Time series adjustment in Austria

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Overview
- Background
- Basic idea
- Method used (X12-Arima)
- Adjustment of Austrian data on nights spent
- Problems & conclusion
### Background - seasonality in Austria - nights spent

#### Development of nights spent in Austria in 2007

![Graph showing the development of nights spent in Austria in 2007.](chart.png)

Source: Statistics Austria, Tourism Statistics

### Background - seasonality in Austria - employment

#### Employment in Austria in all tourism relevant industries\(^1\) in 2007

![Graph showing employment in Austria in all tourism relevant industries in 2007.](chart.png)

Source: Statistics Austria, Tourism Statistics

\(^1\) ÖNACE 55, 60, 61, 62, 63 and 92
Background - seasonality in Austria - employment

Employment in Austria in the accommodation and food service activities in 2007

![Graph showing employment trends in Austria](image)

**Source:** Statistics Austria, Tourism Statistics

Background - seasonality in Europe

Nights spent:
Ratio peak month in relation to lowest month in 2007

![Graph showing nights spent in Europe](image)

**Source:** Eurostat, Tourism Statistics
Basic idea

Main problem:

| Month-to-month comparisons not meaningful due to seasonal fluctuations | Comparisons with the same month of the previous year not meaningful because intervening 11 months not taken into consideration |

Solution:

Seasonal and calendar adjustment

Uncovering of new developments

Reliable interpretation of data possible !!!

Basic idea – decomposition model

Observations can, due to varying, not overlapping causes, be broken down into a number of independent, not directly observable components!

Trend – long-term direction

Economic cycle – cyclical components with periods longer than one year

Season – seasonal fluctuations – during a year

Calender – calendar irregularities

Irregular component – random fluctuations
Basic idea

Seasonal effect

Different months vary:
- e.g. Summer vs winter, January 31 days, February 28 days, ...

Calendar effect

Same months vary:
- e.g. Number of working days in January, leap year effect, shifting of holidays (easter effect), ...

Method X12-ARIMA

Seasonal adjustment software

Features:
- Extensive time series modeling and model selection capabilities for linear regression models with ARIMA errors (RegARIMA models)
- Wide variety of seasonal and trend filter options
- Diagnostics of the quality and stability of the adjustments achieved under the options selected
Method X12-ARIMA

Nights spent: original data

Source: Statistics Austria, Tourism Statistics

Comparisons:
... with the previous year → calendar adjustment
... with the previous month → seasonal and calendar adjustment

Source: Statistics Austria, Tourism Statistics

Method X12-ARIMA

Nights spent: calendar adjusted time series

for comparisons with the previous year

Source: Statistics Austria, Tourism Statistics
Method X12-ARIMA

Nights spent: calendar adjusted time series

Source: Statistics Austria, Tourism Statistics

Easter + 2 weeks
4 days in March 12 days in April

Nights spent: calendar adjustment - example

2006: Easter April 16th → 16 days in April
2007: Easter April 8th → 15 days in April
2008: Easter March 23rd → 16 days in March

→ adjust to 4 days in March and 12 days in April
Method X12-ARIMA

Nights spent: calendar adjustment - example

<table>
<thead>
<tr>
<th>Period</th>
<th>Original data</th>
<th>% change to same month in previous year</th>
<th>Calendar adjusted time series</th>
<th>% change to same month in previous year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan-08</td>
<td>13,708,035</td>
<td>5.25</td>
<td>13,708,035</td>
<td>5.25</td>
</tr>
<tr>
<td>Feb-08</td>
<td>16,891,408</td>
<td>8.69</td>
<td>16,891,408</td>
<td>8.69</td>
</tr>
<tr>
<td>Mar-08</td>
<td>14,817,792</td>
<td>25.71</td>
<td>11,375,758</td>
<td>- 8.88</td>
</tr>
<tr>
<td>Apr-08</td>
<td>4,911,619</td>
<td>- 31.47</td>
<td>6,392,858</td>
<td>- 5.46</td>
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<tr>
<td>May-08</td>
<td>7,109,518</td>
<td>16.44</td>
<td>7,114,968</td>
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<tr>
<td>Jun-08</td>
<td>8,531,234</td>
<td>- 3.32</td>
<td>8,531,234</td>
<td>- 3.32</td>
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<tr>
<td>Jul-08</td>
<td>15,255,160</td>
<td>3.48</td>
<td>15,255,160</td>
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</tr>
</tbody>
</table>

Method X12-ARIMA

Nights spent: season and calendar adjusted time series

Source: Statistics Austria, Tourism Statistics

for comparisons with the previous month
Method X12-ARIMA

Nights spent: season and calendar adjusted time series - example

<table>
<thead>
<tr>
<th>Period</th>
<th>Original data</th>
<th>% change to previous month</th>
<th>Season and calendar adjusted time series</th>
<th>% change to previous month</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan-08</td>
<td>13,708,035</td>
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<tr>
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<td>May-08</td>
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<td>-20.00</td>
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<td>8,531,234</td>
<td>78.82</td>
<td>10,574,825</td>
<td>4.54</td>
</tr>
</tbody>
</table>

% change to previous month

Source: Statistics Austria, Tourism Statistics
Problems & conclusion

Problems

- Technical challenges
- Adjusted series contains the irregular component
  - Tourism demand influenced by many factors (e.g. weather, marketing, foreign holidays, mega events, terrorist attacks, diseases, currency rate fluctuations, …)
  - Tourist consumption can respond relatively easily and quickly

Conclusion

Time spent understanding the seasonal adjustment procedure is time well spent!