DEUTSCHE BUNDESBANK
EUROSYSTEM

# Elementary seasonal adjustment of economic data with JDemetra+: Module I – Introduction

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# Aims

Theory

- Basic understanding $\rightsquigarrow$ Ideas, concepts
- Approach $\rightsquigarrow$ X-11
- Pretreatment $\rightsquigarrow$ RegARIMA models

Application

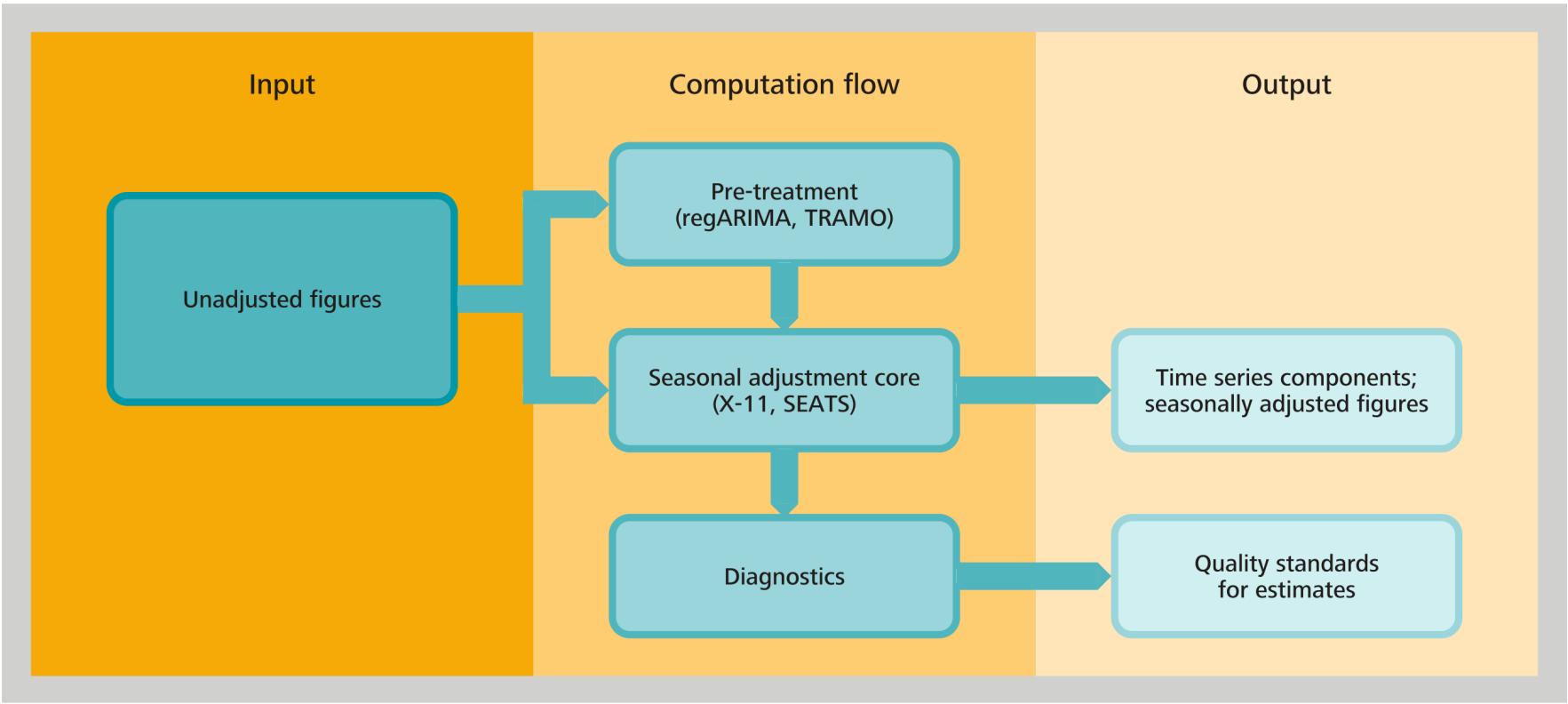
- Software $\rightsquigarrow$ JDemetra+ (JD+)
- Specification $\rightsquigarrow$ Options
- Results $\rightsquigarrow$ Interpretation, quality assessment

Discussion

- Your questions $\rightsquigarrow$ Practical problems

# Road map

## Structure of JDemetra+

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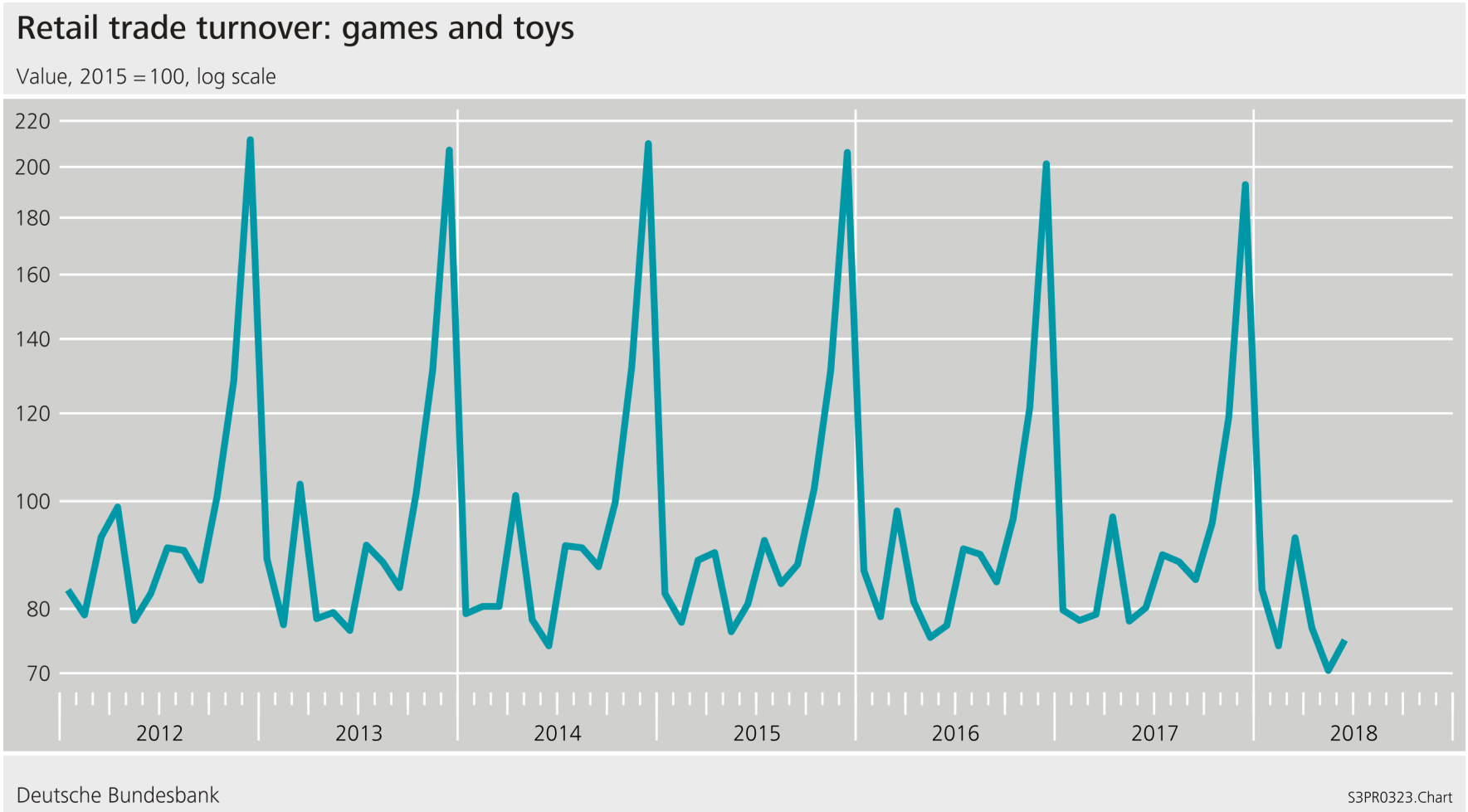
# What is seasonality? (I/II)



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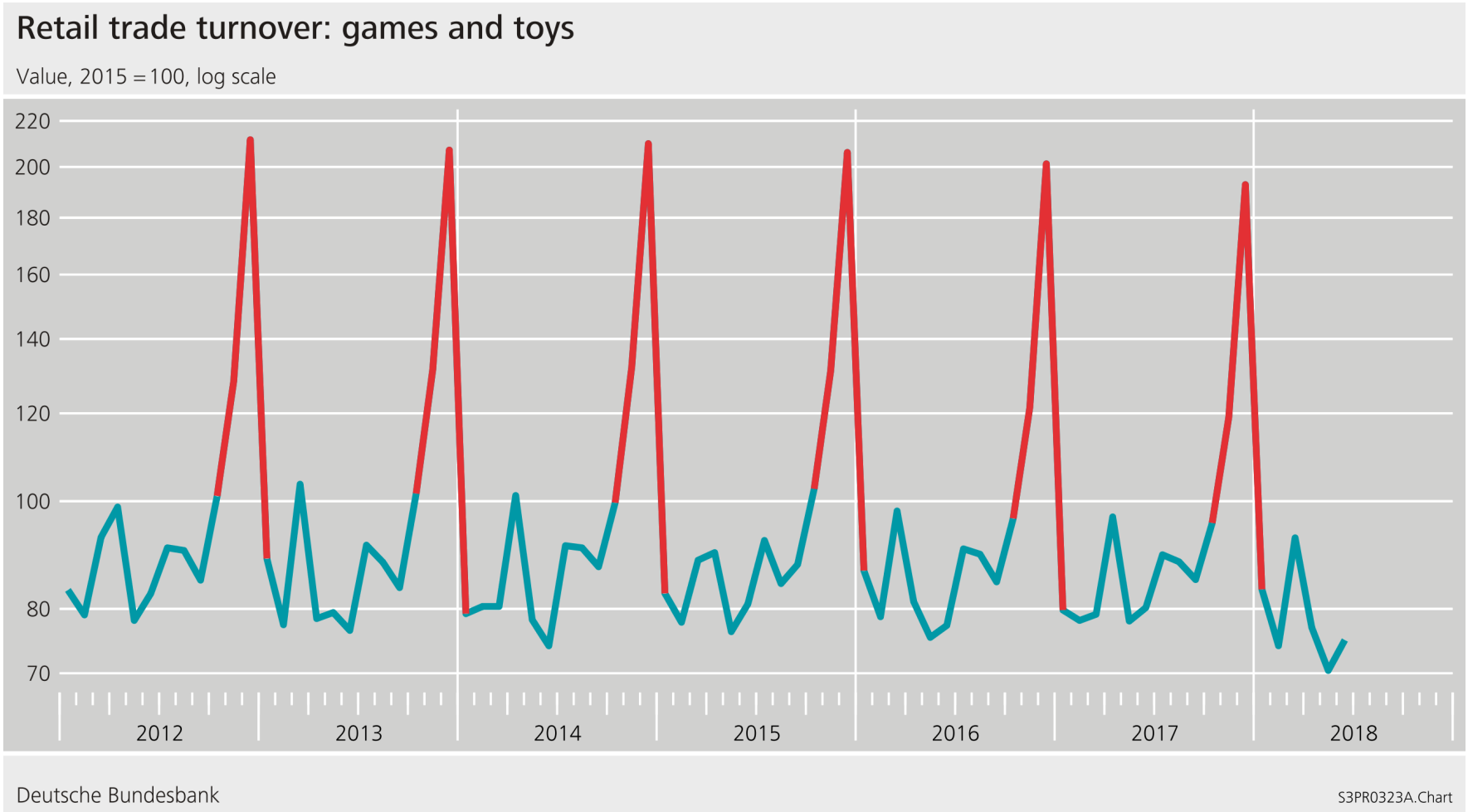

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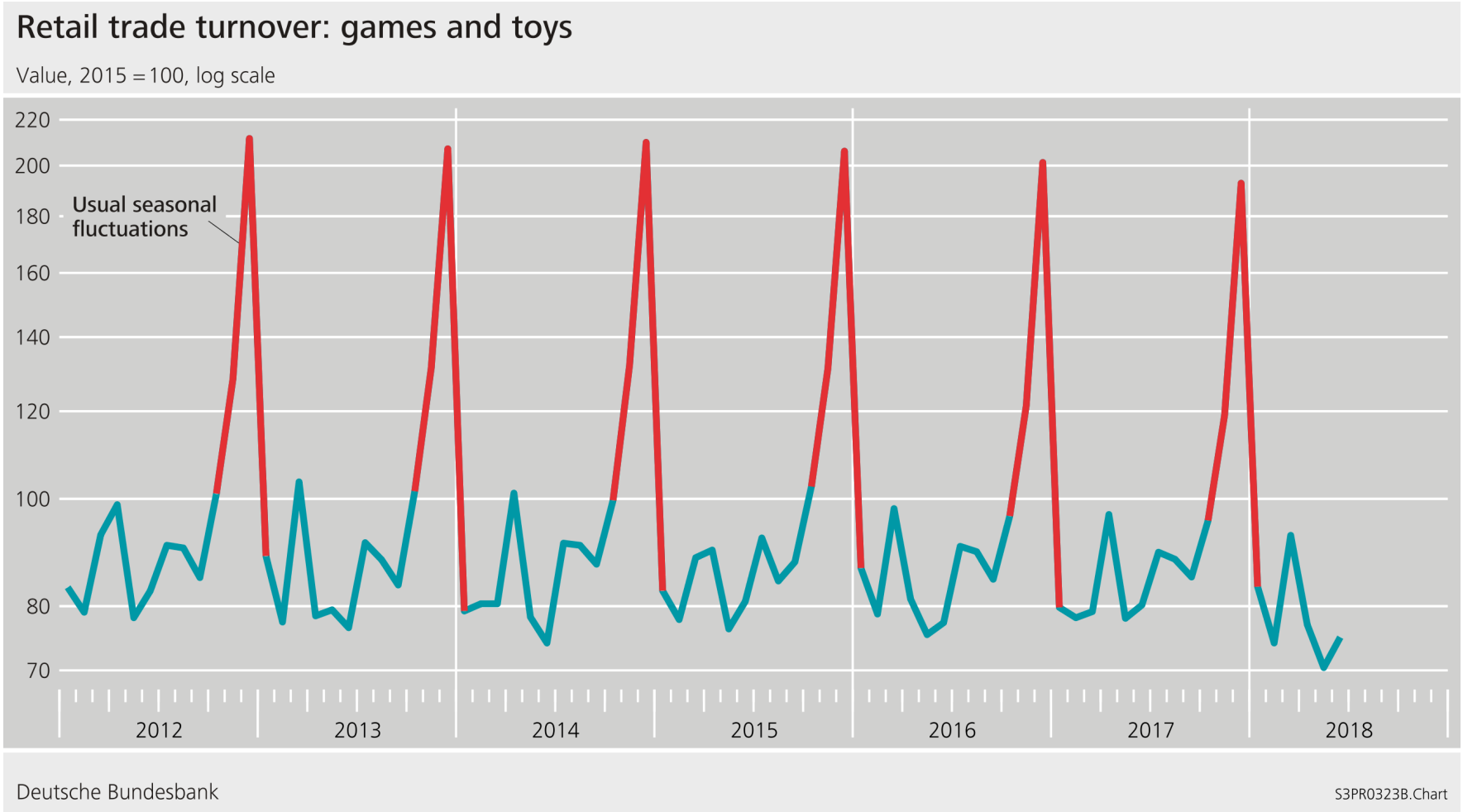


# What is seasonality? (II/II)

**Deutsche Bundesbank, Statistical Supplement 4 "Seasonally adjusted business statistics"**

"**Usual seasonal fluctuations**" means those movements which

- ☞ **recur with similar intensity**
- ☞ **in the same season each year**

**and** which, on the basis of past movements of the time series in question,

- ☞ **can**, under normal circumstances, **be expected to recur**.

# Other verbal definitions

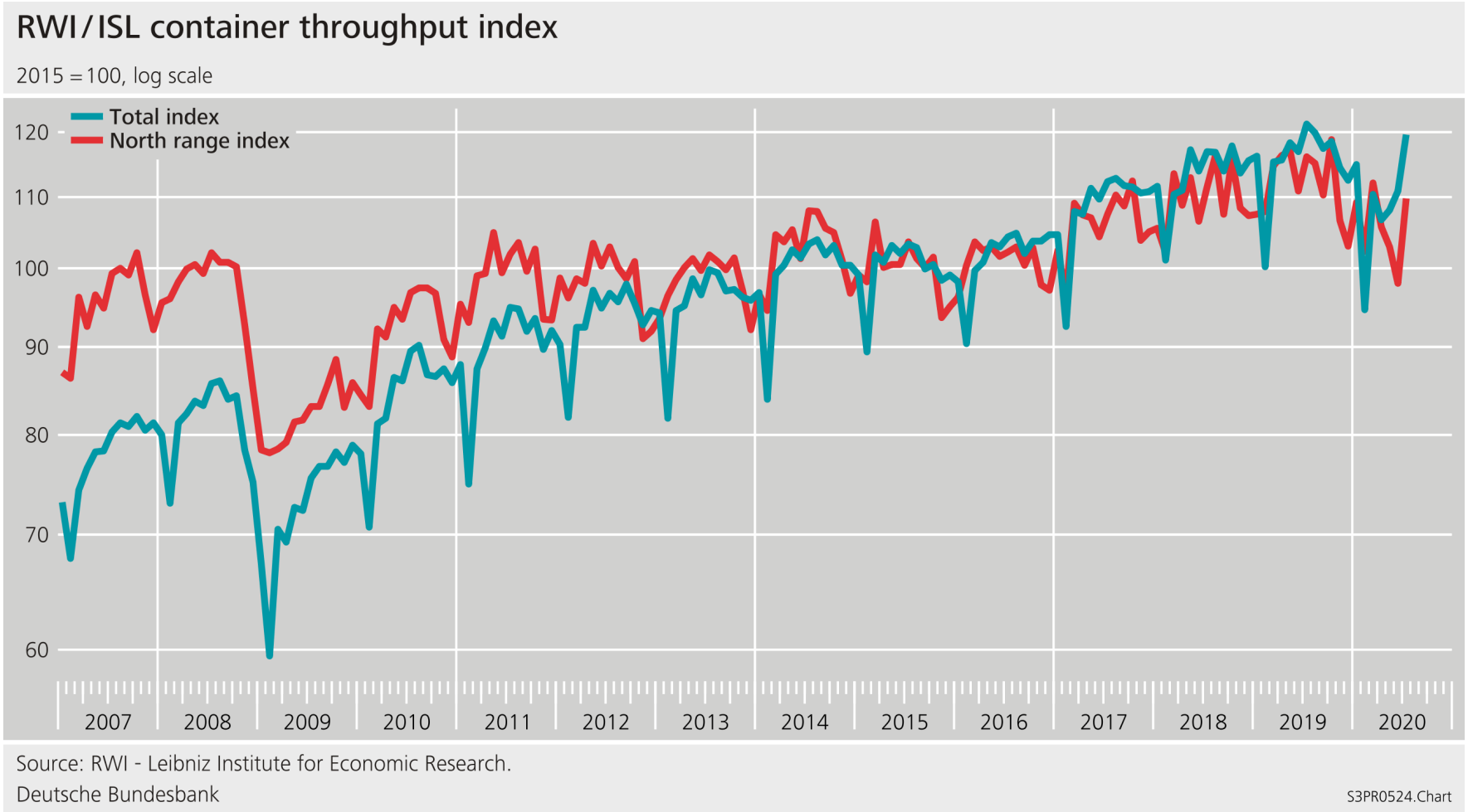
**Hylleberg (1992, ed.), Modelling Seasonality, Oxford University Press**

**Seasonality is the systematic**, although not necessarily regular, **intra-year movement caused by** the **changes of** the **weather,** the **calendar, and timing of decisions**, directly or indirectly through the production and consumption decisions made by the agents of the economy. These decisions are **influenced by endowments,** the **expectations and preferences of** the **agents, and** the **production techniques** available in the economy.

**Nerlove (1964), Spectral Analysis of Seasonal Adjustment Procedures, Econometrica 32 (3), 241-286**

In the more general case, then, we may **define seasonality as that characteristic** of a time series **that gives rise to spectral peaks at seasonal frequencies**.

# Another example



# Why does seasonality show up?

## Repetitive events

- Natural $\rightsquigarrow$ Climatic seasons
- Secular $\rightsquigarrow$ Public holidays
- Clerical $\rightsquigarrow$ Religious festivals

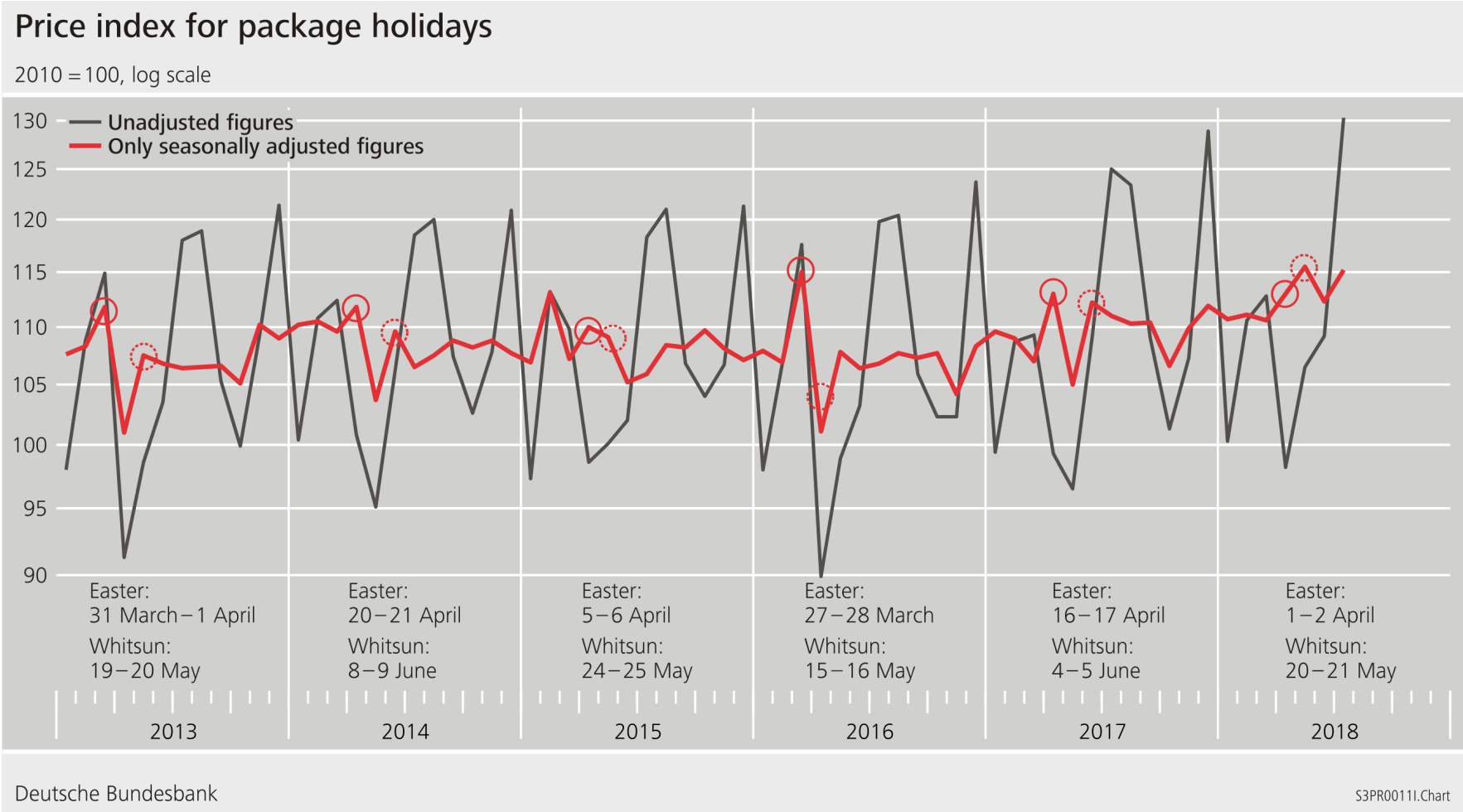
## Economic optimising behaviour

- Agents $\rightsquigarrow$ Expectations, preferences, profit, utility
- Institutions $\rightsquigarrow$ Conventional practices

## Data compilation

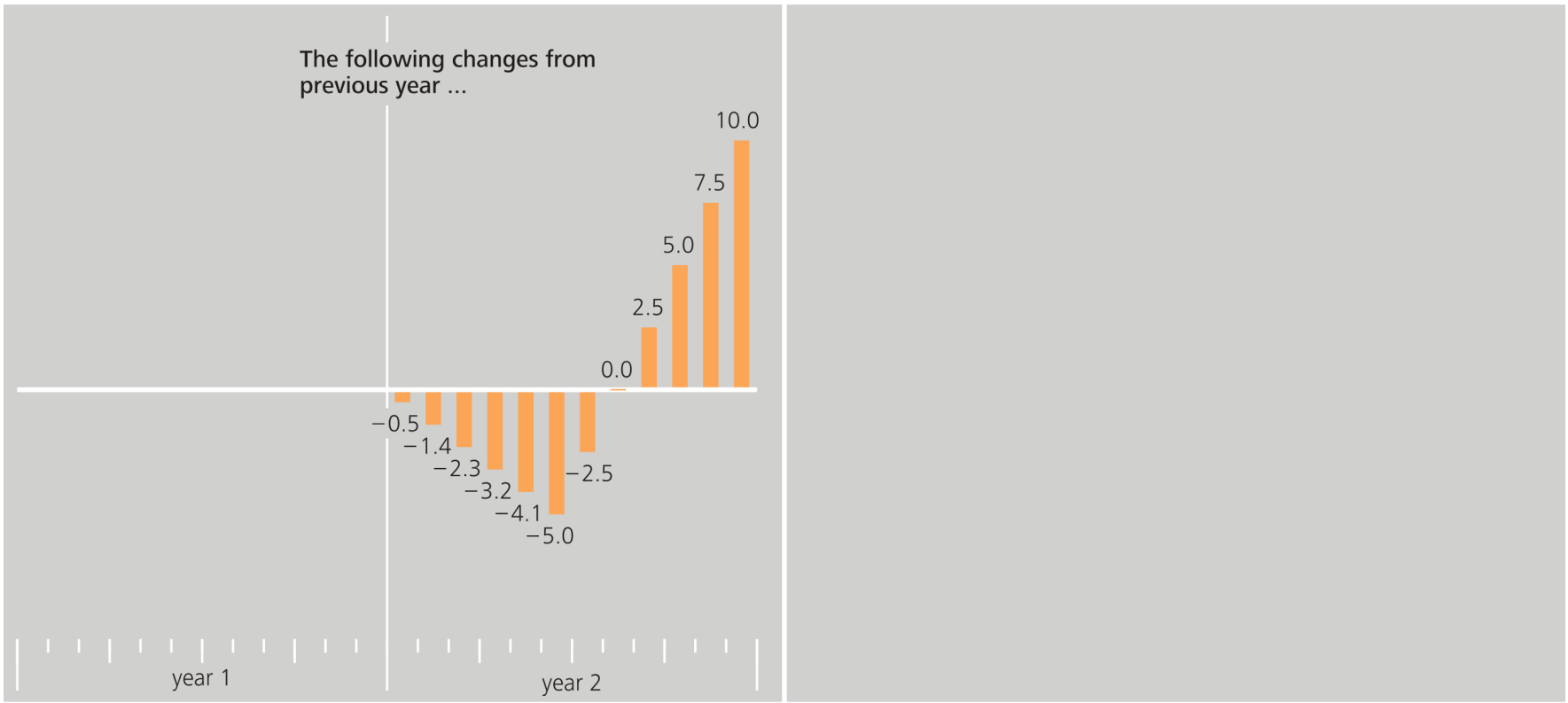
- Aggregation $\rightsquigarrow$ Sub-components

# Why not year-on-year changes? (I/II)



# Why not year-on-year changes? (II/II)

## Meaningfulness of changes from previous year

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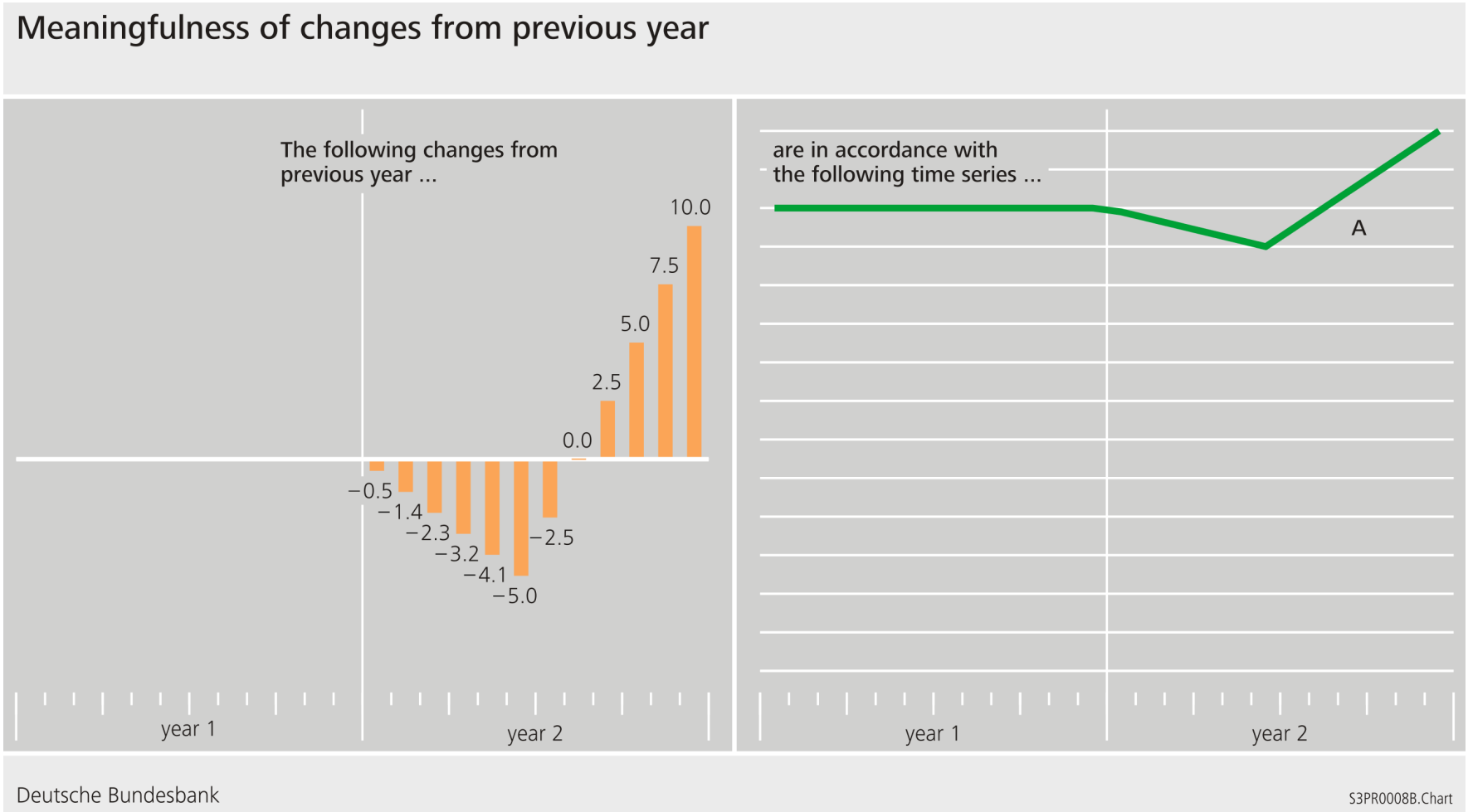

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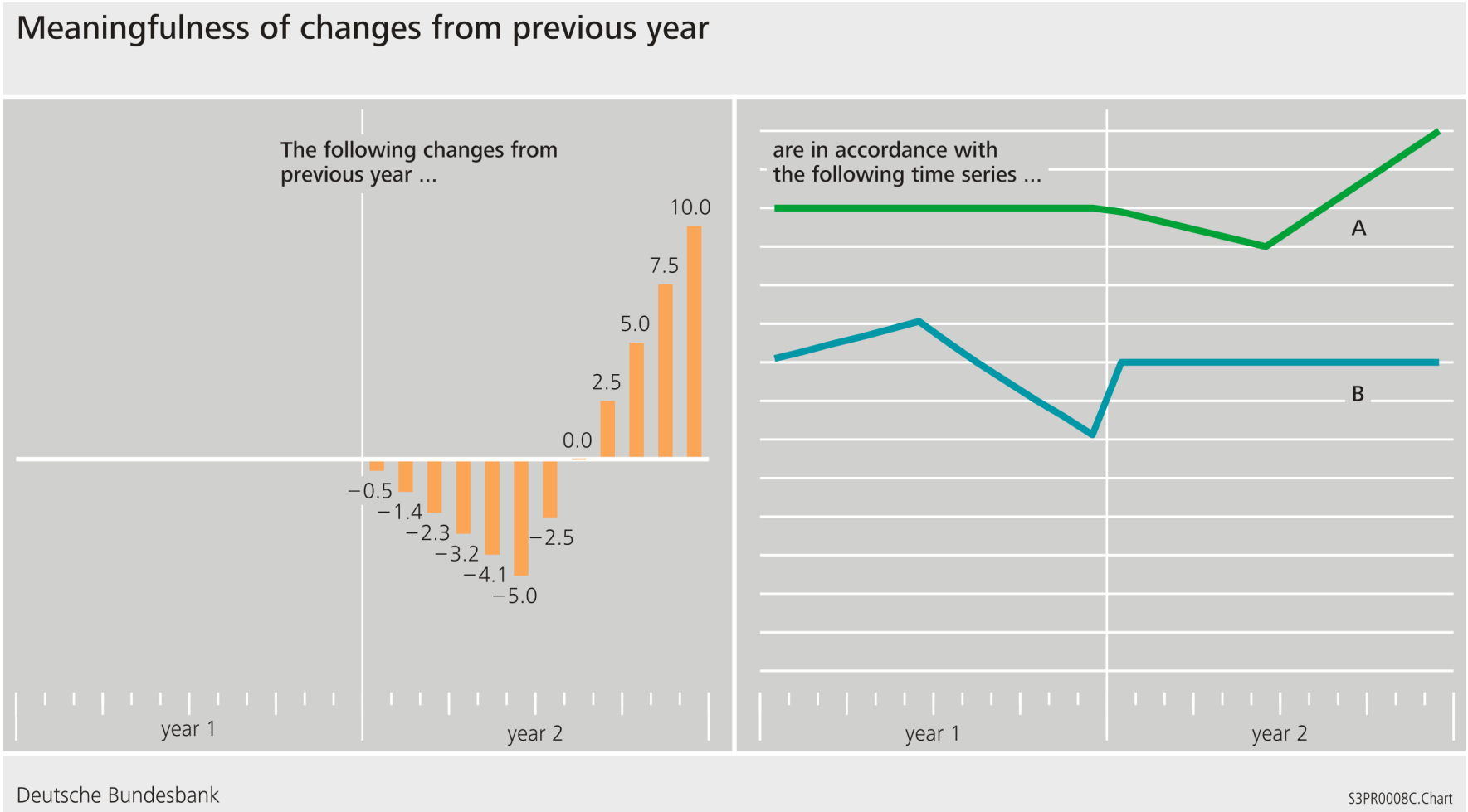

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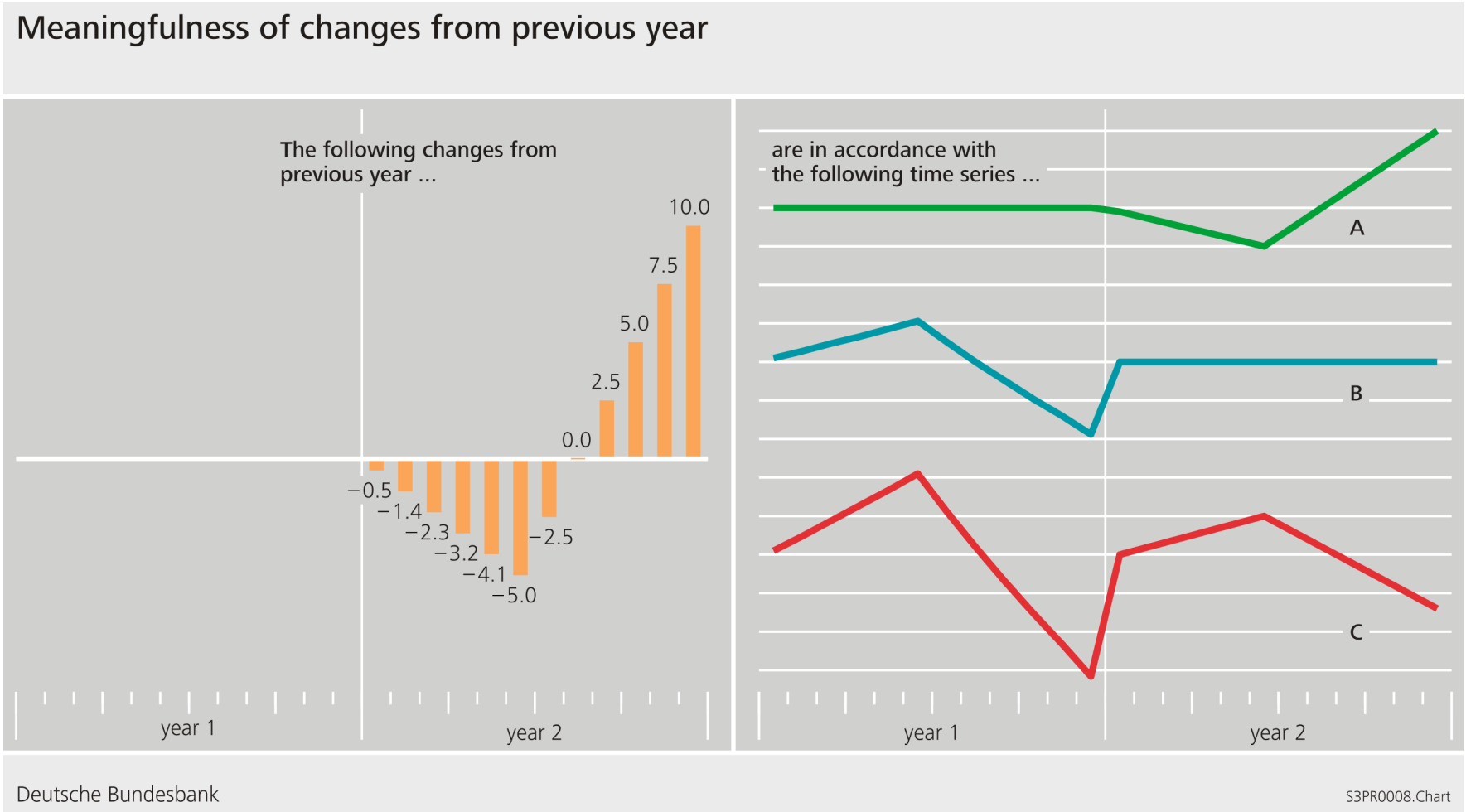

# Why seasonal adjustment? (I/II)

**Deutsche Bundesbank, Statistical Supplement 4 "Seasonally adjusted business statistics"**

**The** […] **purpose** in seasonally adjusting time series **is to filter out the usual seasonal fluctuations** within the movements of the time series under review.

**Bell & Hillmer (1984), Issues Involved With the Seasonal Adjustment of Economic Time Series, JBES 2 (4), 291-320**

**Seasonal adjustment is done to simplify data** so that they may be more easily interpreted by statistically unsophisticated users **without a significant loss of information**.

# Why seasonal adjustment? (II/II)

**Deutsche Bundesbank, Statistical Supplement 4 "Seasonally adjusted business statistics"**

**Seasonal adjustment** also **includes** the

- ☞ **elimination of working-day variations**

insofar **as influences deriving from**

- ☞ **differences in** the **number of working days or** the **dates of particular days**

(e.g. public holidays, weekday on the last day of the month in the case of stock series) **can be demonstrated and quantified**.

# Visibility in seasonally adjusted data

## Deutsche Bundesbank, Statistical Supplement 4 "Seasonally adjusted business statistics"

Thus, **fluctuations due to**

- ☞ **exceptional**ly strong or weak **seasonal influences**

[…] **will** continue to **be visible in the seasonally adjusted series** to the extent that they

- ☞ exceed, or fall short of, the normal seasonal average.

In general, **other**

- ☞ **random disruptions and unusual movements** that are readily understandable in economic terms

[…] **are** also **not eliminated**.

# Seasonal adjustment approaches

## Empirical-based

- Seasonal dynamics $\rightsquigarrow$ Ad hoc extraction methods
- Weighted moving averages $\rightsquigarrow$ STL, X-11

## Model-based

- Seasonal & non-seasonal dynamics $\rightsquigarrow$ Joint framework
- Top-down strategy $\rightsquigarrow$ ARIMA model decomposition
- Bottom-up strategy $\rightsquigarrow$ Structural time series models

## Syntheses

- Model-based pretreatment & ad hoc filters $\rightsquigarrow$ X-12-ARIMA
- Model-based & HP filters $\rightsquigarrow$ Atomic seasonal models

# References (I/III)
## Time series analysis


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- J D Hamilton (1994), Time Series Analysis, Princeton University Press, Princeton.
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- Eurostat (2018), Handbook on Seasonal Adjustment, Publications Office of the European Union, Luxembourg, ISBN 978-92-79-80169-3.