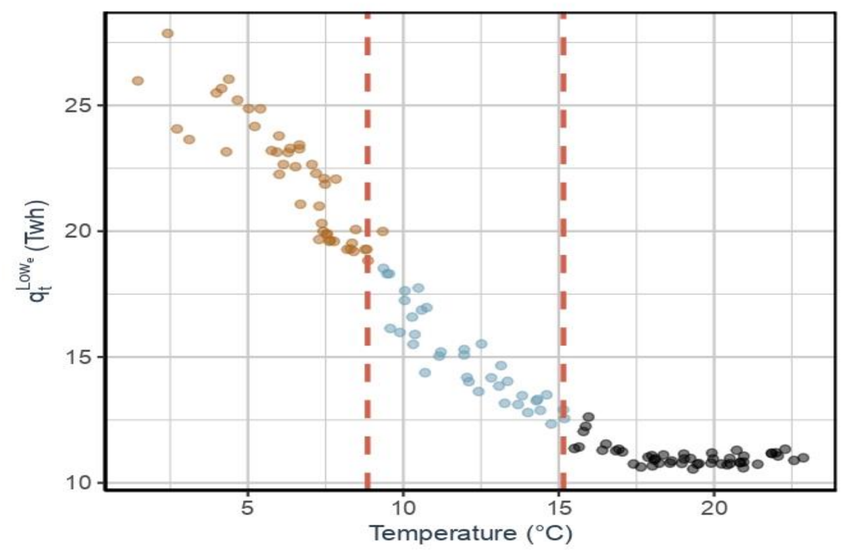
METHODOLOGY

Energy demand adjustment; we used a **regSARIMA** modeling to capture weather (reg) and seasonal (SARIMA) components



Adjusted electricity demand (TWh)

1. **Base temperature;** we introduced the k-means **clustering** algorithm as a tool to detect **regime switching** in a 2-dimensionnal framework



Clustering analysis of monthly energy response to temperature

2. **Optimal set of weather indicator**; we introduced the **LASSO penalisation** as a tool to select an optimal set of weather regressors

DATA

Energy

- Time span : 2012-2022 at a monthly frequency
- Spatial level : France
- Source : *Service des Données et Etudes Statistiques*

Weather

- Time span : 1990 – 2022 at a daily frequency
- Spatial level : Weather station (539)
- Source : *Météo France*
- Pre-processing : Population-weighted monthly frequency aggregation

KEY RESULTS

- We define a **base temperature of 15°C** for France during the period 2012-2022 rather than 18°C as stated in the literature (Thom, 1954)
- Beside temperature, the amount of **wind and sunlight duration** significantly influence energy demand
- The definition of the optimal base temperature is heterogenous
  - Over the **long run**
  - Over **administrative regions**
  - Over **economic sectors**

RELATED LITERATURE

- Bessec M., Fouquau J. (2008). *The non-linear link between electricity consumption and temperature in Europe: A threshold panel approach*, Energy Economics
- Dell M. et al (2014). *What Do We Learn from the Weather? The New Climate-Economy Literature*, Journal of Economic Literature
- Thom H.C.S. (1954). *The rational relationship between heating degree days and temperature*, Monthly Weather Review

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