Will the real inflation rate please stand up –
overlooked "quirks" of a favoured chain-linking technique

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"*0.8%*" (Eurostat's flash estimate of euro-area annual inflation in December 2013)

1. Background & motivation

- The *Oxford Dictionary of English* defines "quirk" as **"a peculiar aspect of a person's character or behaviour"**.

- Claire Jones, Financial Times, 8 January (p 3): "**A methodological quirk in the calculation of holiday costs in the currency bloc's largest economy helped push core inflation in the eurozone to an all-time low in December...**"

- Mario Draghi, President of the ECB, 9 January (press conference Q&A): "**The data that came out in December 2013 were essentially the result of a technical issue, what some people would call a quirk, in the statistics on services inflation in Germany.**"

- Nota bene: The so-called "quirk" was **neither due to seasonal adjustment nor some peculiarities of the German price statistics** but it was the outcome of the **legally binding linking procedures in the HICP**; it, hence, seems likely that such twists happened in **other countries as well** – but were not detected.

2. Sources of deviations

- **Accommodation services**, COICOP group 11.2, 2013 weight 11.90‰:
  - Because internet surveys now allow data to be collected from **smaller service providers**, which are **less likely to charge seasonal premiums** than larger providers, the results show significantly smaller seasonal fluctuations than previously.
  - In particular, the **July-August and December price peaks** of holiday flats have been largely **eliminated**.

- **Package holidays**, COICOP group 09.6, 2013 weight 37.81‰:
  - Instead of observing individual tour operators, **consumptions segments** are now defined by the **geographical destination** and the **type of package holiday** (e.g. seaside, mountain).
  - In addition, **round trips and cruises** have been included **newly in the sample**; especially prices of round trips are **less subject to seasonal fluctuations**.
  - As a consequence, **seasonality, even in the month of December, is dampened** considerably.

3. Basic index theory

− The **Harmonised Index of Consumer Prices** (HICP) is defined as

  • a chained Laspeyres-type price index with **annual weight updating**,
  • weighting reference period average year $y - 1$ (price-updated to December),
  • **price reference period December of the previous year**, and
  • current index reference period 2005=100.

− **Short-term** *monthly* Laspeyres price index:

$$- P_L^{12,y-1:m,y} = \sum_{i=1}^{n} \frac{p_i^{m,y}}{p_i^{12,y-1}} \cdot \frac{p_i^{12,y-1} \cdot \overline{q}_i^{y-1}}{\sum_{i=1}^{n} p_i^{12,y-1} \cdot \overline{q}_i^{y-1}} = \sum_{i=1}^{n} P_i^{m,y} \cdot w_i^{12,y-1}.$$

− **Long-term** annually chain-linked *monthly* Laspeyres price index:

$$- \widetilde{P}_L^{0:m,Y} = \widetilde{P}_L^{0:12,Y-1} \cdot P_L^{12,Y-1:m,Y} = P_L^{0:12,1} \cdot \prod_{y=2}^{Y-1} P_L^{12,y-1:12,y} \cdot P_L^{12,Y-1:m,Y}.$$

4. Understanding the "quirk"

- Without loss of generality assume, for the sake of simplicity, that the HICP sub-indices consist of a **single good only** – but still **apply chain-linking via December of the previous year**.

- **Observed price** of item i in month m of year y: $p_i^{m,y}$.

- Decomposition into non-seasonal and seasonal part: $p_i^{m,y} = \pi_i^{m,y} \cdot \sigma_i^{m,y}$, where $\pi_i^{m,y}$ is the **"seasonally-adjusted" price** and $\sigma_i^{m,y}$ is the (multiplicative) **seasonal component**, respectively, of item i in month m of year y.

- Note: Seasonality here refers to the **usual seasonal fluctuations of observed prices** $p_i^{m,y}$, i.e. those movements which recur with similar intensity in the same season each year and **not** to Regulation (EC) No 330/2009 laying down detailed rules for the treatment of **seasonal products that are not available for purchase** for certain periods in a typical cyclical pattern.

5. Effect on price index levels

− Calculate the **chain-linked price** (index) of item i in month m in 2013, with period "0" equal to December 2011:

$$
\begin{aligned}
-\ \tilde{p}_i^{m,2013} &= p_i^{12,2011} \cdot \frac{p_i^{12,2012}}{p_i^{12,2011}} \cdot \frac{p_i'^{m,2013}}{p_i'^{12,2012}} \\[2mm]
&= \pi_i^{12,2011} \cdot \sigma_i^{12,2011} \cdot \frac{\pi_i^{12,2012} \cdot \sigma_i^{12,2012}}{\pi_i^{12,2011} \cdot \sigma_i^{12,2011}} \cdot \frac{\pi_i^{m,2013} \cdot \sigma_i'^{m,2013}}{\pi_i^{12,2012} \cdot \sigma_i'^{12,2012}} \\[2mm]
&= \pi_i^{m,2013} \cdot \sigma_i'^{m,2013} \cdot \frac{\sigma_i^{12,2012}}{\sigma_i'^{12,2012}} \\[2mm]
&= p_i'^{m,2013} \cdot \frac{\sigma_i^{12,2012}}{\sigma_i'^{12,2012}} \\[2mm]
&\neq p_i'^{m,2013},
\end{aligned}
$$

− where p' is the monthly price according to the **new seasonal profile σ'**.

6. Effect on year-on-year rates

− The **change from December 2012 to December 2013** in the chain-linked series **does not introduce a step** in the series:

$$\frac{\tilde{p}_i^{12,2013}}{p_i^{12,2012}} = \frac{\pi_i^{12,2013} \cdot \sigma_i'^{12,2013}}{\pi_i^{12,2012} \cdot \sigma_i^{12,2012}} \cdot \frac{\sigma_i^{12,2012}}{\sigma_i'^{12,2012}}$$

$$= \frac{\pi_i^{12,2013} \cdot \sigma_i'^{12,2013}}{\pi_i^{12,2012} \cdot \sigma_i'^{12,2012}}$$

$$= \frac{p_i'^{12,2013}}{p_i'^{12,2012}}.$$

− Observe that the **change from month _m_ in 2012 to month _m_ in 2013** (_m_ ≠ 12) in the chain-linked series **differs from the corresponding change**:

$$\frac{\tilde{p}_i^{m,2013}}{p_i^{m,2012}} = \frac{\pi_i^{m,2013} \cdot \sigma_i'^{m,2013}}{\pi_i^{m,2012} \cdot \sigma_i^{m,2012}} \cdot \frac{\sigma_i^{12,2012}}{\sigma_i'^{12,2012}}$$

$$= \frac{p_i'^{m,2013}}{p_i'^{m,2012}} \cdot \frac{\sigma_i^{12,2012}}{\sigma_i'^{12,2012}} \bigg/ \frac{\sigma_i^{m,2012}}{\sigma_i'^{m,2012}}.$$
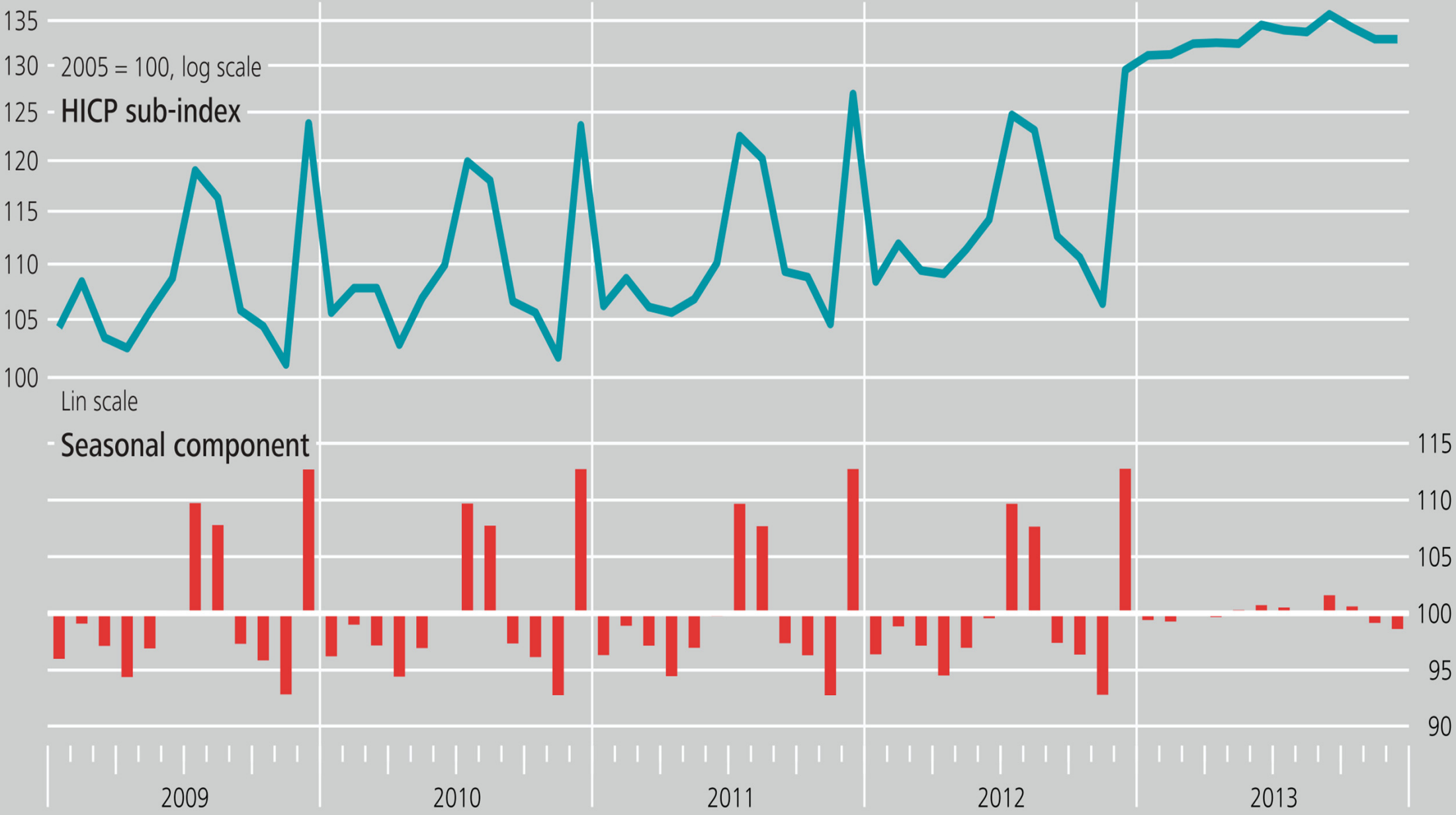
7. Effect on average annual inflation

− **Recall**: $\text{Cov}[X, Y] = E[X \cdot Y] - E[X] \cdot E[Y]$; if $\text{Cov}[X, Y] \approx 0$ and $E[Y] \approx 1$, then $E[X \cdot Y] \approx E[X]$.

$$-\frac{\frac{1}{12}\sum_{m=1}^{12}\tilde{p}_i^{m,2013}}{\frac{1}{12}\sum_{m=1}^{12}p_i^{m,2012}} = \frac{\frac{1}{12}\sum_{m=1}^{12}p_i'^{m,2013} \cdot \dfrac{\sigma_i^{12,2012}}{\sigma_i'^{12,2012}}}{\frac{1}{12}\sum_{m=1}^{12}\pi_i^{m,2012} \cdot \sigma_i^{m,2012} \cdot \dfrac{\sigma_i'^{m,2012}}{\sigma_i'^{m,2012}}}$$

$$= \frac{\overline{p_i'}^{2013} \cdot \dfrac{\sigma_i^{12,2012}}{\sigma_i'^{12,2012}}}{\frac{1}{12}\sum_{m=1}^{12}p_i'^{m,2012} \cdot \dfrac{\sigma_i^{m,2012}}{\sigma_i'^{m,2012}}}$$

$$\approx \frac{\overline{p_i'}^{2013}}{\overline{p_i'}^{2012}} \cdot \frac{\sigma_i^{12,2012}}{\sigma_i'^{12,2012}},$$

− where $X = p'^{2012}$ and $Y = \sigma^{2012} / \sigma'^{2012}$; hence, **changes in seasonality are assumed to be unrelated with price levels** and the **volatility of the new seasonal pattern is not too high**.

Accommodation services in the German HICP

2005 = 100, log scale

HICP sub-index

135
130
125
120
115
110
105
100

Lin scale

Seasonal component

115
110
105
100
95
90

2009   2010   2011   2012   2013

8. Impact quantification

− **Impute the _estimated_ 2013 seasonal pattern** to December 2011-November 2012 figures and chain-link in order to achieve **consistent year-on-year rates** throughout the year (please note that this analysis is subject to revisions):
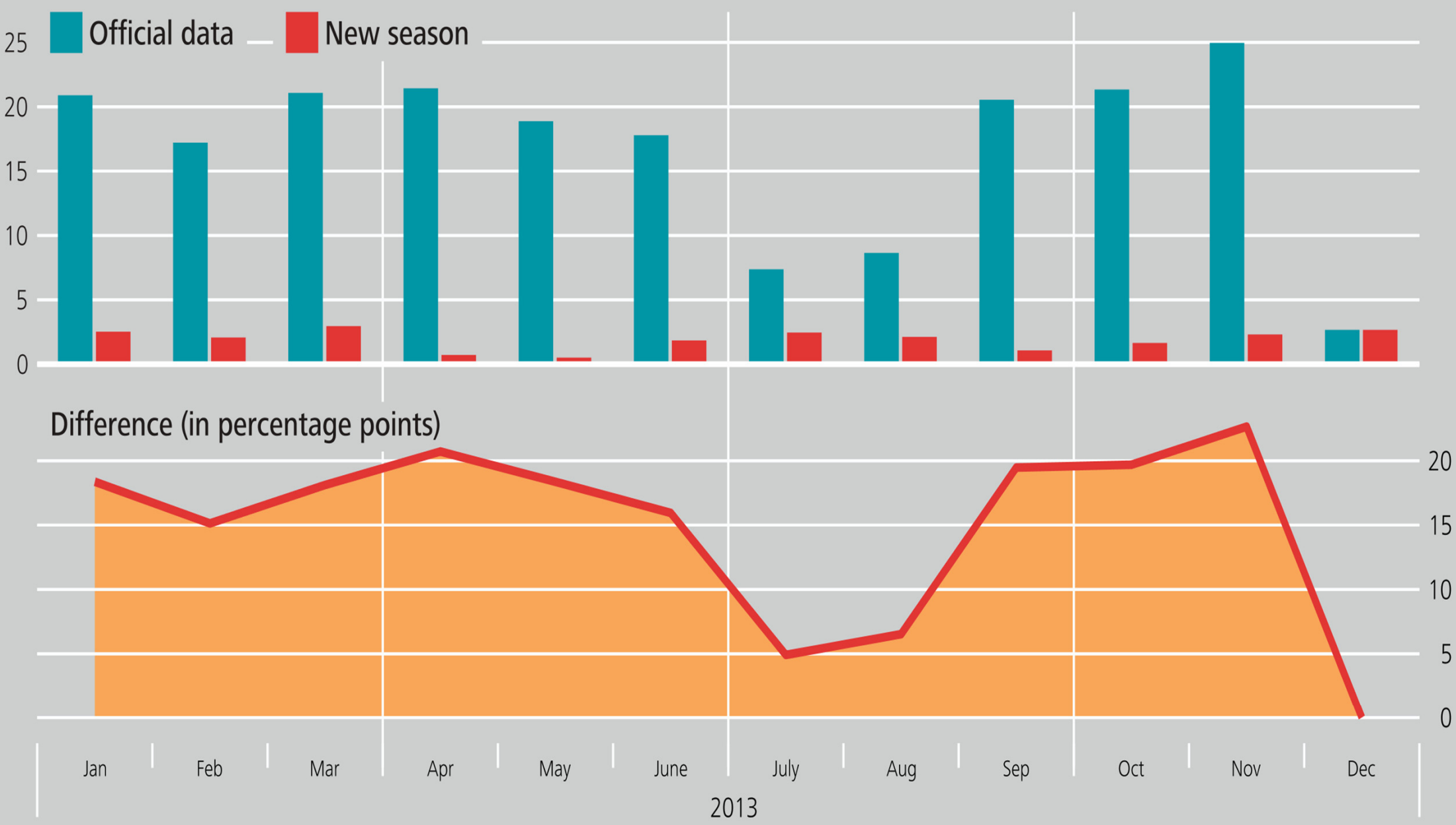
Table: 2013 average annual inflation in Germany (in %)

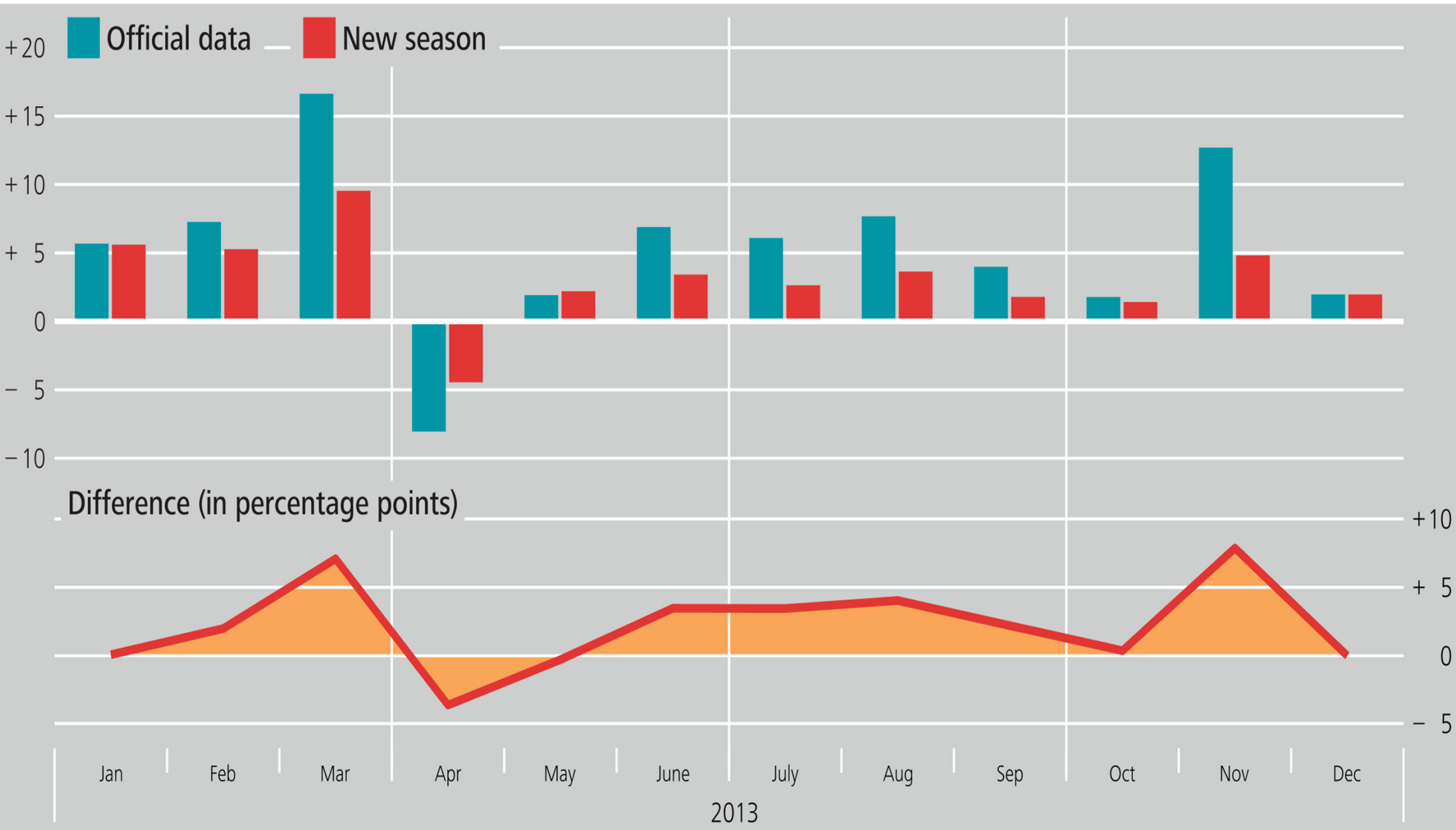| Group	Official data	New season	Difference*
Accommodation services	16.5	1.9	+14.6
Package holidays	5.3	3.2	+ 2.1
Overall HICP	1.6	1.3	+ 0.3

* In percentage points.
Expected values from changes in seasonality are +14.3 percentage points for accommodation services and +2.1 percentage points for package holidays.
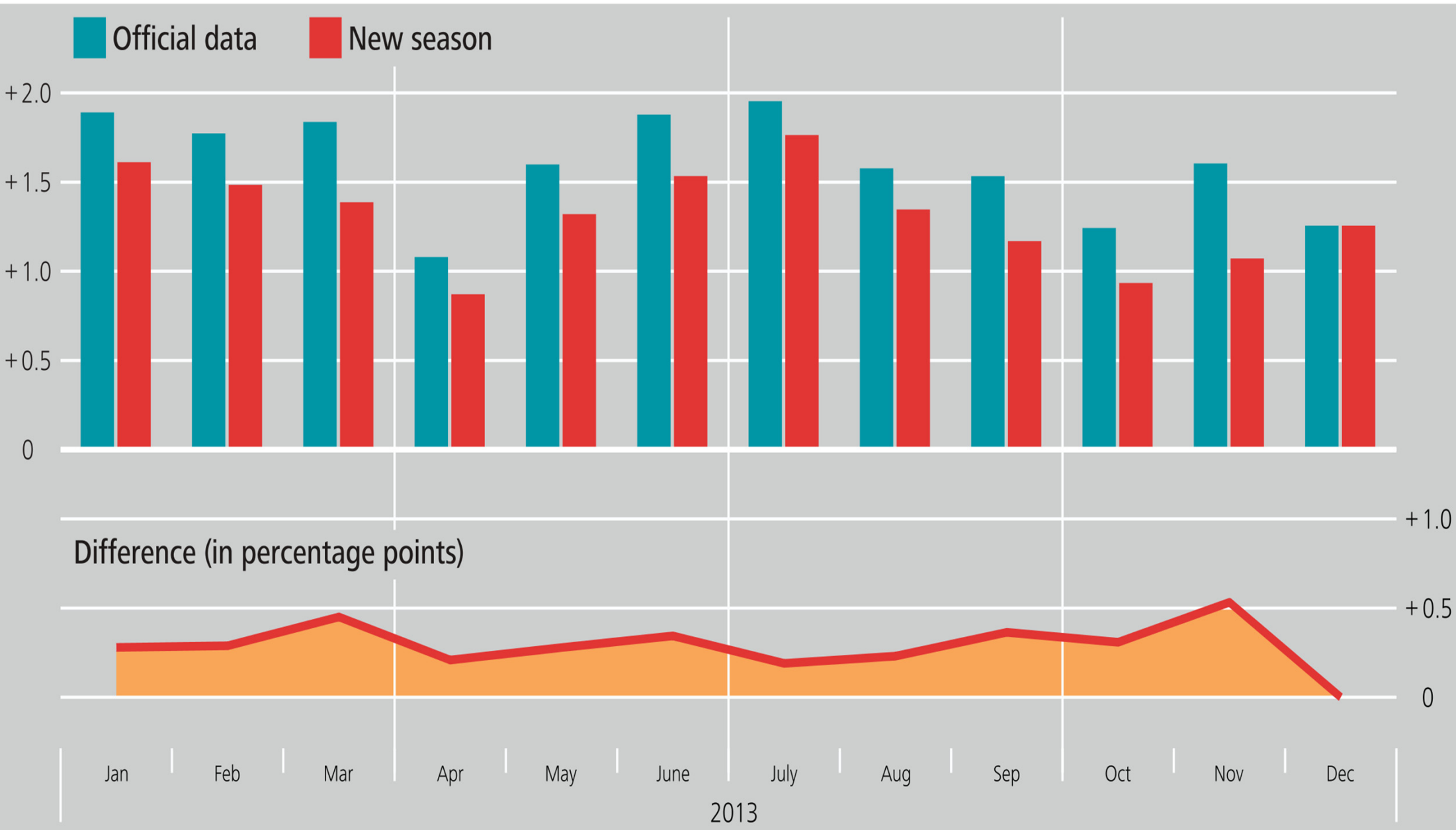
Annual percentage change of accommodation services prices in Germany

Official data ▪ New season

25
20
15
10
5
0

Difference (in percentage points)

20
15
10
5
0

Jan Feb Mar Apr May June July Aug Sep Oct Nov Dec

2013

Annual percentage change of package holidays prices in Germany

■ Official data   ■ New season

Difference (in percentage points)

2013

Jan | Feb | Mar | Apr | May | June | July | Aug | Sep | Oct | Nov | Dec

Annual percentage change of overall HICP in Germany

Official data   New season

+2.0
+1.5
+1.0
+0.5
0

Difference (in percentage points)

+1.0
+0.5
0

Jan   Feb   Mar   Apr   May   June   July   Aug   Sep   Oct   Nov   Dec

2013

9. Discussion & implications

- There was **no underestimation of inflation** due to the "quirk" in December 2013! (Since then the temporary effect on *inflation rates* has vanished.)
  - Quite the contrary, **annual inflation had been overestimated** in Germany from January to November 2013 (see Deutsche Bundesbank, Monthly Report, April 2013, p 7); totalling to a **discrepancy of just under +0.1 percentage point on average from 2012 to 2013 in the euro area**.
  - Rather than decelerating from 0.9% in November 2013, **euro-area annual inflation actually accelerated** from 0.7% in November to 0.8% in December.
  - Chaining the new price series to the seasonal high of the old price series generated a **permanent upward deviation in overall HICP levels**, which, in turn, gives windfall benefits to the holders of index-linked debt.

- Because the annual sub-indices for the HICP are **chain-linked via the month of December without performing back-calculations**, this led to **marked statistical distortions** which seriously hampered the interpretability of the HICP figures.
  - Potentially, **other countries' results are adversely affected, too**.

10. Possible way forward

- Any **change in definitions, methods, or practices** – such as that on the **treatment of seasonal products** – can result in problems with chain-linking.
  - We, thus, need an **early warning system** for the **methodologically more involved chain indices** – along with a **reflection on European regulations** in terms of how the **annual linking** is performed and the stance on **data revisions**.

- A different approach to chaining that had been discussed would be **annual overlap**, i.e. the same procedure that is in place for the System of National Accounts. Hence, we would rely on an **annual price reference period** that, per definitionem, shows **no seasonality**.
  - Of course, before such a major change can be introduced into the HICP, we need **much more empirical analyses** in order to support this preliminary impression and ensure, based on euro-area wide facts, that a changeover would significantly **increase the information value of HICP figures**.
  - In this sense, this presentation seeks to **trigger a discussion** on the subject rather than being definitive on the matter. Particularly, **experiences from Member States** with a national CPI that follows a different linking strategy than the HICP would be very valuable.