

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:

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

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

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

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:

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

– 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:

$$\begin{aligned}
 - \frac{\tilde{p}_i^{12,2013}}{p_i^{12,2012}} &= \frac{\pi_i^{12,2013} \cdot \sigma_i'^{12,2013}}{\pi_i^{12,2012} \cdot \sigma_i'^{12,2012}} \cdot \frac{\sigma_i^{12,2012}}{\sigma_i'^{12,2012}} \\
 &= \frac{\pi_i^{12,2013} \cdot \sigma_i'^{12,2013}}{\pi_i^{12,2012} \cdot \sigma_i'^{12,2012}} \\
 &= \frac{p_i'^{12,2013}}{p_i'^{12,2012}} \cdot
 \end{aligned}$$

- Observe that the **change from month m in 2012 to month m in 2013** ($m \neq 12$) in the chain-linked series **differs from the corresponding change**:

$$\begin{aligned}
 - \frac{\tilde{p}_i^{m,2013}}{p_i^{m,2012}} &= \frac{\pi_i^{m,2013} \cdot \sigma_i'^{m,2013}}{\pi_i^{m,2012} \cdot \sigma_i'^{m,2012}} \cdot \frac{\sigma_i^{12,2012}}{\sigma_i'^{12,2012}} \\
 &= \frac{p_i'^{m,2013}}{p_i'^{m,2012}} \cdot \frac{\sigma_i^{12,2012}}{\sigma_i'^{12,2012}} \bigg/ \frac{\sigma_i^{m,2012}}{\sigma_i'^{m,2012}} \cdot
 \end{aligned}$$

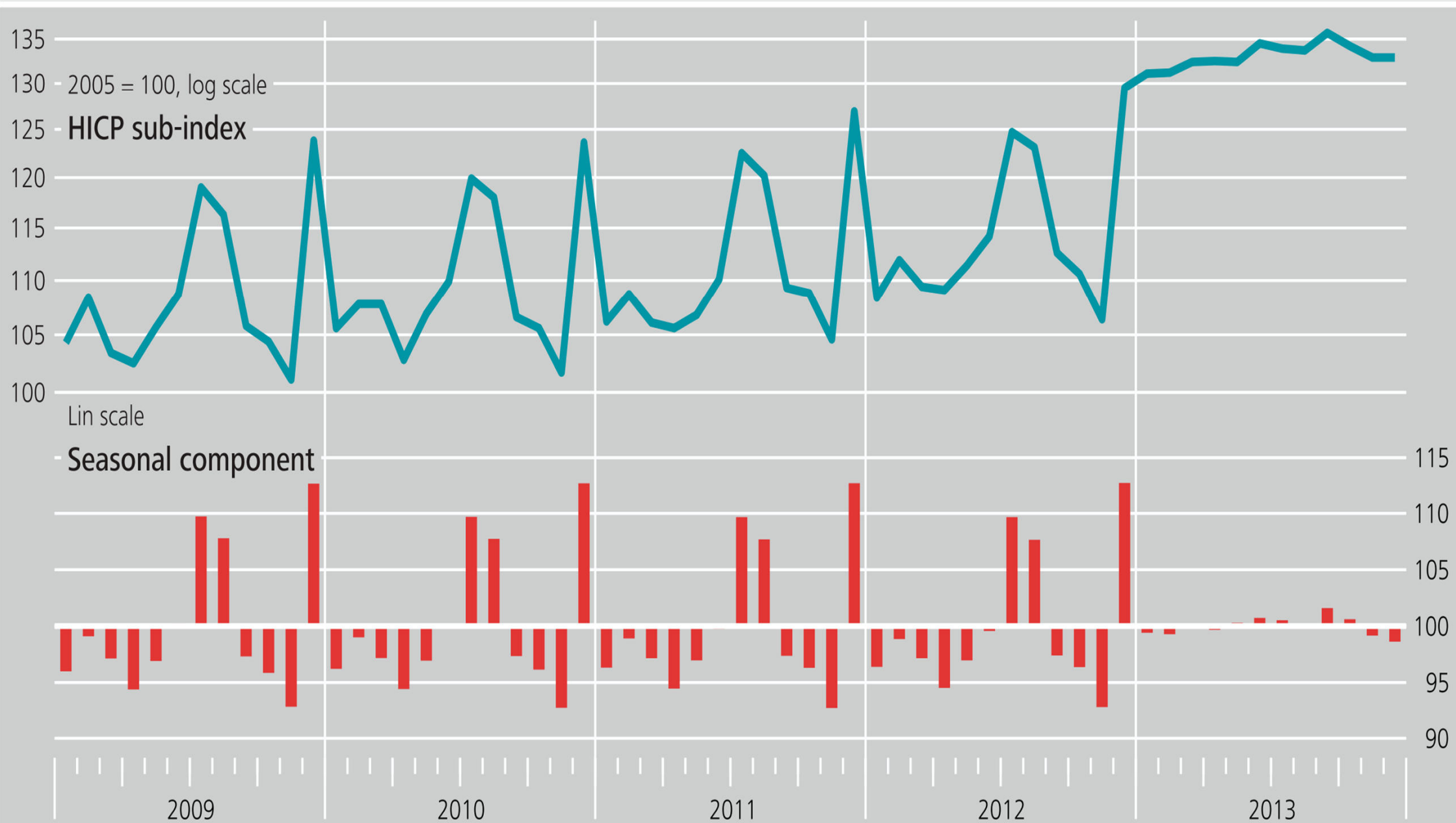
7. Effect on average annual inflation

– **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 $E[X \cdot Y] \approx E[X]$.

$$\begin{aligned} \frac{\frac{1}{12} \sum_{m=1}^{12} \tilde{p}_i^{m,2013}}{\frac{1}{12} \sum_{m=1}^{12} p_i^{m,2012}} &= \frac{\frac{1}{12} \sum_{m=1}^{12} p_i'^{m,2013} \cdot \frac{\sigma_i^{12,2012}}{\sigma_i'^{12,2012}}}{\frac{1}{12} \sum_{m=1}^{12} \pi_i^{m,2012} \cdot \sigma_i^{m,2012} \cdot \frac{\sigma_i'^{m,2012}}{\sigma_i'^{m,2012}}} \\ &= \frac{\bar{p}_i'^{2013} \cdot \frac{\sigma_i^{12,2012}}{\sigma_i'^{12,2012}}}{\frac{1}{12} \sum_{m=1}^{12} p_i'^{m,2012} \cdot \frac{\sigma_i^{m,2012}}{\sigma_i'^{m,2012}}} \\ &\approx \frac{\bar{p}_i'^{2013}}{\bar{p}_i'^{2012}} \cdot \frac{\sigma_i^{12,2012}}{\sigma_i'^{12,2012}}, \end{aligned}$$

– 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



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):

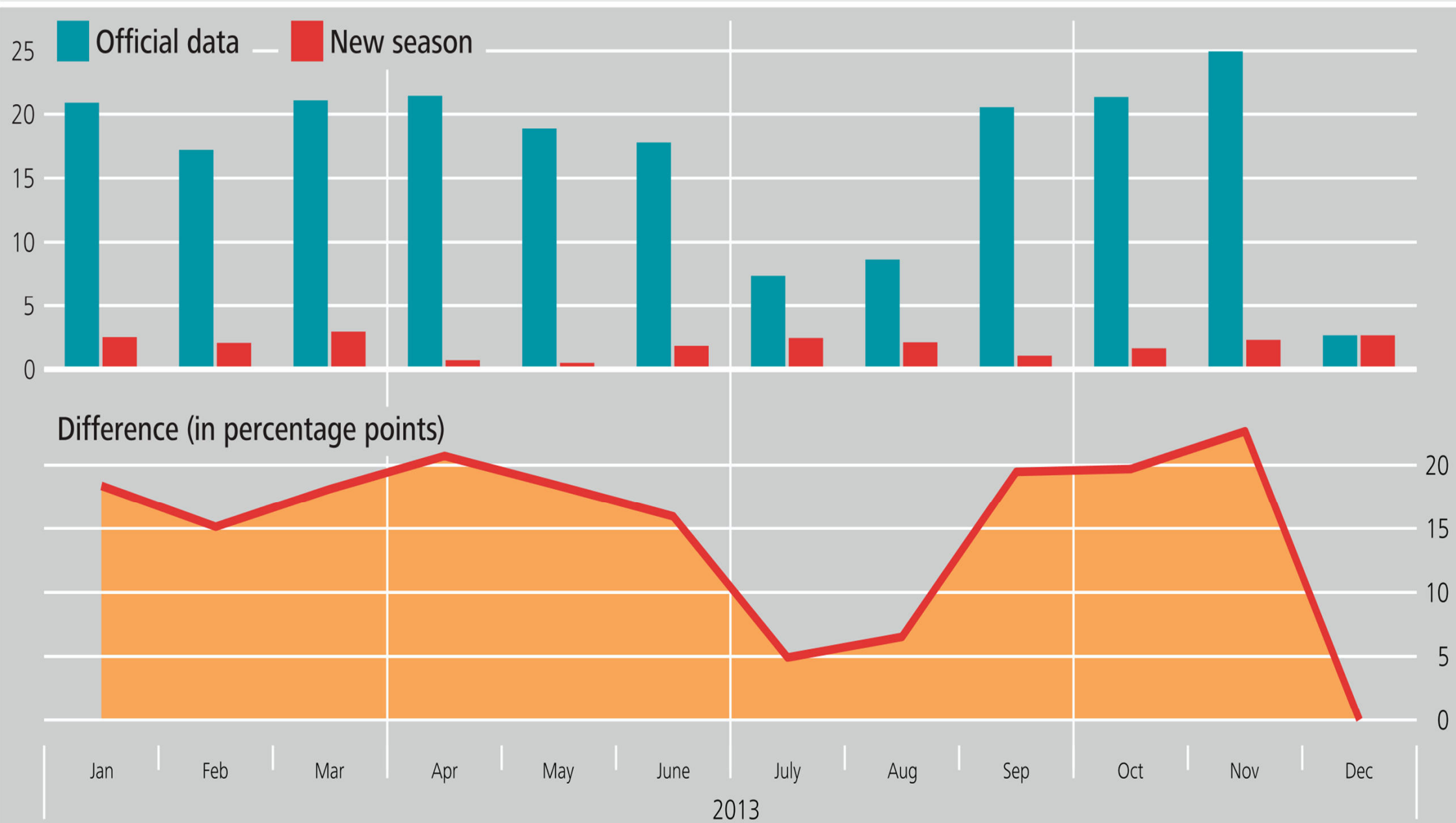
Table: 2013 average annual inflation in Germany (in %)

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

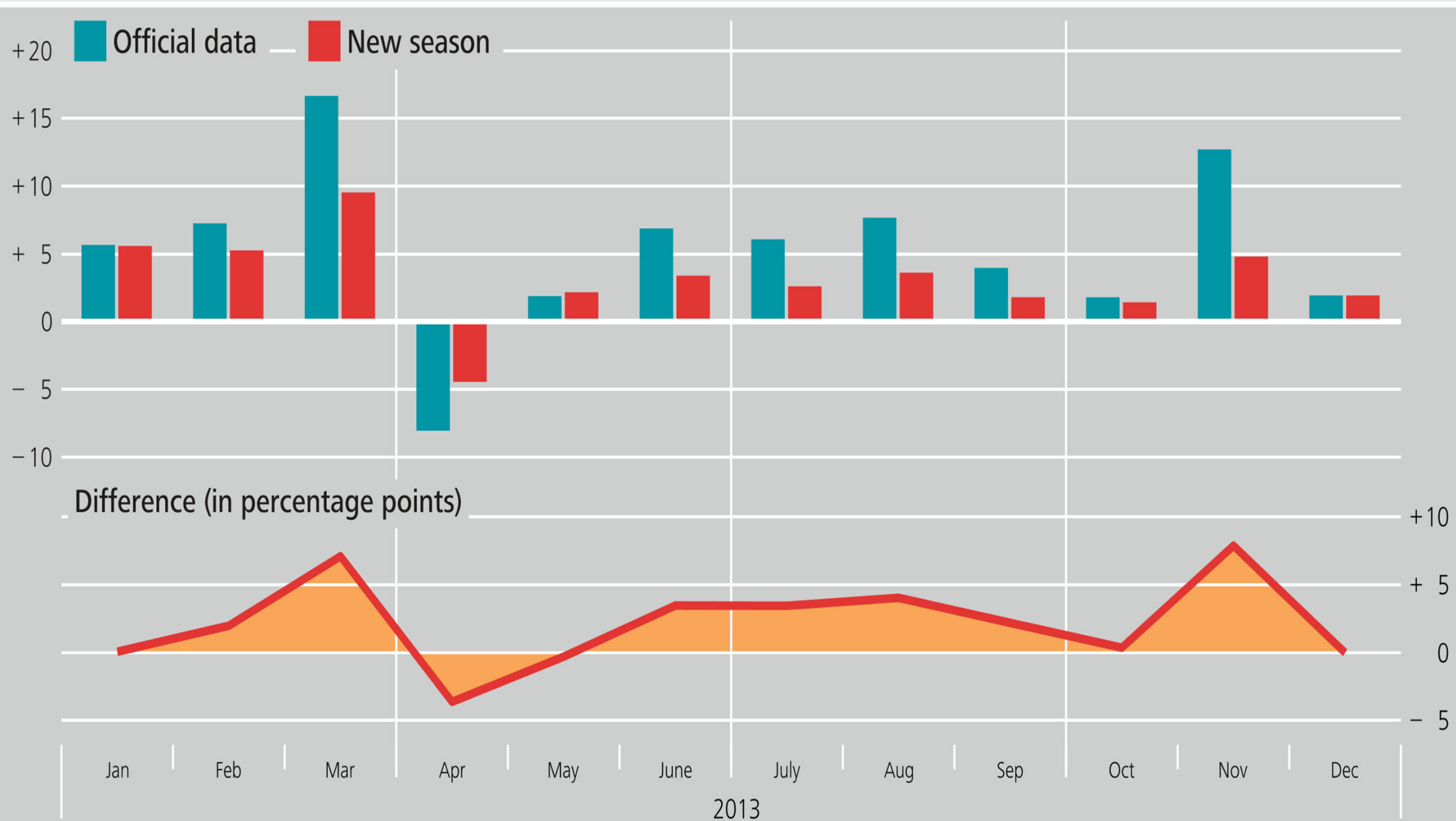
* In percentage points.

Expected values from changes in seasonality are +14.3 percentage points for accommodation services and +2.1 percentage points for package holidays.

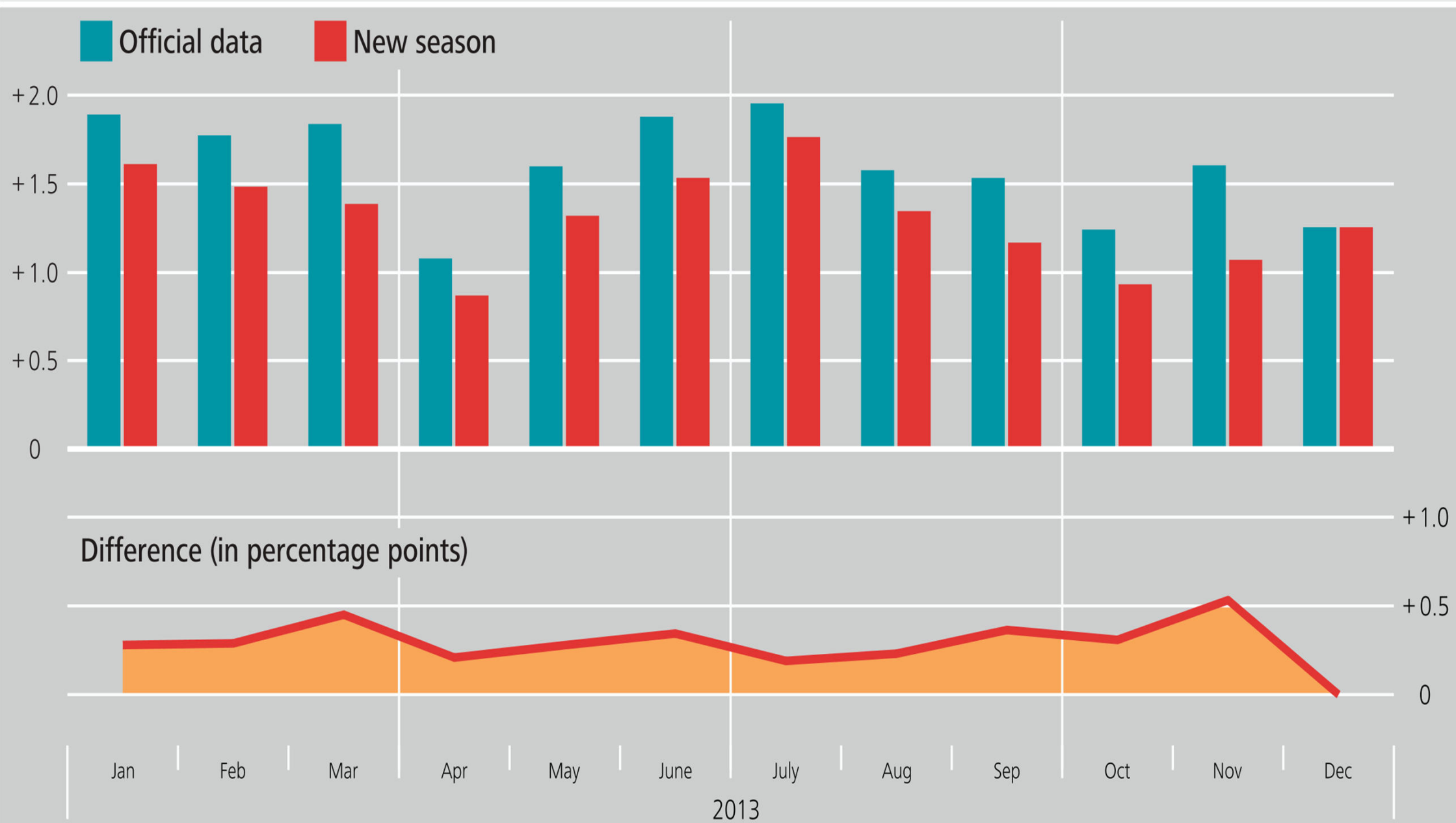
Annual percentage change of accommodation services prices in Germany



Annual percentage change of package holidays prices in Germany



Annual percentage change of overall HICP in Germany



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.

Annex 1

- In January 2012 **Statistics Netherlands (CBS)** introduced new methods for the observation of prices for **airline tickets and package holidays** in the CPI. As a result, the **seasonal patterns of both product groups changed**.
 - These **changes had significant impacts** on the published indices in some months. **In order to ensure correct inflation rates, CBS re-calculated the CPI** for the year 2011.
- *Reductio ad absurdum*: If the sole aim was **unbiased annual inflation measurement**, there would be **two and only two approaches – fixed base indices and the over-the-year-technique**.
 - First, **traditional fixed base indices** are **less representative of the economic conditions** for periods farther away from the base year, which is why the CPI Manual suggests **moving to annually chain-linked measures**.
 - Second, the **over-the-year technique** can result in **distorted seasonal patterns** in the linked series; the 2008 SNA, thus, recommends that it **should be avoided** (cf. paragraph 15.50).

Annex 2

- Even without a change of the seasonal pattern, the chain-linking technique can **adversely affect the results from indirect seasonal adjustment**.
 - Indirect seasonal adjustment means performing seasonal adjustment of a time series by **combining the individual estimates for two or more components**.
 - This approach is preferred when components series show **seasonal patterns differing in a significant way**, such as those for food or clothing and footwear.
- Walschots (2013, Ottawa Group) gave some empirical evidence that **weights for the seasonally adjusted series should be adjusted**, too, albeit the impact might be small in practice at least for the euro-area headline HICP but maybe not so for Member States and components series.
 - The **seasonal pattern is in the prices only** but not in the weights (although annual weights are price-updated to the month of December).
 - Components series may have stable and identifiable seasonal patterns where the **overall HICP seasonal pattern changes due to annual chain-linking**.