

We are moving

information

**Time series adjustment  
in Austria**

*UNWTO Capacity Building Programme on Tourism Statistics 2008-2009  
Workshop II, 2 – 5 December 2008, Vienna*

**Johanna Ostertag**

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**Overview**

- ✓ **Background**
- ✓ **Basic idea**
- ✓ **Method used (X12-Arima)**
- ✓ **Adjustment of Austrian data on nights spent**
- ✓ **Problems & conclusion**

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**Background - seasonality in Austria - employment**

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

Month	Total (%)	Accommodation (%)	Food service activities (%)
Jan-07	8.5	9.2	8.2
Feb-07	8.5	9.2	8.2
Mar-07	8.2	9.2	8.2
Apr-07	7.5	6.8	7.8
May-07	8.2	7.2	8.0
Jun-07	8.8	8.5	8.5
Jul-07	9.2	9.2	8.8
Aug-07	9.0	9.2	8.8
Sep-07	8.5	8.8	8.2
Oct-07	7.8	6.5	8.0
Nov-07	7.2	6.2	7.5
Dec-07	9.0	9.8	8.5

Source: Statistics Austria, Tourism Statistics

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**Background - seasonality in Europe**

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

Country	Ratio (%)
hr Croatia	20.0
gr Greece	13.0
bg Bulgaria	8.0
cy Cyprus	6.5
is Iceland	6.5
it Italy	5.0
ro Romania	4.5
mt Malta	4.0
at Austria	4.0
pt Portugal	4.0
ie Ireland	4.0
es Spain	4.0
hu Hungary	4.0
no Norway	4.0
dk Denmark	4.0
eu27 European Union	3.5

Source: Eurostat, Tourism Statistics

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**Basic idea**



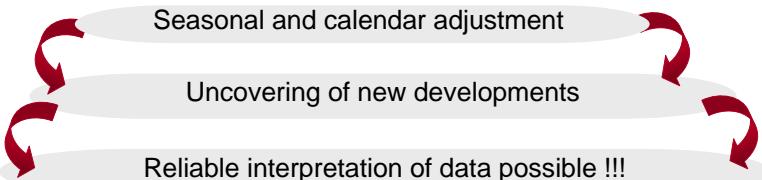
**Main problem:**



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:**



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**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

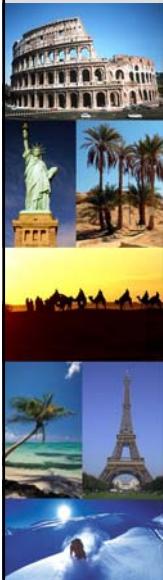
**Irregular component** – random fluctuations

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## 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), ...

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## Method X12-ARIMA



Seasonal adjustment software

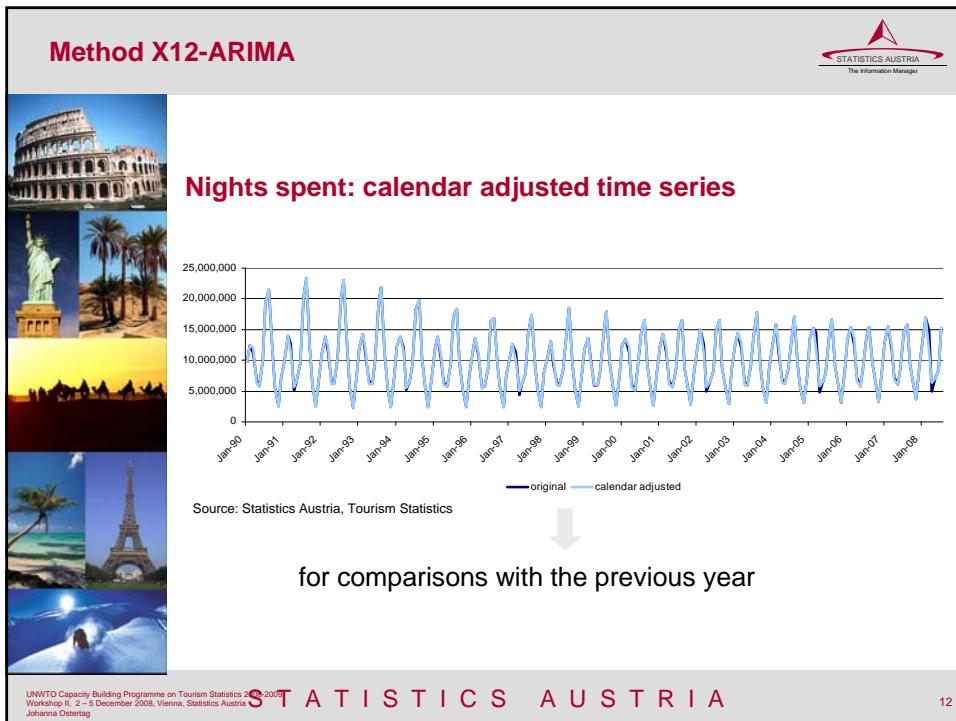
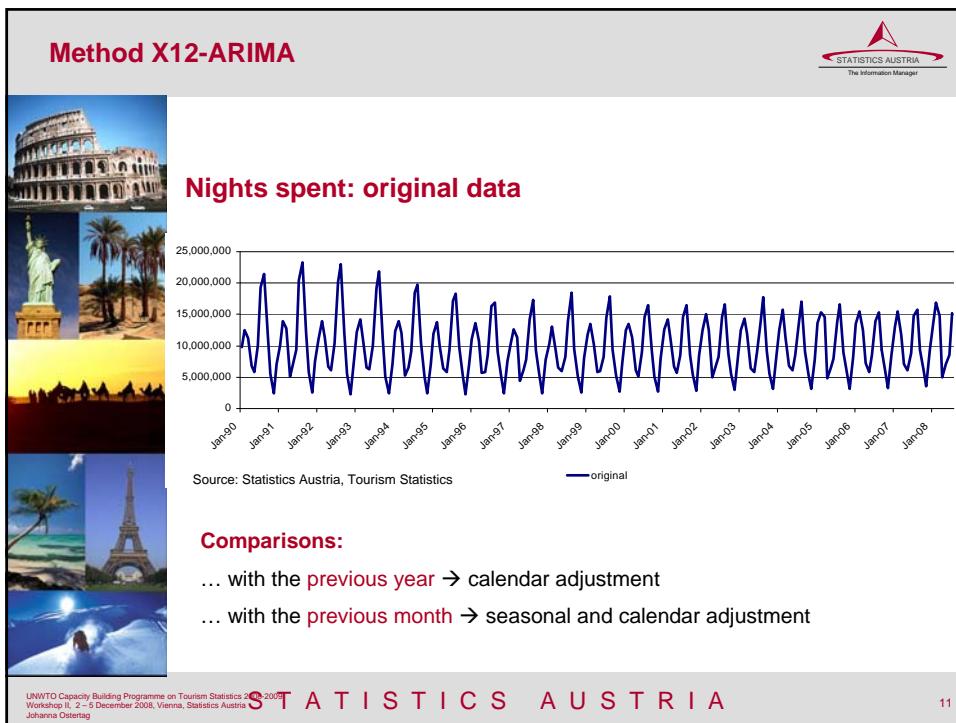
### Features:

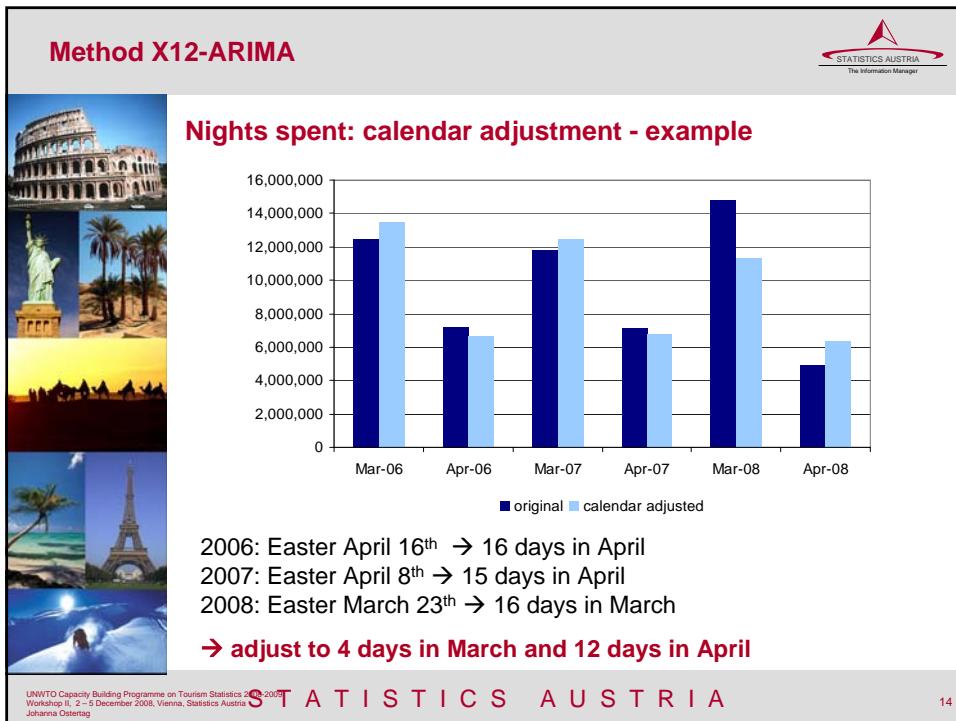
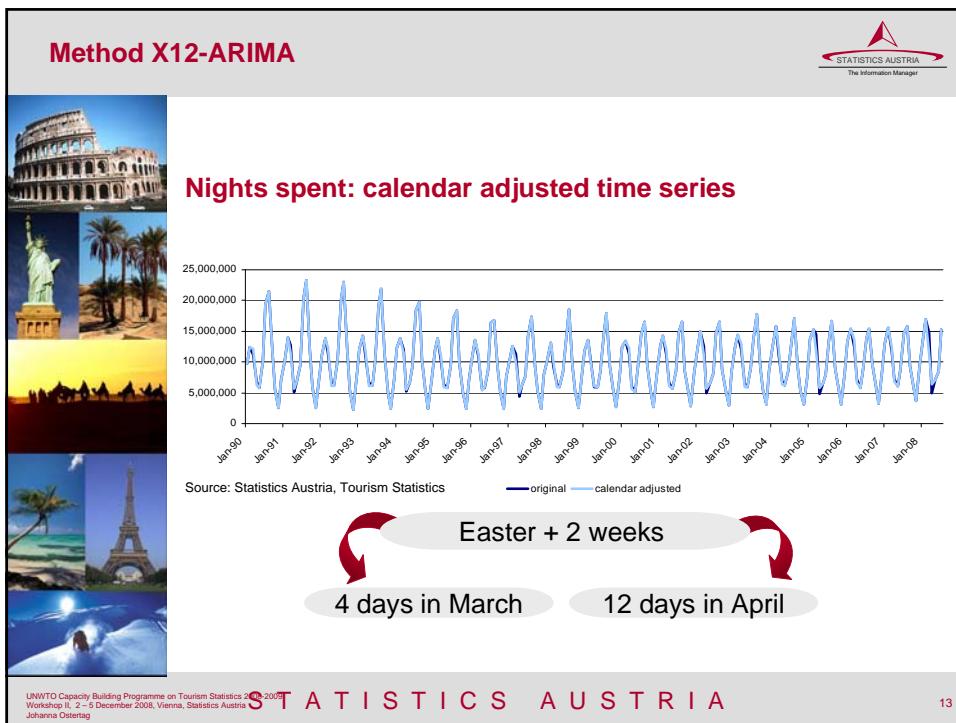
- Extensive time series modeling and model selection capabilities for linear regression models with ARIMA errors (RegARIMA models)
- Wide variety of seasonal and trend filter options
- Diagnostics of the quality and stability of the adjustments achieved under the options selected

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**Method X12-ARIMA**



**Nights spent: calendar adjustment - example**

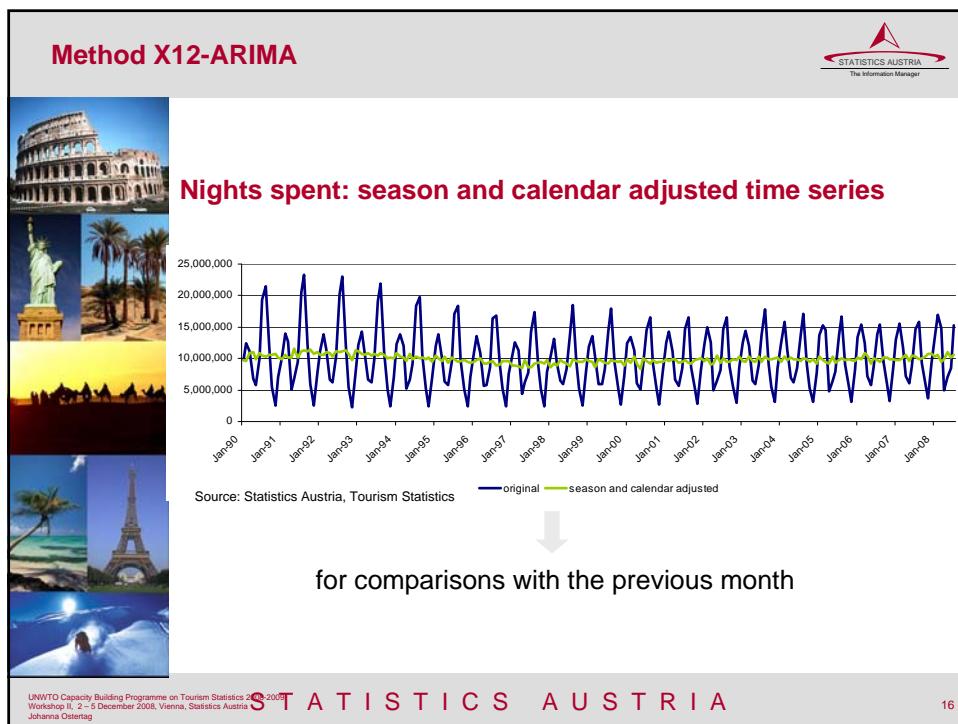


Period	Original data	% change to same month in previous year	Calendar adjusted time series	% change to same month in previous year
Jan-08	13,708,035	5.25	13,708,035	5.25
Feb-08	16,891,408	8.69	16,891,408	8.69
Mar-08	14,817,792	25.71	11,375,758	- 8.88
Apr-08	4,911,619	- 31.47	6,392,858	- 5.46
May-08	7,109,518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

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**Method X12-ARIMA**

**Nights spent: season and calendar adjusted time series - example**

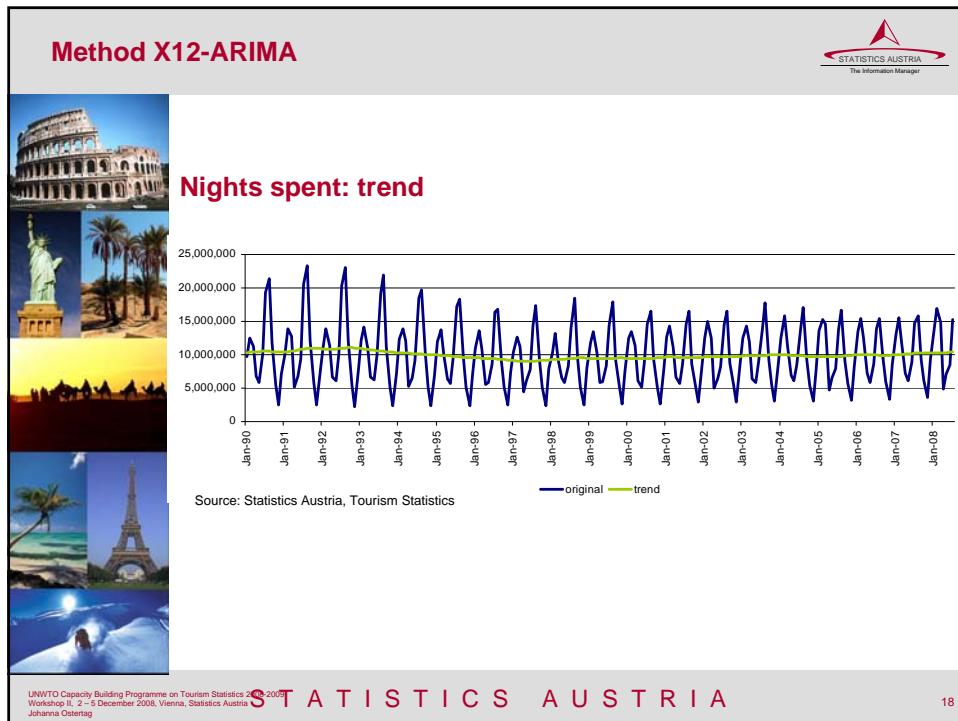


Period	Original data	% change to previous month	Season and calendar adjusted time series	% change to previous month
Jan-08	13,708,035		10,286,394	
Feb-08	16,891,408	23.22	10,608,868	3.13
Mar-08	14,817,792	- 12.28	9,463,442	- 10.80
Apr-08	4,911,619	- 66.85	9,951,492	5.16
May-08	7,109,518	44.75	11,085,533	11.40
Jun-08	8,531,234	20.00	10,116,016	- 8.75
Jul-08	15,255,160	78.82	10,574,825	4.54

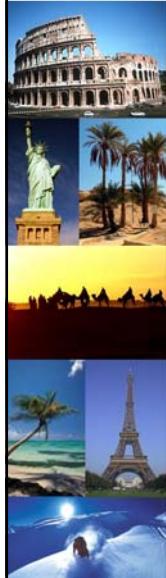
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## Problems & conclusion



### 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!

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