Outlier Methodology Review

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Outline

- Motivation (1) (1 min)
- Approach - Classify series (3) (3 min)
- Critical values (2) (2 min)
- Ensuring quality (1) (1 min)
- Revisions (2) (3 min)
- Next Steps (1) (1 min)
- Questions (1) (3.5 min)
- Contact (1) (.5 min)

Motivation

- Ad-hoc outlier methodology was implemented as a rapid response to Covid due to its unknown effects on time series.
- With more time and data, better solutions were investigated
- Objectives:
  - Address current issues
    - Potential over-modelling. Critical value of 2 is too low.
    - Too much manual burden on analysts
  - Develop a general approach to outliers

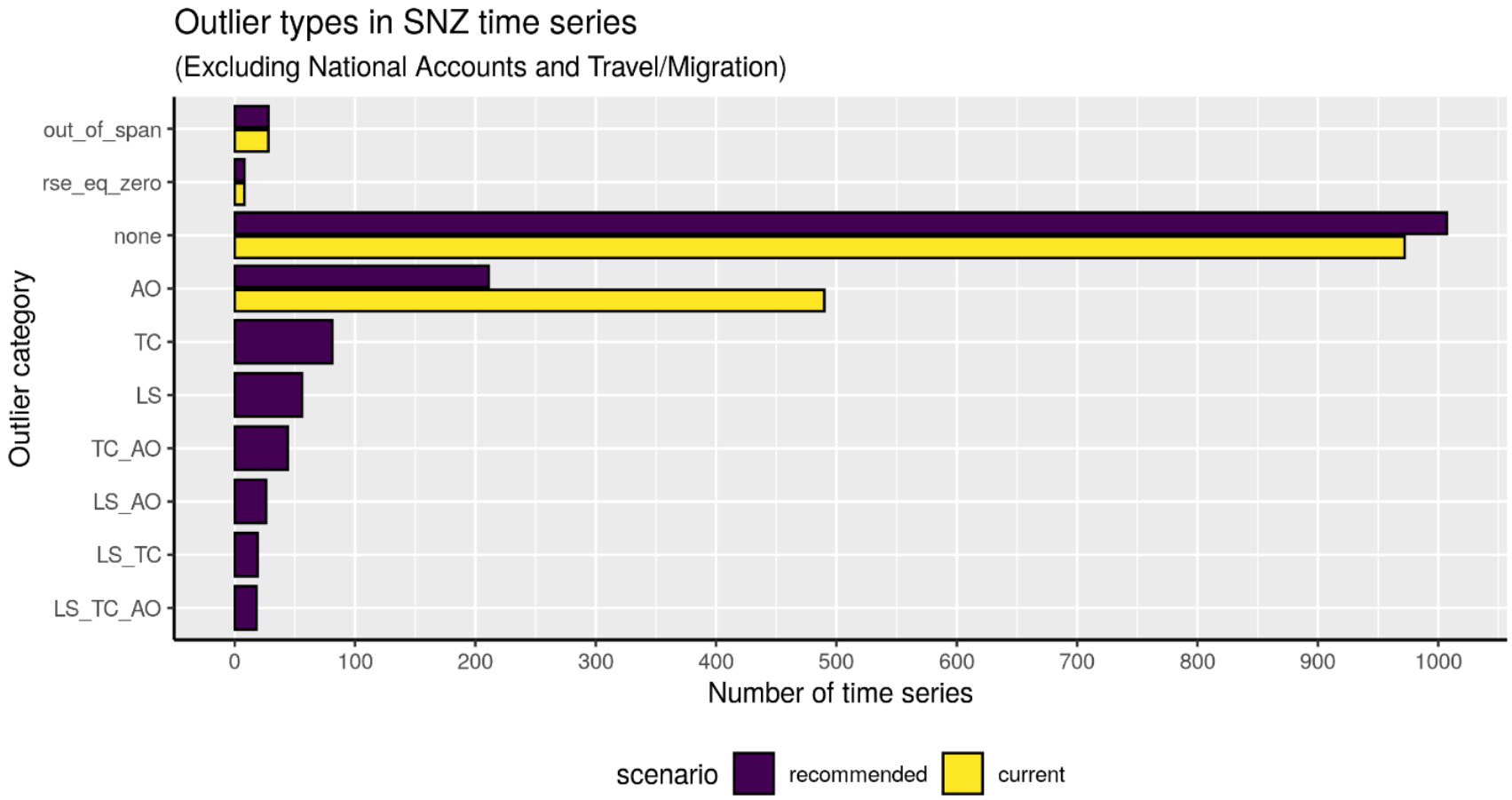
Approach - Classify

- Simple cases - short-term or minimal effects
  - 80% of cases
  - Additive outliers are a sufficient pre-treatment
  - Automatically handled in X-13-ARIMA -SEATS.
- Complex cases - long-term effects
  - 20% of cases
  - Level shifts and/or temporary changes may be necessary
  - Automation may be used in some but not all cases.

Using X13 to Classify

- Determine a critical value: 3.75
- Set automatic detection to search for AO, LS, TC for periods between April 2020 and now.
- Series for which no outliers or only AO's are detected are classified as simple.
- Series for which at least one TC or one LS is detected are provisionally classified as complex.

Classification with automatic detection



Critical Values

Do we actually care about type I and type II errors?

- If our model is perfect, occurrence of type I:

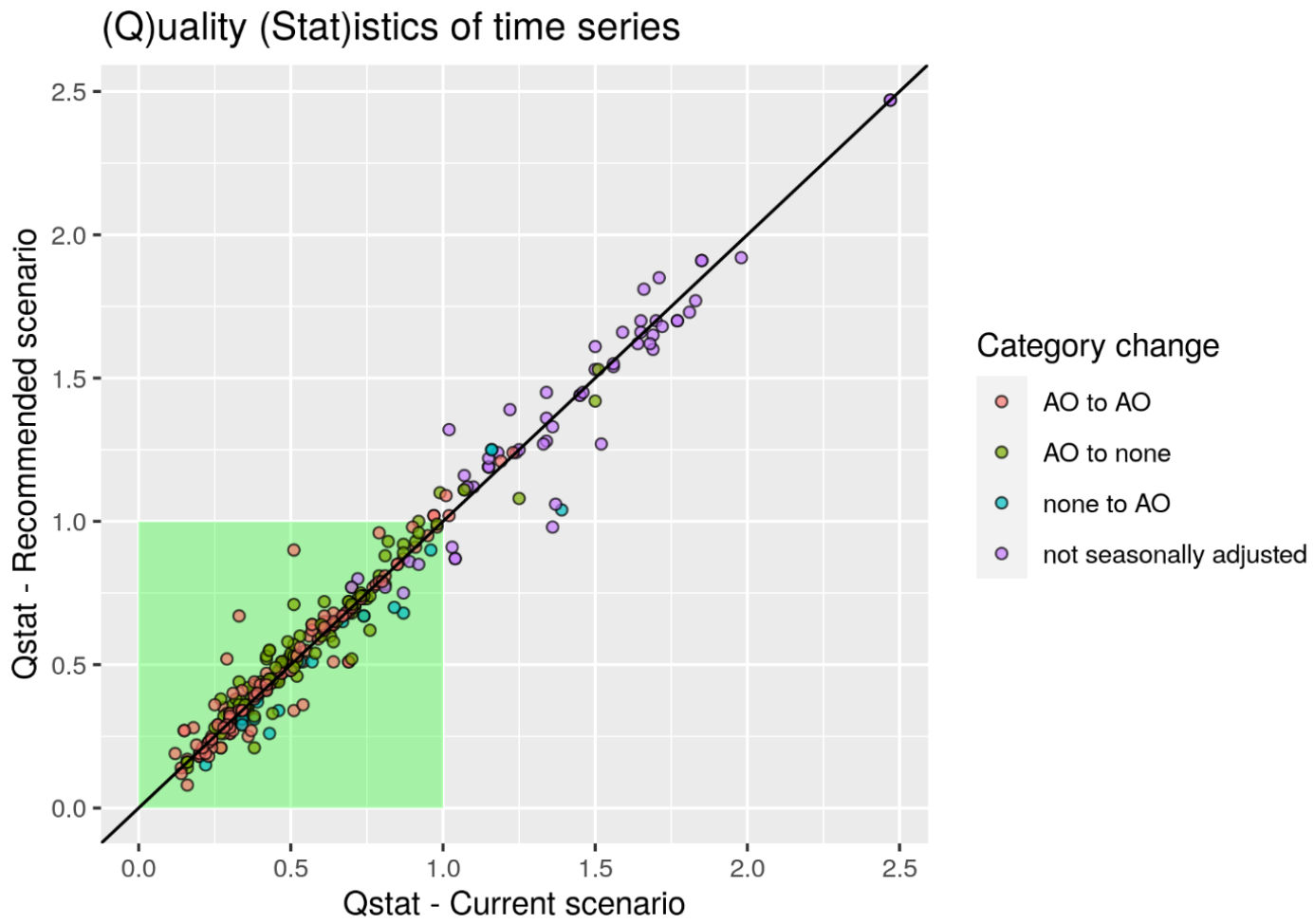
Frequency	Average # of periods	Expected False Positives C=2	Expected False Positives C=3.75
Quarterly	102	5	0
Monthly	267	13	0

- We actually care about the performance of the X-11 algorithm. We can test this empirically

Critical Values

- “Choosing the critical value requires both judgement and experience.”
- We chose a critical value of 3.75 for medium/low sensitivity according to guidelines set by *Chang, Tiao, Chen*
- Empirical evidence used to test reasonability of choice:
  - Quality Statistics
  - Revisions

Ensuring Quality

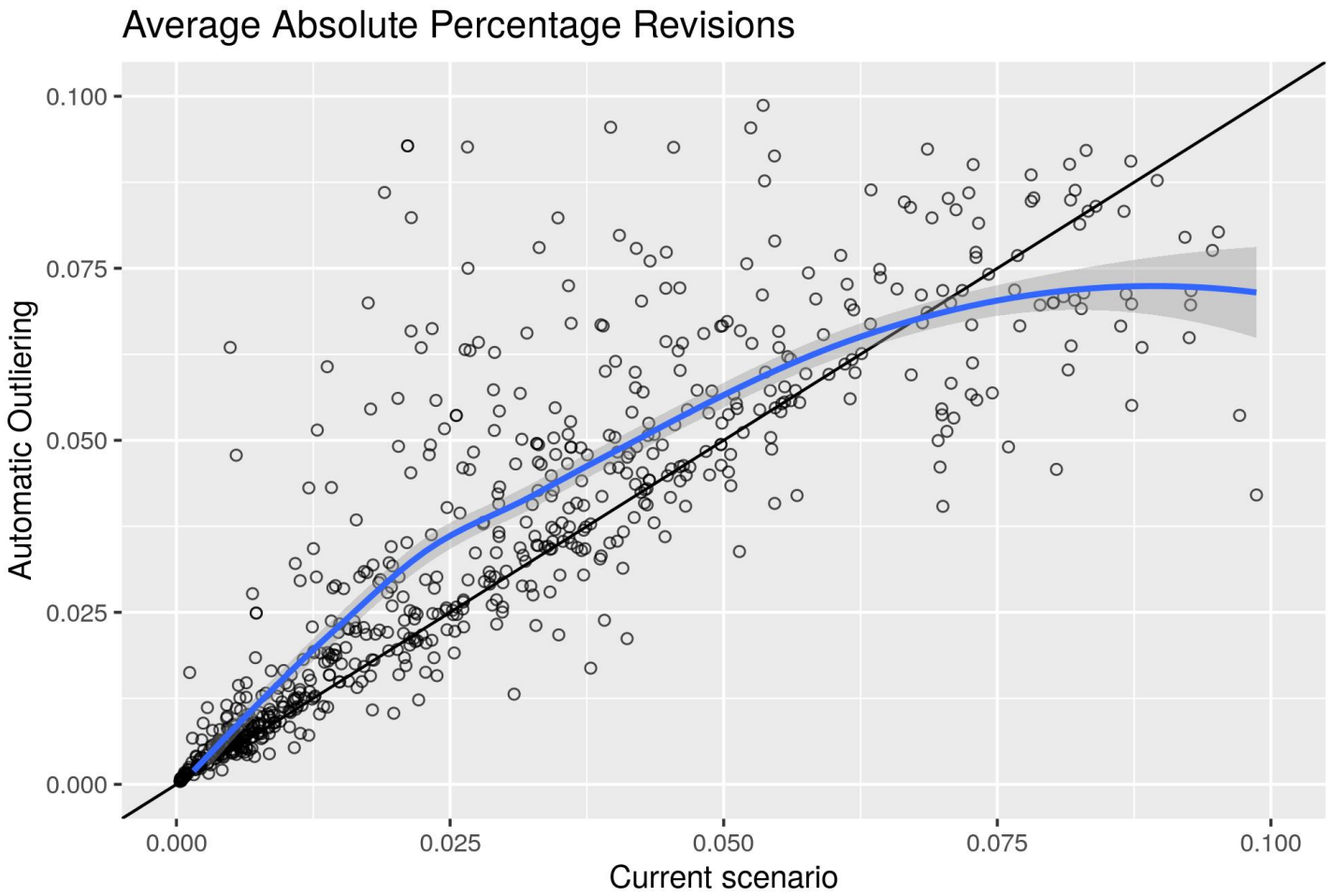


Revisions

- We calculated average periodic absolute percent over all points in a series and over all revision periods from the start of Covid (early 2020) until the end of 2021 to produce one measure per series.
- $A_{t|n}$ is the seasonally adjusted value at time *t*, calculated from the series $y_1, y_{t+1}, \ldots y_n$
- For a single observation at time t, the mean one-period-ahead absolute percent revision over all periods from start of Covid events (c) until now:

$$\frac{1}{n-t} \sum_{\substack{i=c \\ \{i|\ i \geq t\}}}^{n-1} \left| \frac{A_{t|i} - A_{t|i+1}}{A_{t|i}} \right|$$

Revisions


Average Absolute Percentage Revisions
Automatic Outliering
0.100
0.075
0.050
0.025
0.000
0.000
0.025
0.050
0.075
0.100
Current scenario

Implementation

- Roll out will be staggered by area
- Set a span for automatic detection
- Create guidelines for handling border cases
- Create monitoring tools and dashboards for keeping tabs on automatic AO’s

Next Steps

- Simple outliers are chosen purely based on statistical significance and can be automated. Complex outlier types requires much more subject matter expertise.
- Use manual and automated methods to further subset the series down to the obvious cases.
- The most obvious level shift cases will be modelled.
- Less obvious cases require a hypothesis to be posed from the subject matter experts.

Questions?

Contact

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