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Weekly Seasonality

TEAL Pre-Processing for Trend Estimation



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Time-series analysis

Time series means the order of the data matters

A single signal is decomposed into multiple component signals

The exact components vary by author and intent, but generally it includes:

- Trend / cycle
- Seasonality
- Holidays / outliers
- Irregular

Often some of these are separated in a pre-processing step

Seasonality

There are standard, accepted, and broadly implemented methods to partition out and remove the seasonality component for monthly and quarterly time series.

Seasonality

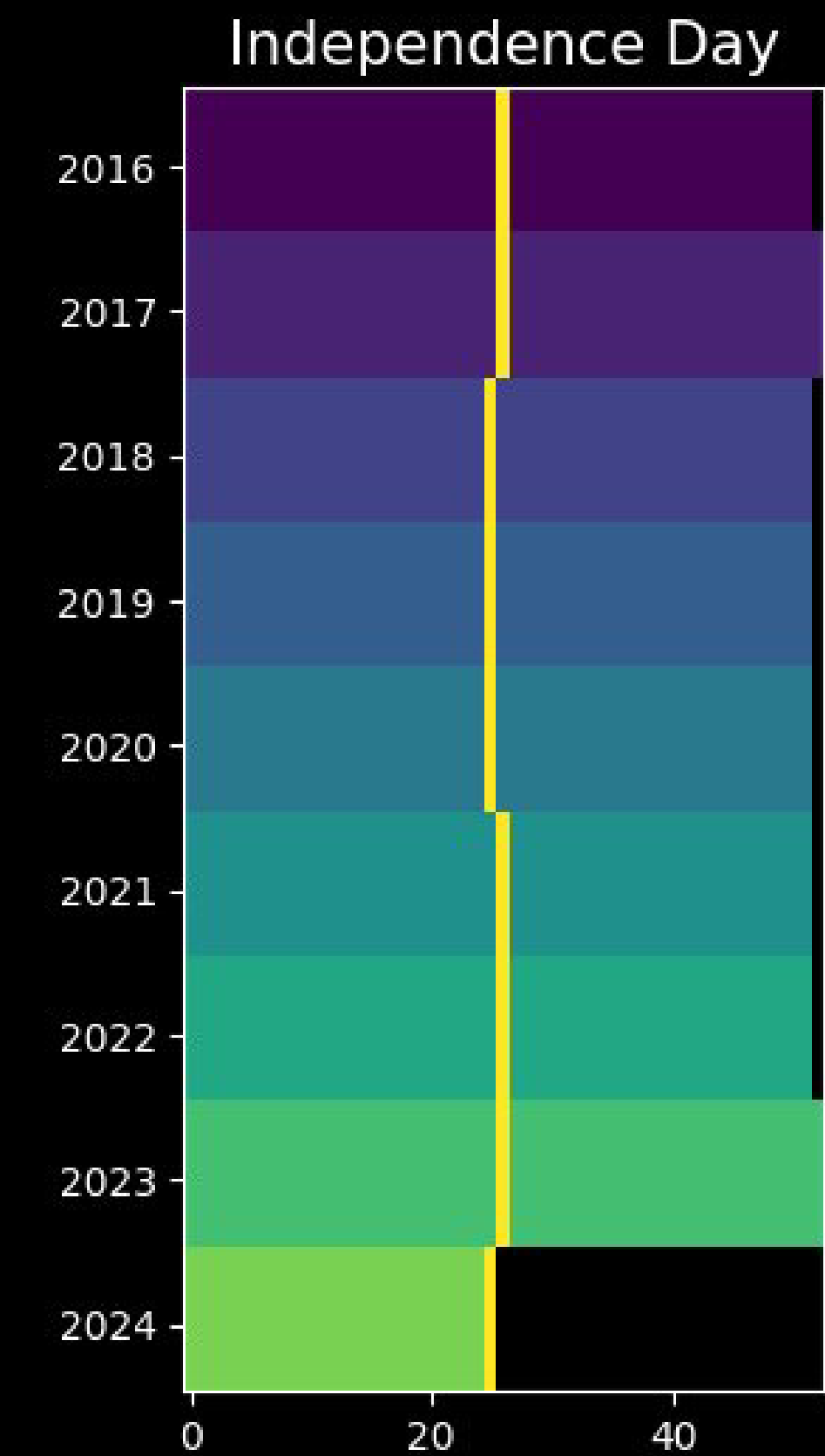
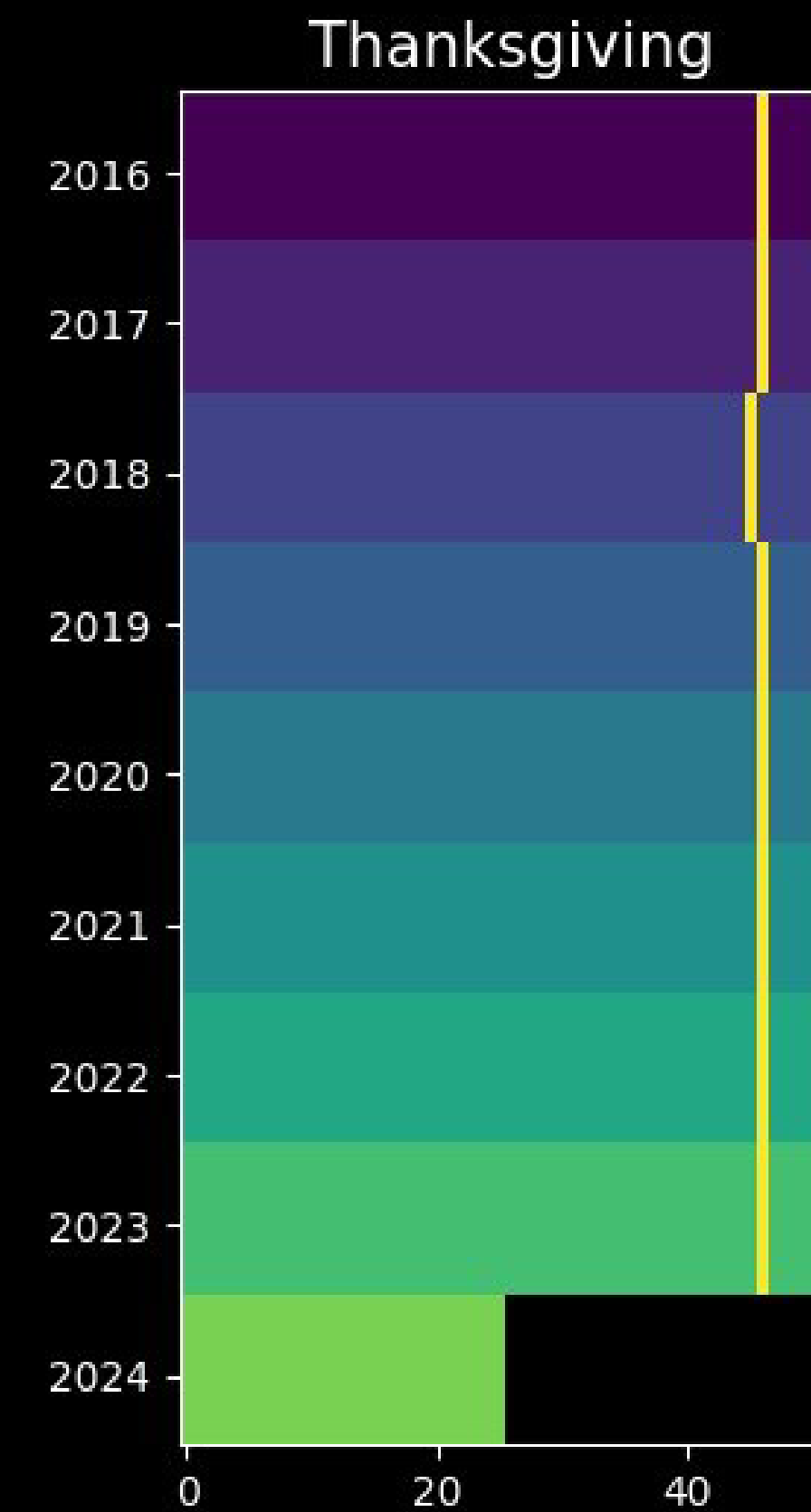
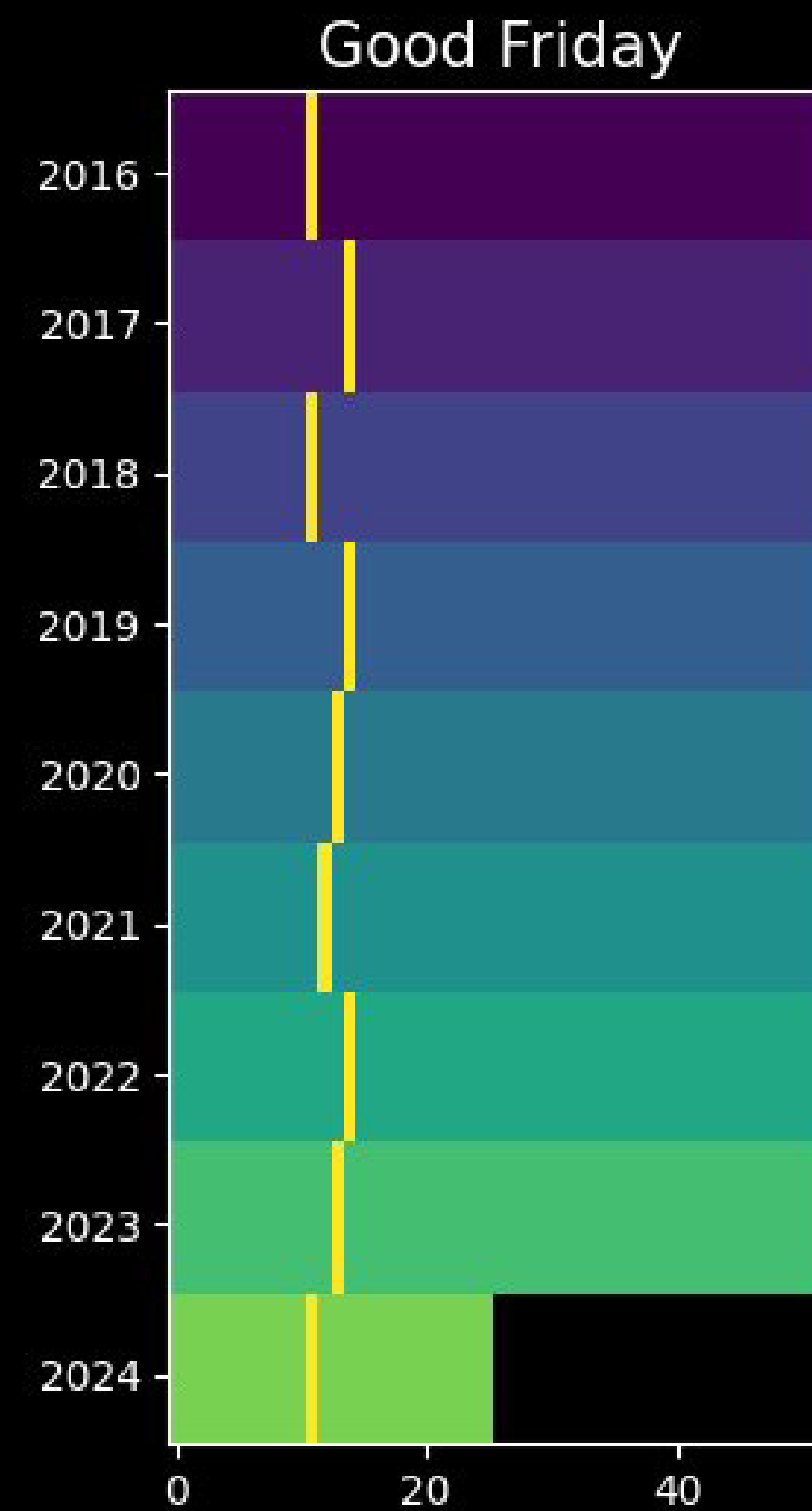
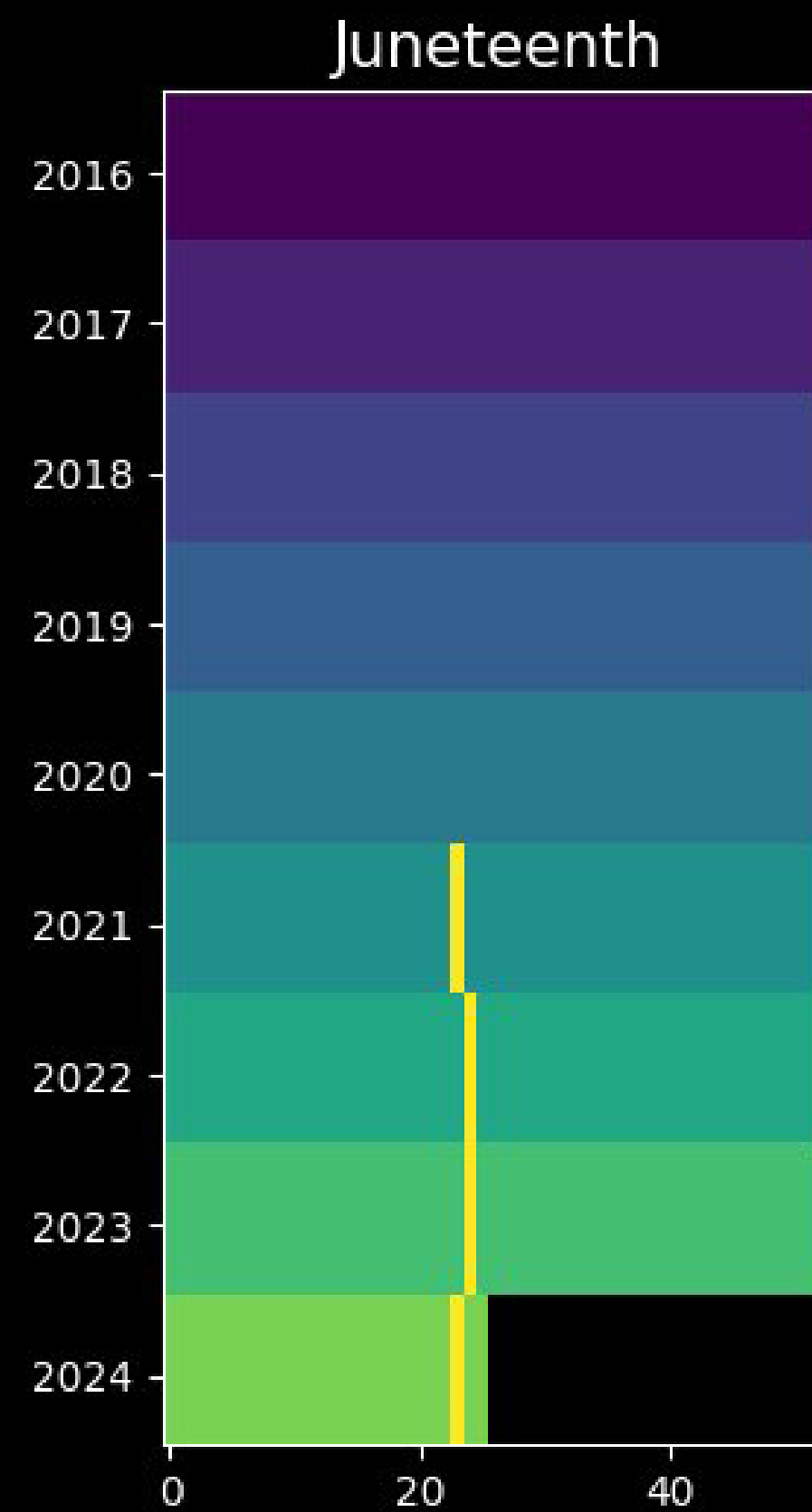
No similar standard exists for weekly data. Why?

Weekly data has
non-integer
seasonality

Relationships
between weeks of
the year and
holidays change

Relationships
between weeks of
the year and days
of the year change

Holidays



Current approaches for weekly time-series decomposition

TRAMO-SEATS

Needs to be modified to deal with non-integer period

Cleveland, et al

- Like a discrete Fourier transform, but allows the phase of the sine/cosine components to shift as the first day of the week shifts year to year
 - Allows parameters to vary with time
-

Structural time series

Specifies and fits a state-space model

STL

Not usually used in production statistics, but good for getting a quick read

TEAL (Trend Estimation with Adaptive LOESS)

A pre-processing step that separates trend/cycle and level shift outlier components from the original signal

Mixes STL and X-13ARIMA style approaches to separate the signal

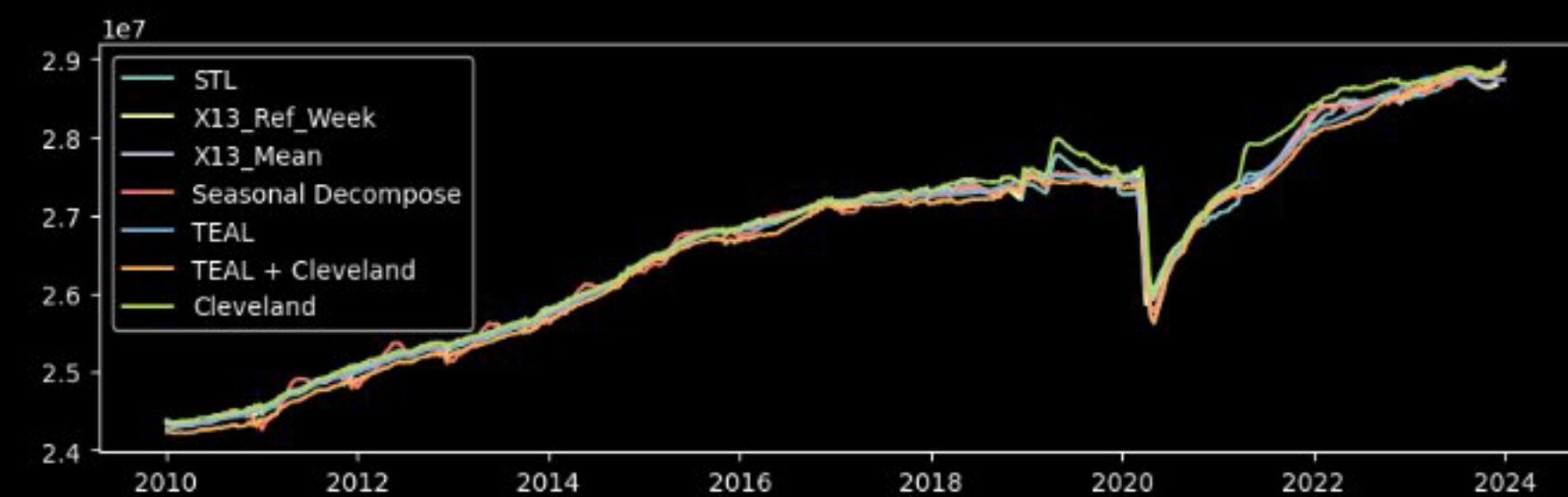
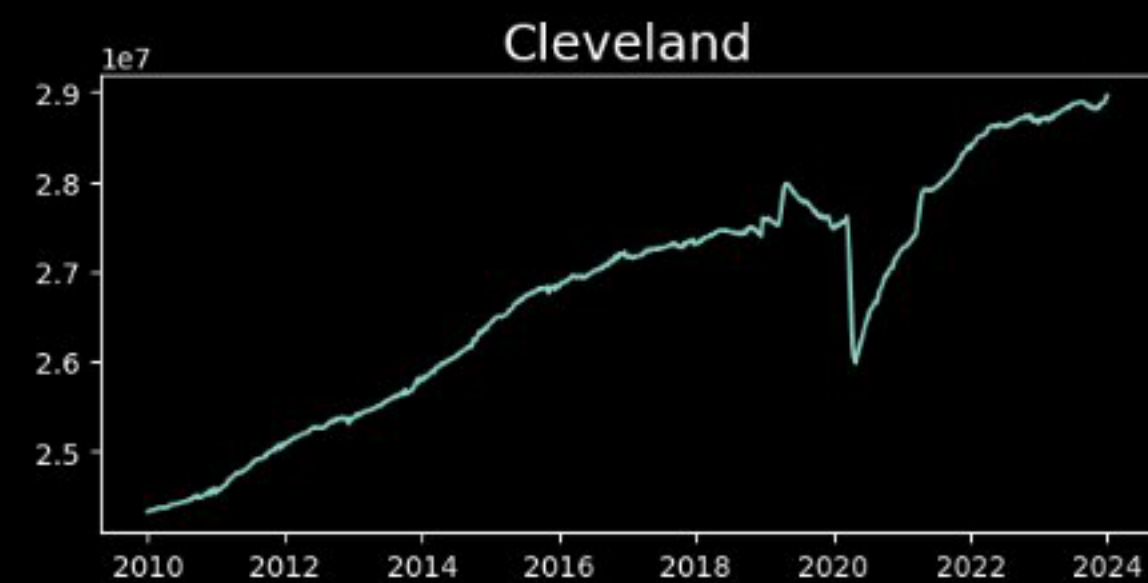
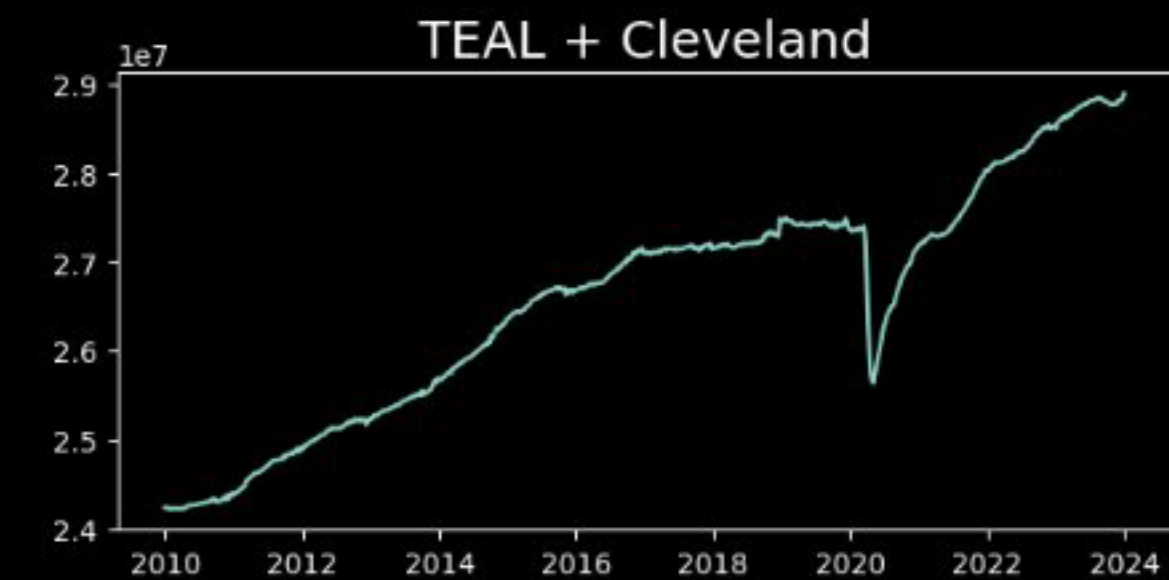
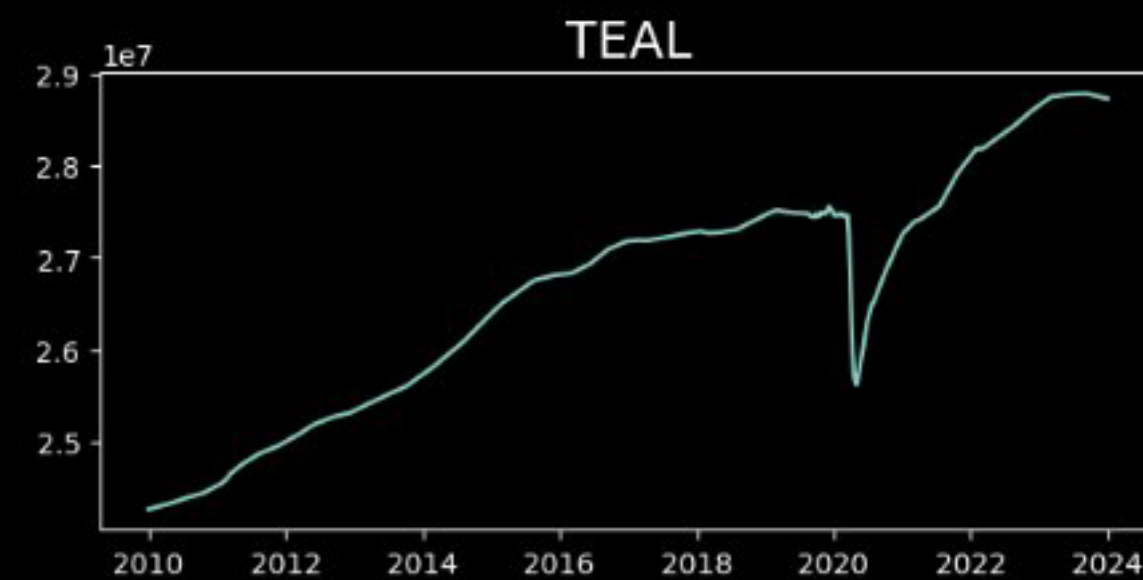
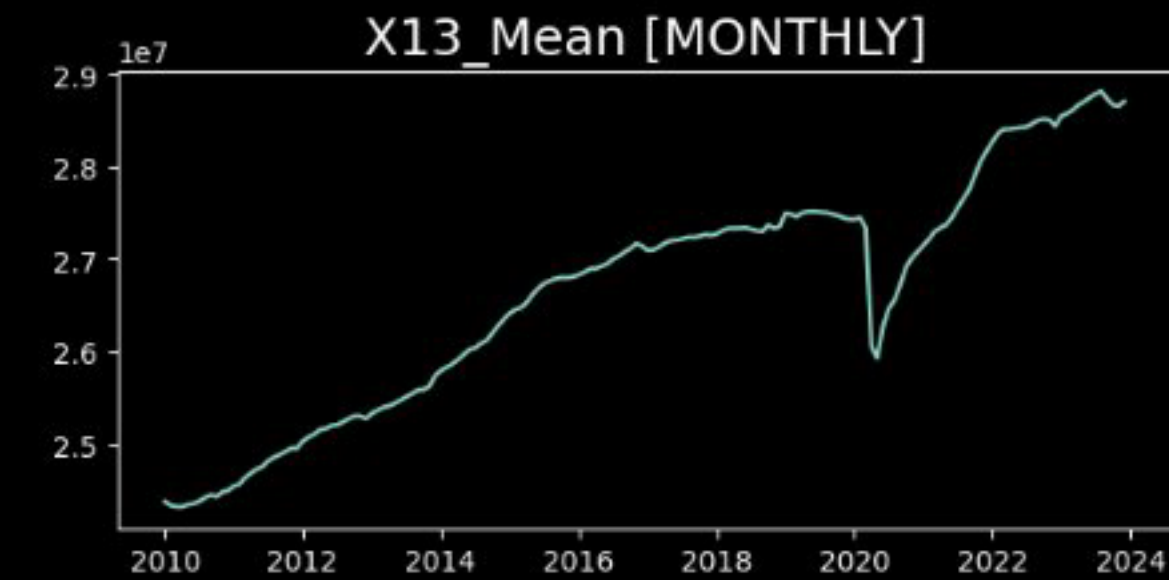
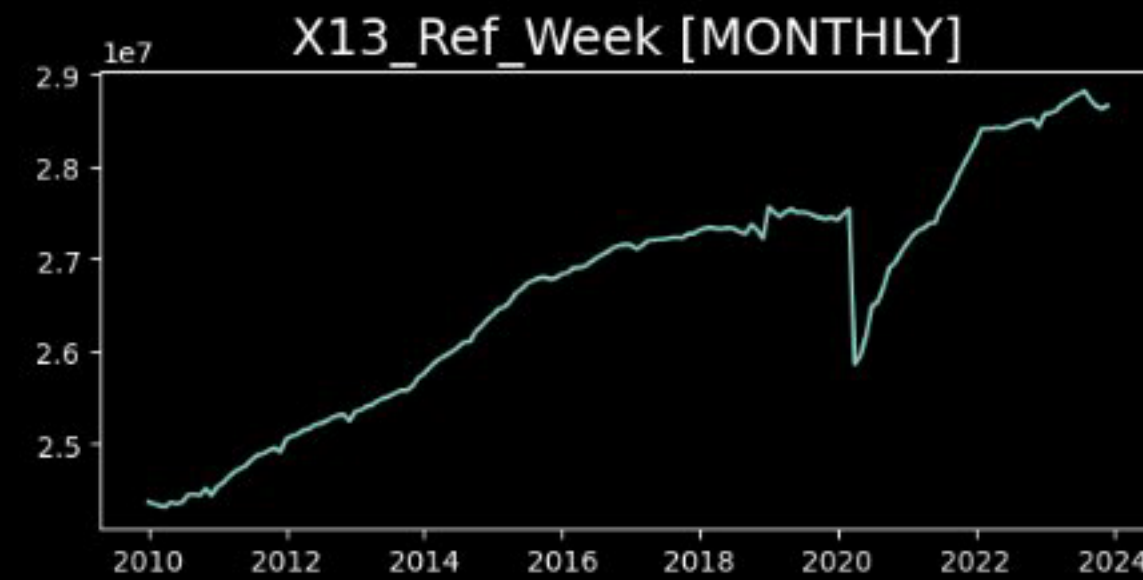
Starts with an estimate of seasonality

Performs adaptive LOESS smoothing on remaining data

More smoothing where the signal is flatter

Less smoothing where the signal change is steep

Comparison with NER data



Available packages for weekly time series decomposition

R

- RJDOMETRA
- RJDHF
- BOIWSA

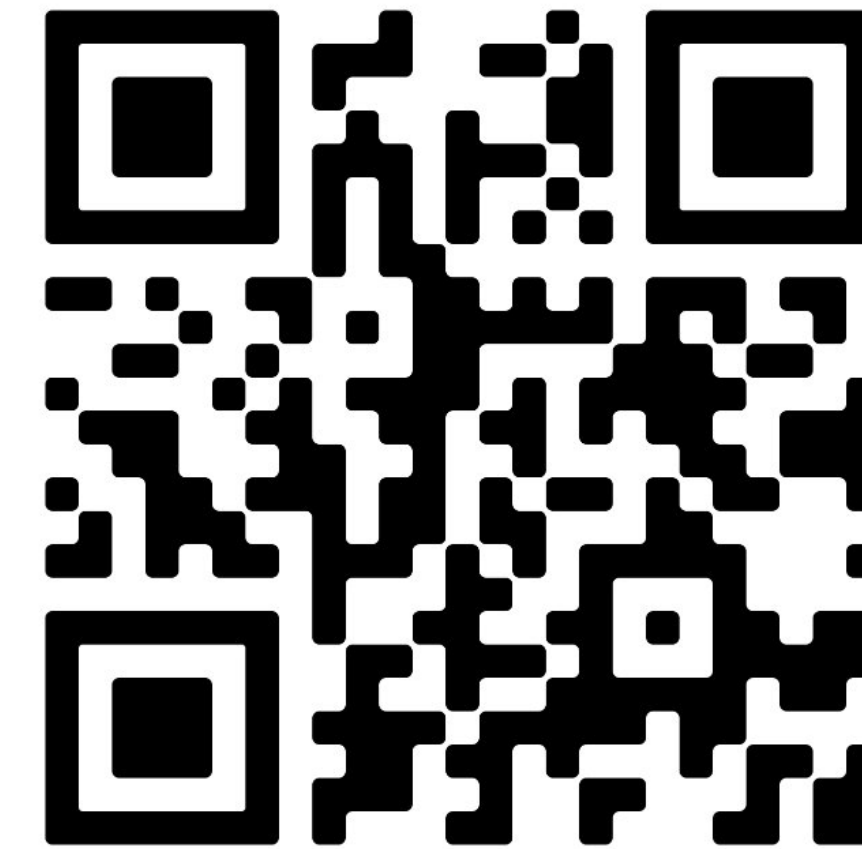
SAS

- ProcSSM

Python

- Statsmodels

Thank you



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