# Improving forecasting by estimating time series structural components across multiple frequencies



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# **Business Forecasting**

Forecasting is crucial for several operations of an organisation

- Short- and long-term objectives
- Demand and inventory planning
- Capacity planning
- Pricing and marketing strategy planning
- Budgeting
- etc.

Requirement for large number of forecasts → Automation

#### Issues for organisations:

- Forecast accuracy
- Forecast reliability/robustness
- Forecast reconciliation





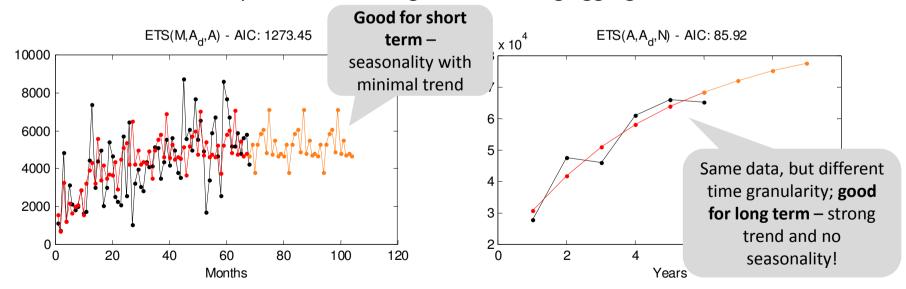
## **Business Forecasting**

#### The problem of temporal reconciliation

An organisation has to often produce forecasts for:

- Short term operational horizons
- Medium term tactical horizons
- Long term strategic horizons

We know that different forecasting models are better for different forecast horizons. We also know that it helps to forecast long horizons using aggregate data



These forecasts often do not agree, even though they are based on the same data! → How to align planning, decision making and operations?



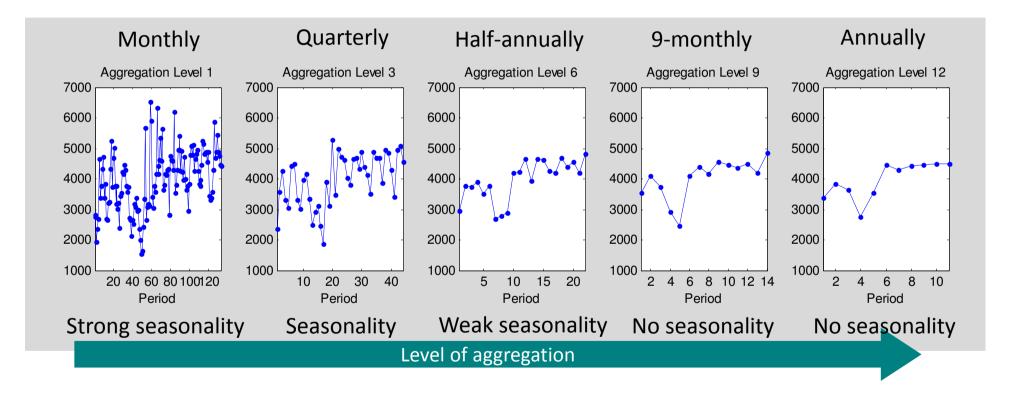


# **Temporal Aggregation**

**Benefits** 

With temporal aggregation we can change the properties of a time series

→ Different components become weaker or stronger, e.g. seasonality

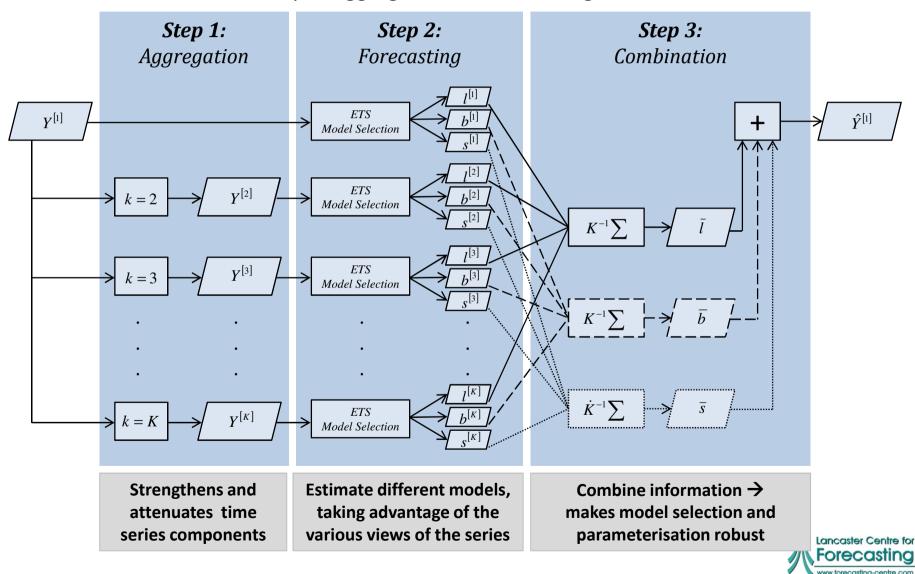


Fitting a model at each temporal aggregation level will capture different types of information

- → If these are combined then there can be major accuracy benefits
- → Such combined forecasts are reconciled across all time scales (short, medium, long)

# Temporal Aggregation & Reconciliation MAPA

#### Multiple Aggregation Prediction Algorithm





### **Results & Conclusions**

- Proposed algorithm can provide temporally reconciled forecasts → Short, medium and long term planning are based on the same forecast, rather than using different models and forecasts → Simplifies decision making
- Accuracy superior to using single model, or multiple models (one for each time granularity). Initial prototype +5% accuracy over best performance in the literature → Current model more than 10% accuracy improvements, across all forecast horizons → Particularly accurate on long term predictions
- 3. Reconciliation method is model independent → Use current forecasting methods/systems
- 4. Reduces risk of selecting wrong forecasting models or parameters

Detailed analysis, findings and references in the paper:

http://kourentzes.com/forecasting/2014/04/19/improving-forecasting-by-estimating-time-series-structural-components-across-multiple-frequencies/

