Taken by Surprise? – Air traffic volatility and capacity/demand balancing

EUROCONTROL – PRU

Research workshop on volatility in air traffic and its impact on ATM Performance

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Variability or Volatility?

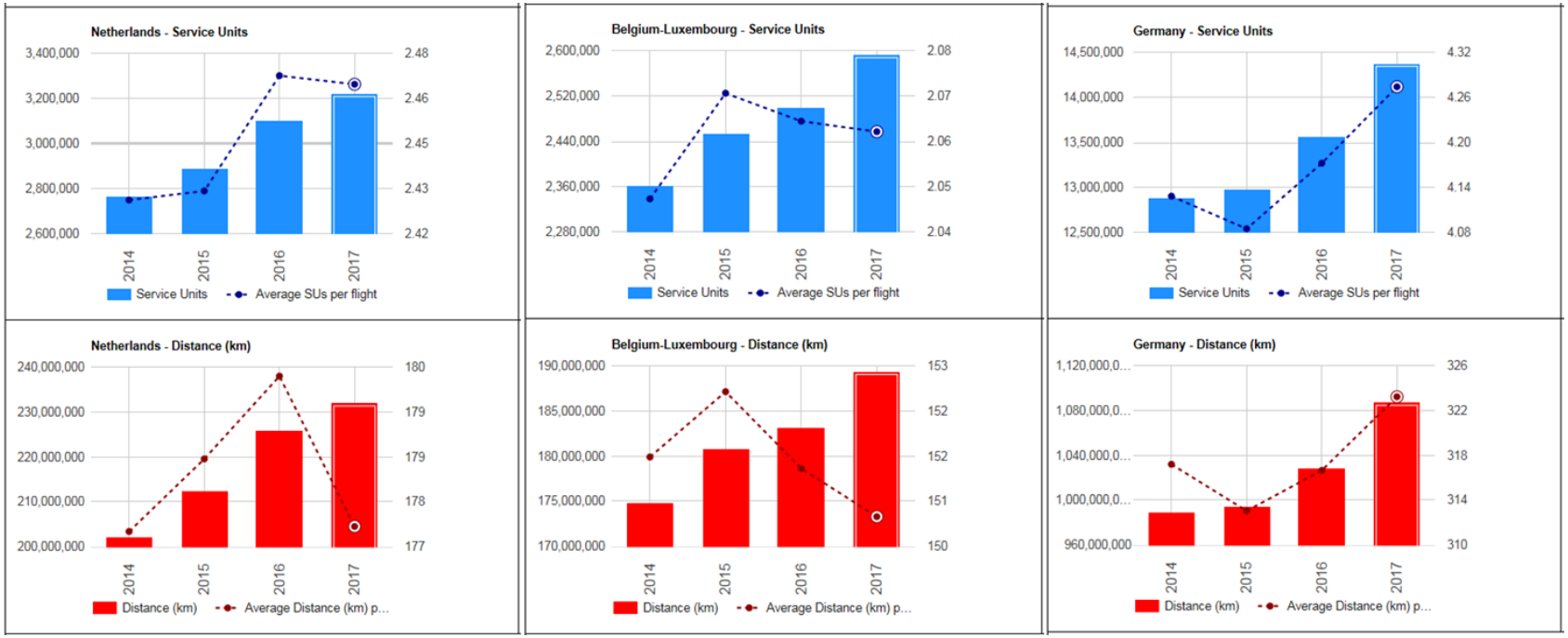
- Volatility as a “buzzword” – emerging topic for debate in ATM context
- Well established in economics/finance when dealing with uncertainties to refer to sudden and unexpected changes
- Which factors contribute to traffic variability?
  - ✓ Weather
  - ✓ External shocks
  - ✓ Airlines practices and route charges
  - ✓ Seasonality
  - ✓ Route network and airspace changes
  - ✓ Capacity/demand imbalances
- Most of these factors are outside ANSPs’ control but should nevertheless be taken into account – flexibility and robustness are key to meet traffic demand and to react to unexpected events

Impact of route charges on demand

- Which is the impact of unit rate differentials on airlines route selection?
  - ✓ Strategic view
  - ✓ Tactical view
- Airlines route selection based on an optimisation process able to trade-off between different factors, e.g.:
  - ✓ Delay,
  - ✓ Flying time and route length
  - ✓ Fuel and other operating costs
  - ✓ Route charges
- Depending on the relative weight of the factors entering the optimisation process, which are often airline/flight-specific
- If savings realised from lower charges outweigh the costs incurred by flying longer or congested routes

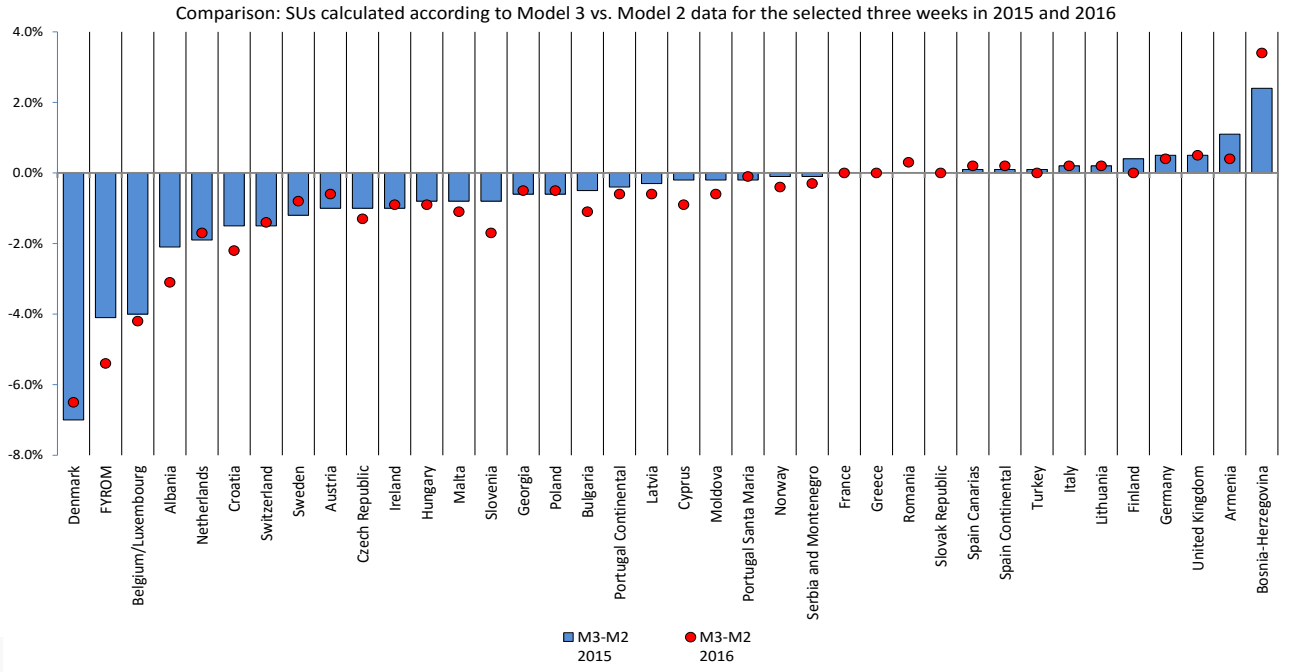
Impact of Route Charges on demand - Strategic view

- Following an increase in German Unit Rate between 2014 and 2015 a certain degree of traffic shifts was observed along the main axis
- No impact in terms of overflights but reduction of average distance flown generated downward revision of SUs in Germany and parallel increase in neighbouring countries (i.e. Belgium, the Netherlands)



Impact of Route Charges on demand – Tactical view

- Does the current charging policy "*Pay what you plan*" contribute to traffic unpredictability?
- CRCO study: comparisons SUs estimated on the basis of the last filed flight plan vs. SUs estimated on the basis of the actual flown trajectory
- Although some differences were recorded at local level, overall no major impact was observed at European system level (-0.3%)

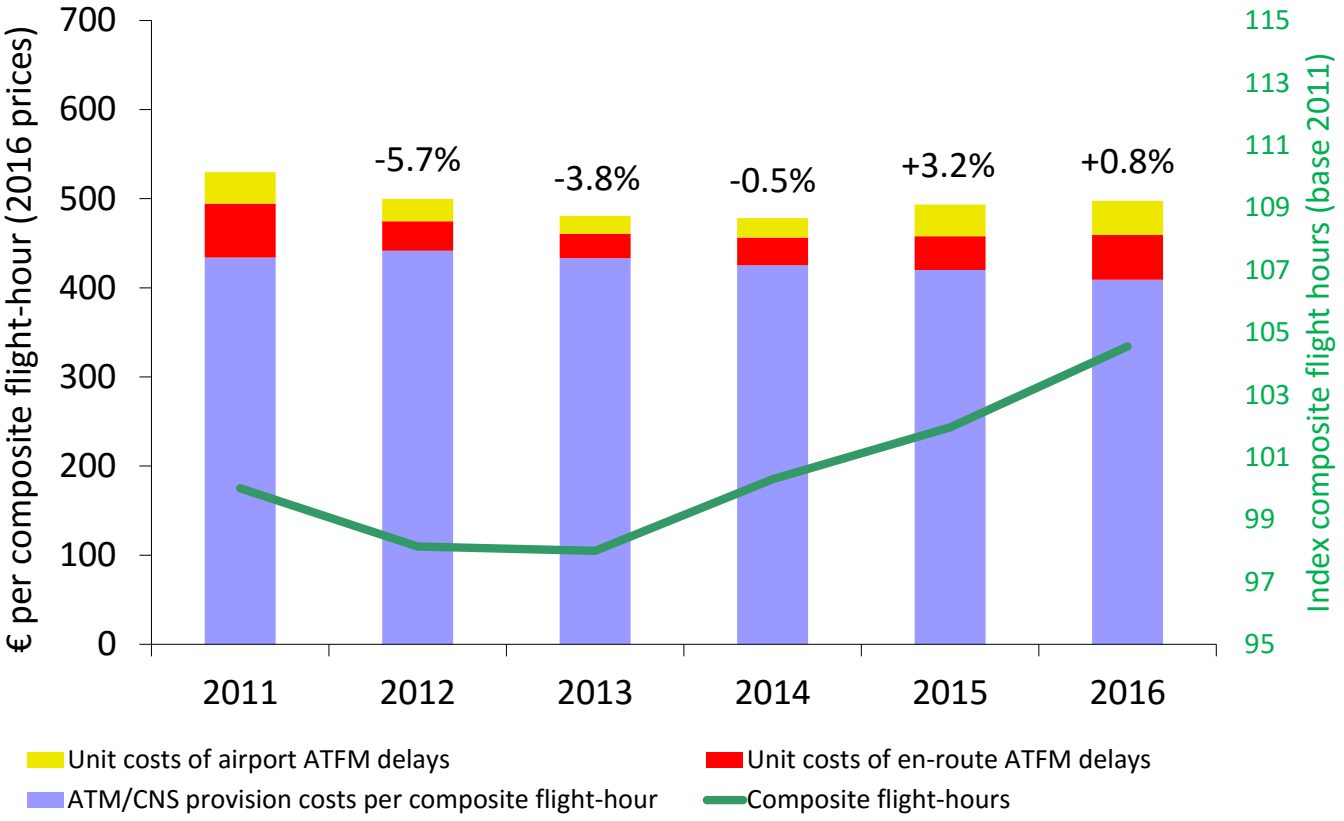


Capacity and demand: two sides of the same coin

- Any informed discussion should not be limited to changes in traffic demand but also consider capacity provision (planning and deployment)
- Defining characteristic of the relationship between capacity and demand: asymmetry in terms of impact of imbalances
- When capacity is less than demand, there are knock-on effects due to the need of displacing demand to other airspaces or to other times
- Lack of capacity has a significant disruptive potential to airspace users and the entire network
- In economic terms, it generates external costs
- It generates volatility, inasmuch traffic (which includes displaced demand) will be different from forecasted demand

Cost-efficiency savings offset by delay costs

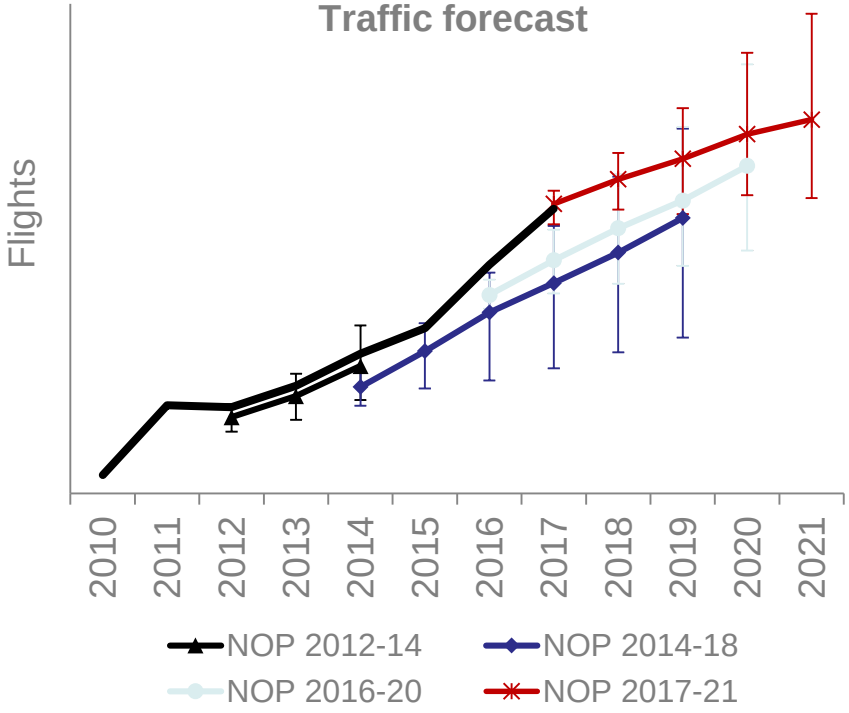
- Despite a decrease in ANS provision costs, total economic costs increase due to increasing delay costs

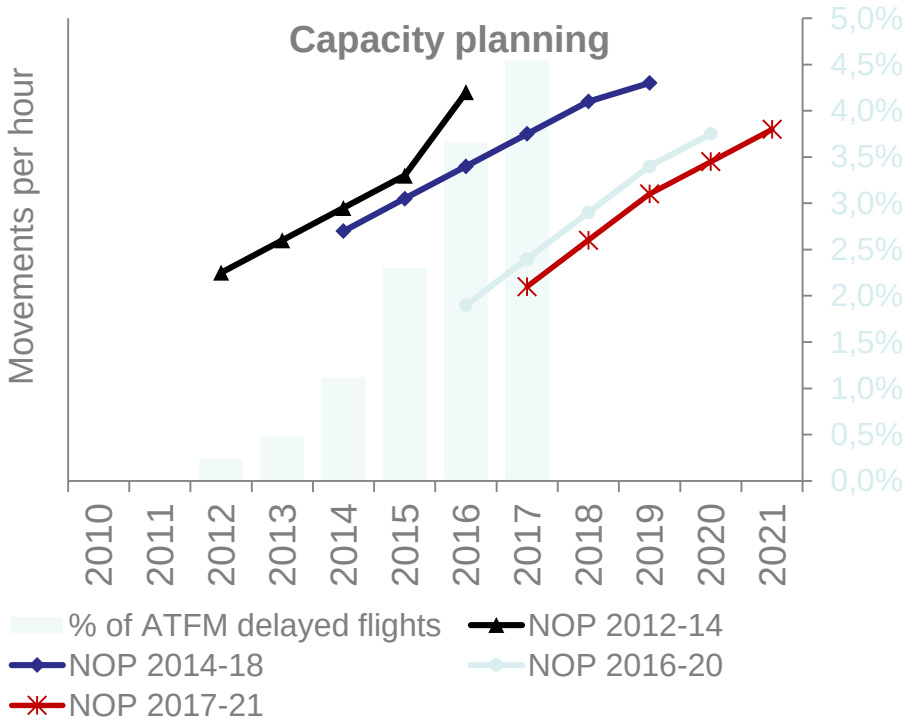


* -1.1% if new methodology (REA) is applied as of April 2016

Source: 1st draft ACE 2016
Data still provisional

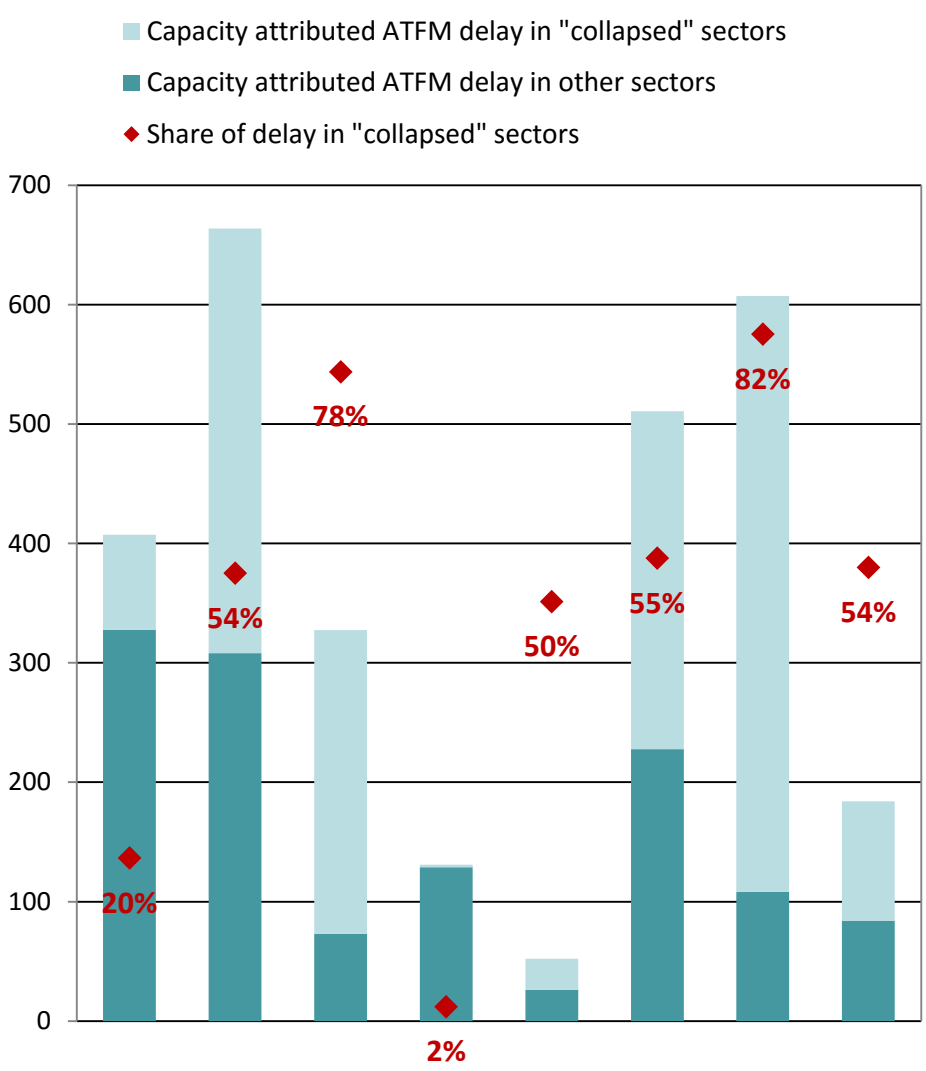
Capacity planning falling behind forecasts

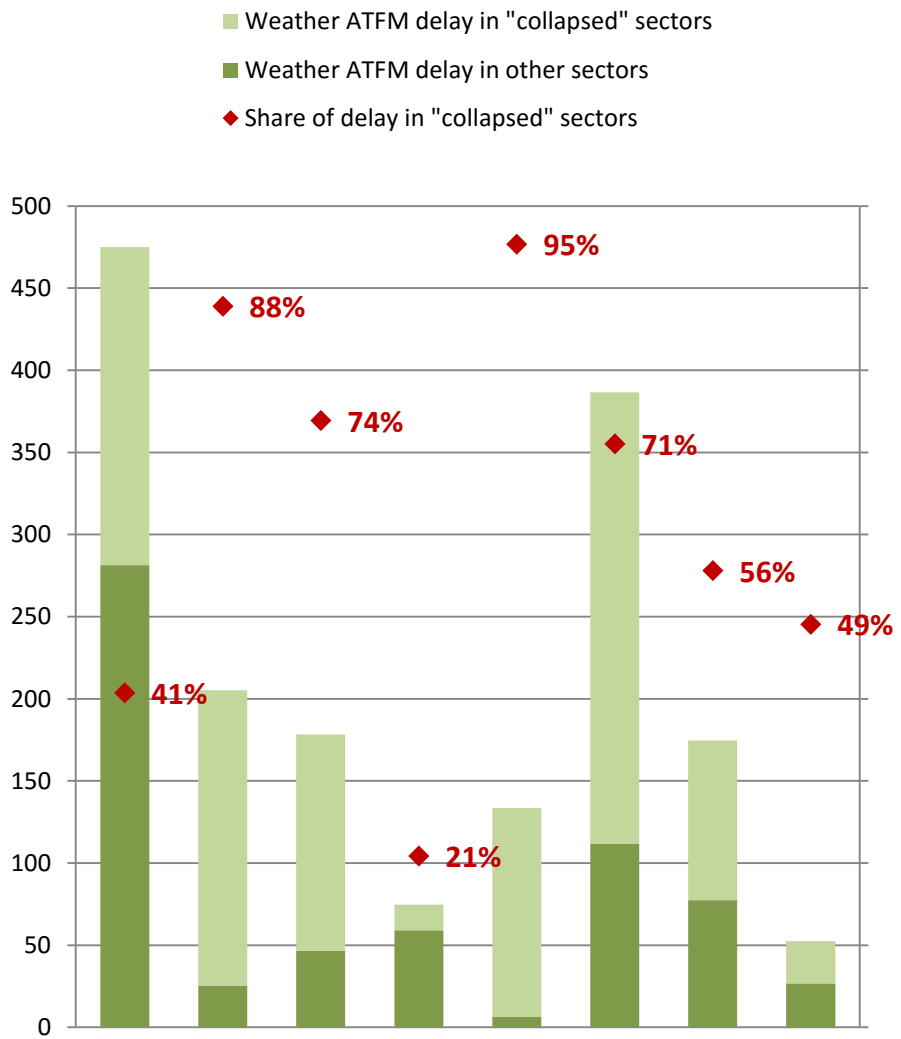




Source: PRU analysis based on NOP reports

Potential capacity vs deployed capacity





Source: draft PRR 2017

The role of uncertainty

- Demand: Demand different from forecasted demand
  - This is to be expected, at least within forecasting error
- Capacity: Capacity deployed different from planned capacity
  - This is also to be expected

- Imbalances
  - Induced variation: multiplicative effects of imbalances, creating and amplifying differences between traffic (which includes displaced demand) and demand

- Ignoring uncertainties about demand and capacity increases the risk of induced variation and therefore volatility
- This is exacerbated by the use of optimisation models, which by their nature reduce “slack” in the system

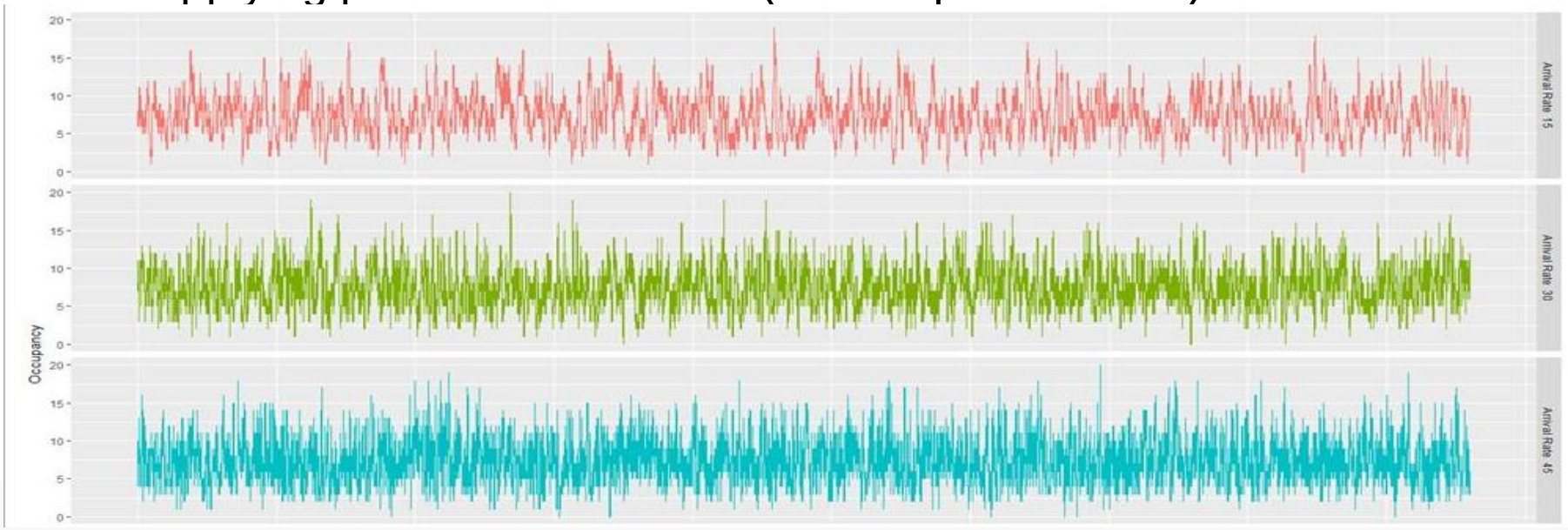
Capacity demand balancing

- Balancing capacity and demand is a dynamic process
- Changes occur at very different timescales and granularity
- Forecast and planning are inherently subject to uncertainty
  - The coarser the granularity, the weaker the relationship between capacity, demand and delays
- Processes can induce additional volatility, and strategic decisions might negatively impact the possibility to react at operational level

- Robust planning needs to be complemented by flexible deployment

Possible pitfalls in processes

- Using the same methodologies for long term/coarse granularity (strategic) and short term/fine granularity (operational)
- Using different scales/definitions for capacity and demand
- Ignoring forecast errors and assumptions
- Ignoring the statistical trade-off between accuracy and precision
- Applying optimisation without proper consideration of uncertainties
- Misapplying probabilistic models (what is predictable?)



Conclusions

- As traffic variability is not a new phenomenon (Yugoslavia crisis, growth of low cost carries over the past 20 years, etc.) the discussions on volatility should not be limited to variations in traffic demand but take a wider perspective and focus on:

  - ✓ Why is variability in demand more of an issue today?
  - ✓ What makes management of capacity different today?
  - ✓ Why are we taken by surprise?