

Improving forecasting by estimating time series structural components across multiple frequencies



Nikolaos Kourentzes, Fotios Petropoulos and Juan R. Trapero
International Journal of Forecasting, 30 (2014), p 291-302.

This work was supported by the Lancaster University Management School research grant scheme



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

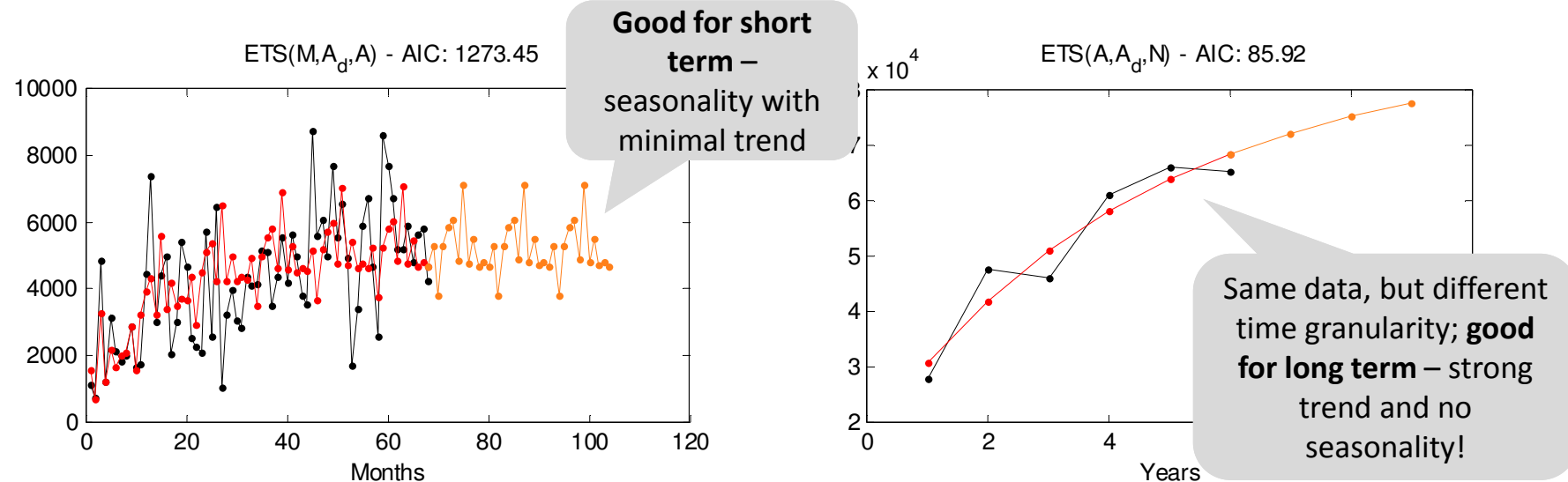
The problem of temporal reconciliation

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?

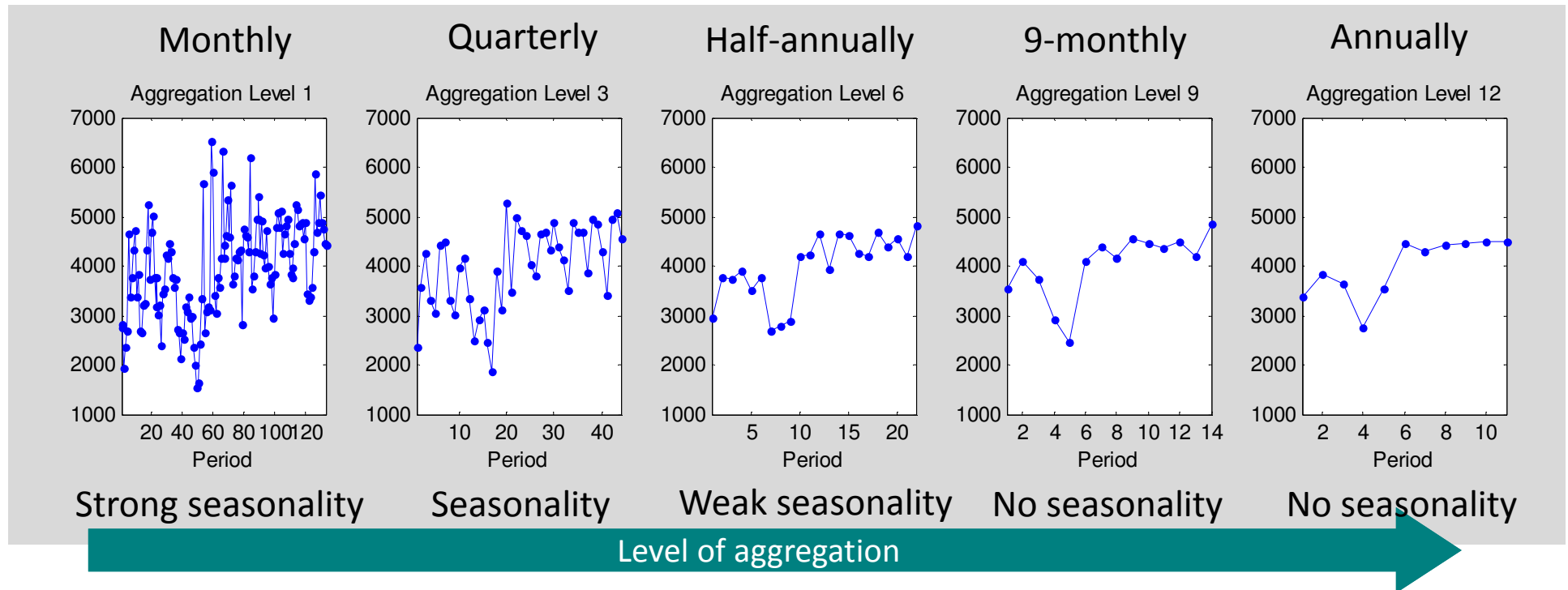


Temporal Aggregation

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

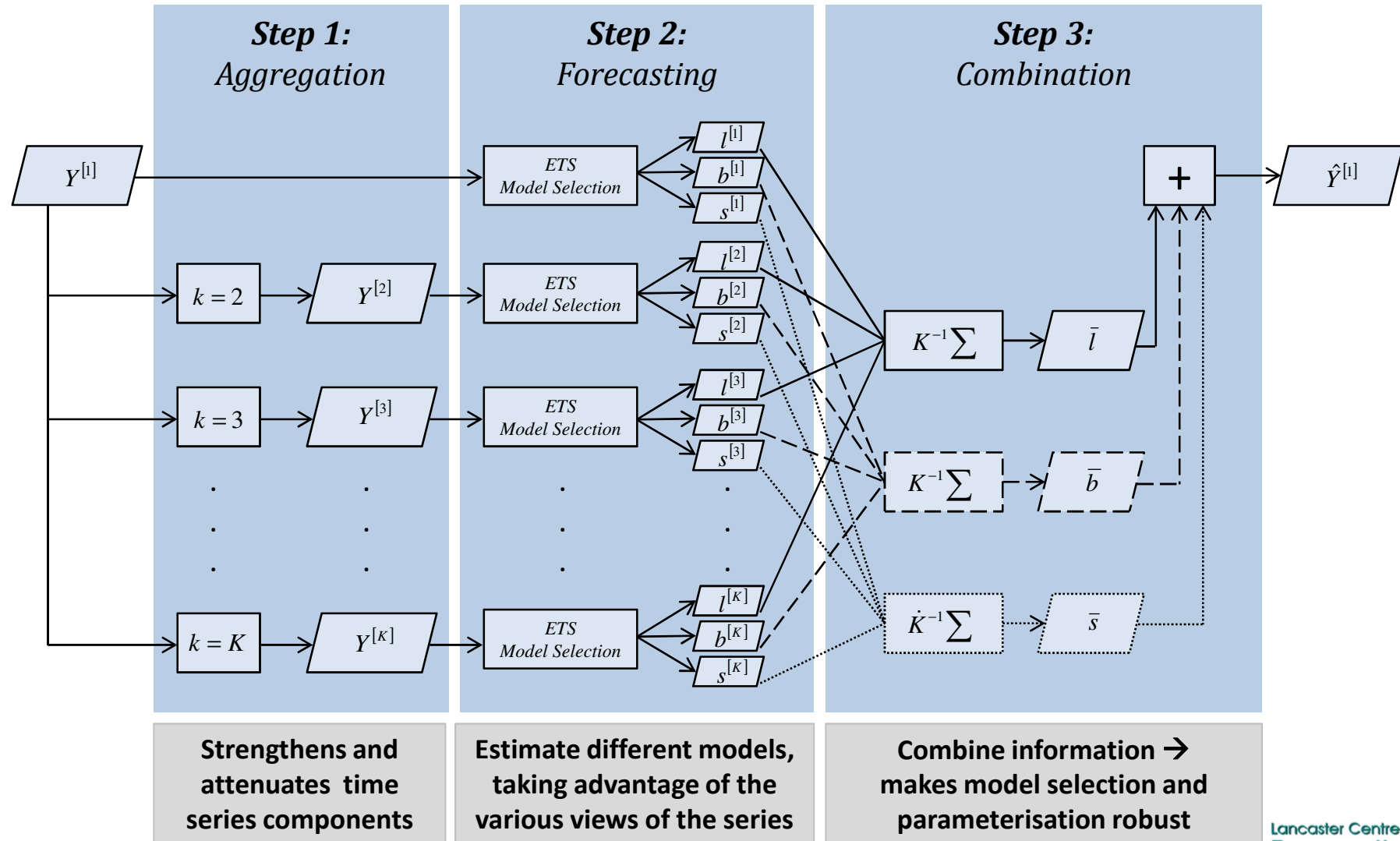
→ Such combined forecasts are reconciled across all time scales (short, medium, long)



Temporal Aggregation & Reconciliation

MAPA

Multiple Aggregation Prediction Algorithm





Results & Conclusions

1. 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
2. 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/>