Measuring Seasonality in Tourism Statistics

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Peter Laimer, Johanna Ostertag
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We are moving

Overview
✓ Background
✓ Basic idea
✓ Difference adjusted/not adjusted data
✓ Methods
✓ Problems & conclusion
Background

**Development of nights spent in Austria 2000 - 2008**

The broad aim when analyzing time series data is the recognition of significant changes in the direction and level of economic activity.

Seasonal patterns make the recognition of significant changes difficult!

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**Interpretation of nights spent in Austria**

“In comparison to the previous month, the number of nights spent in April decreased by 67%”
Background

Interpretation of nights spent in Austria

January February March April May June July

Source: Statistics Austria, Tourism Statistics

“In comparison to April 2007, the number of nights spent in April 2008 decreased by 31%”

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
Calendar – calendar irregularities
Irregular component – random fluctuations

Basic idea

Seasonal effect
Different months vary:
e.g. Summer vs winter, October 31 days, November 30 days, …

Calendar effect
Same months vary:
e.g. Number of working days in January, leap year effect, shifting of holidays (Easter effect), …
Difference between adjusted and not adjusted data

Nights spent: original data

Source: Statistics Austria, Tourism Statistics

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

Nights spent: calendar adjusted time series

Source: Statistics Austria, Tourism Statistics

for comparisons with the previous year
2.000.000
4.000.000
6.000.000
8.000.000
10.000.000
12.000.000
14.000.000
16.000.000
18.000.000
0
Jan- 07 Feb- 07 Mar- 07 Apr- 07 May- 07 Jun- 07 Jul- 07 Aug- 07 Sep- 07 Oct- 07 Nov- 07 Dec- 07 Jan- 08 Feb- 08 Mar- 08 Apr- 08 May- 08 Jun- 08 Jul- 08

Nights spent: calendar adjusted time series

Source: Statistics Austria, Tourism Statistics

Original data: “In comparison to April 2007, the number of nights spent in April 2008 decreased by 31%”

Calendar adjusted data: “In comparison to April 2007, the number of nights spent in April 2008 decreased by 5%”

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
### 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>
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<tr>
<td>Feb-08</td>
<td>16,891,408</td>
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<td>16,891,408</td>
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<tr>
<td>Mar-08</td>
<td>14,817,792</td>
<td>25.71</td>
<td>11,375,758</td>
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<tr>
<td>Apr-08</td>
<td>4,911,619</td>
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<td>6,392,858</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>
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<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>
<td>3.48</td>
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</tbody>
</table>

### Nights spent: season and calendar adjusted time series

Source: Statistics Austria, Tourism Statistics

For comparisons with the previous month
### Nights spent: season and calendar adjusted time series

Source: Statistics Austria, Tourism Statistics

Original data: “In comparison to the previous month, the number of nights spent in April decreased by 67%”

Season and calendar adjusted data: “In comparison to the previous month, the number of nights spent in April increased by 5%”

### Difference between adjusted and not adjusted data

<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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<td>10,286,394</td>
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<tr>
<td>Feb-08</td>
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<td>Apr-08</td>
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<tr>
<td>May-08</td>
<td>7,109,518</td>
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<td>11.40</td>
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<tr>
<td>Jun-08</td>
<td>8,531,234</td>
<td>20.00</td>
<td>10,116,016</td>
<td>- 8.75</td>
</tr>
<tr>
<td>Jul-08</td>
<td>15,255,160</td>
<td>78.82</td>
<td>10,574,825</td>
<td>4.54</td>
</tr>
</tbody>
</table>
Methods

Methods in use range from simple to very sophisticated!

**Austria: X12-ARIMA** Seasonal adjustment software

**X12-ARIMA 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

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Simple seasonal adjustment with factors:

1. Calculate average for each month
2. Calculate average for the entire time series
3. Calculate factor for each month:
   - e.g. January factor: \( \frac{\text{average for January}}{\text{average for the entire time series}} \)
4. Calculate seasonally adjusted values:
   - \( \frac{\text{original monthly values}}{\text{factors for the respective month}} \)
Challenges

- **Technical** challenges (find the right method!)
- **Adjusted series** contains the *irregular component*
  - Tourism demand influenced by many factors (e.g. weather, political factors, economic factors, social factors, health factors, technology factors as well as foreign holidays, mega events, marketing, …)
  - Tourist consumption can respond relatively easily and quickly
- **Practical** challenges
  - Users do not understand the difference
  - Users misuse the data

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**Challenge - example**

**Nights spent: calendar adjusted time series**

- **Risk** that data users take the data that’s better, for example: in March the original data (+26%) is taken instead of the adjusted data (-9%) and in April the adjusted data (+5%) is taken instead of the original (-31%)!

Source: Statistics Austria, Tourism Statistics
Conclusion

Time series adjustment

… is an important analytical tool;
… can improve the comprehension and interpretation of figures;
… can advance a clear understanding of developments;
… can impede misinterpretation and allows more informed decisions;
… can help to understand the underlying structure of observed data;
… is important in tourism, where seasonality is a significant factor;
… is the first step towards forecasting.

“Time spent understanding the adjustment procedure is time well spent”

Scott Meis (Executive Director Research - CTC), 2004