Sources of Revisions of Seasonally Adjusted Real Time Data

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*This presentation represents the author's personal opinion and does not necessarily reflect the view of the Deutsche Bundesbank or its staff.

Outline of the presentation

1. **Introduction**
2. **Measuring revisions**
3. **Decomposition approach**
4. **Variance decomposition**
5. **Summary**

1. Introduction

- **The importance of real time data becomes obvious when one tries to understand economic policy decisions made in the past based on past data and reconsiders it in the light of more recent data.**

- **Statistical agencies and users of seasonally adjusted real time data alike are interested in it, *inter alia* in terms of the quality and interpretation of statistics.**

- **Thus, revisions of real time data are a frequently discussed topic.**

- **The contribution is to empirically quantify the uncertainty of seasonally adjusted real time data in terms of revisions and decompose them into two sources.**

1. Introduction

- Let u_t be a seasonally time series, where c_t, s_t and i_t represent a trend-cycle, seasonal and irregular component, respectively:
- (1) $u_t = c_t \cdot s_t \cdot i_t$
- The aim of seasonal adjustment is to calculate the seasonally adjusted time series a_t:
- (2) $a_t = u_t / s_t$
- Its relative period-to-period changes in per cent are denoted Δ_t:
- (3) $\Delta_t = (a_t / a_{t-1}) - 1$

2. Measuring revisions

- **Per cent revisions of the seasonally adjusted time series a_t are defined as the relative deviation of the most recent estimate $a_{t|T}$ from the first one $a_{t|t}$:**
- **(4) $r_t^a = (a_{t|T} / a_{t|t}) - 1$**
- **Revisions of per cent period-to-period changes Δ_t are measured in percentage points:**
- **(5) $r_t^\Delta = \Delta_{t|T} - \Delta_{t|t}$**

2. Measuring revisions

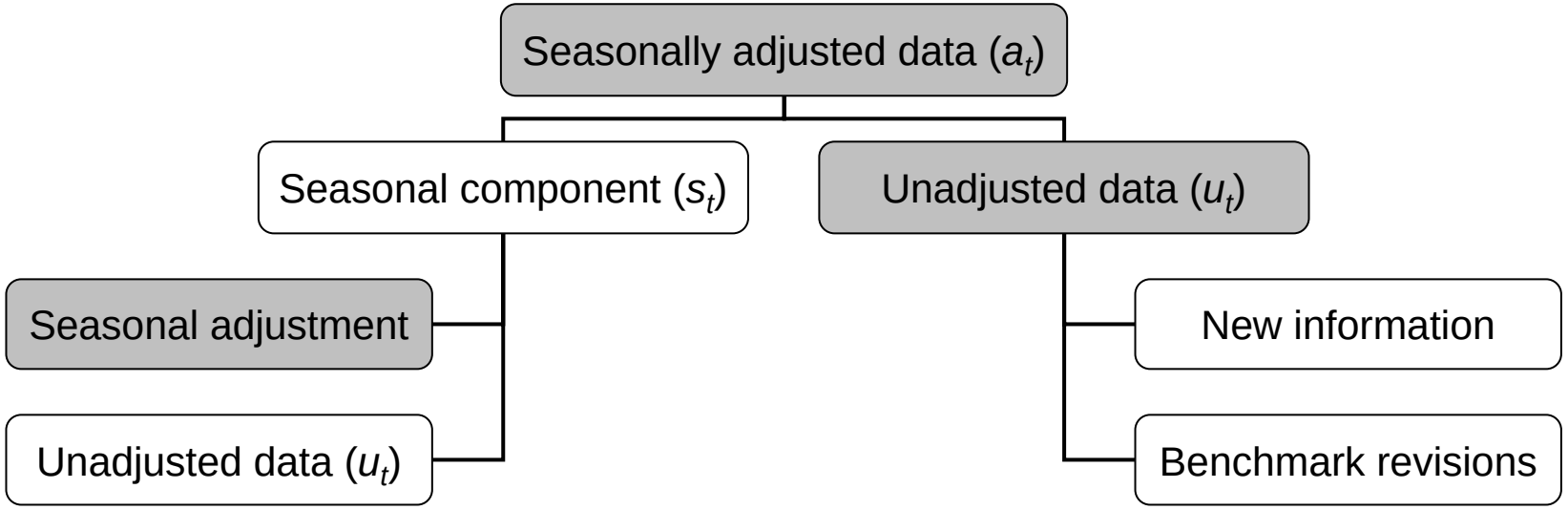
- **Equation (2) for the seasonally adjusted time series ($a_t = u_t / s_t$) illustrates that, generally, revisions to seasonally adjusted real time data have two separate but inter-related sources.**

- **One source is the technical procedure of the method used for seasonal adjustment (responsible for s_t).**

- **The other is the revision process of unadjusted data (u_t).**

2. Measuring revisions

Figure 1: Sources of revisions



2. Measuring revisions

- **A simple approach to the decomposing of revisions is:**
- **(6)** $r_t^a = r_t^s + r_t^u$
- **However, the iterative, mathematical procedure in the seasonal adjustment core means in general the above equality does not hold:**
- **(7)** $\mathrm{Var}(r_t^s + r_t^u) = \mathrm{Var}(r_t^s) + 2 \cdot \mathrm{Cov}(r_t^s, r_t^u) + \mathrm{Var}(r_t^u) \qquad \mathrm{Cov}(r_t^s, r_t^u) \neq 0$
- **It follows that: "The whole is greater than the sum of its parts."** ***Aristotle***

2. Measuring revisions

Table 1: Data structure for revision analysis

	Seasonal adjustment				Real time data			
t	**1**	**2**	**. .**	***T***	**1**	**2**		***T***
1	$a_{1\|T}$	$a_{1\|T}$	. .	$a_{1\|T}$	$a_{1\|1}$	$a_{1\|2}$	. .	$a_{1\|T}$
2		$a_{2\|T}$	. .	$a_{2\|T}$		$a_{2\|2}$	. .	$a_{2\|T}$
:			. .	**:**			. .	**:**
T				$a_{T\|T}$				$a_{T\|T}$

3. Decomposition approach

- **Data available are:**

1. **Unadjusted real time data (rebased to the current base year)**

2. **X-12-ARIMA procedure (latest available, *ie* holding user settings incl. RegARIMA model parameters constant)**

3. **Seasonally readjusted real time data (using 1. and 2.)**

3. Decomposition approach

- **For seasonal adjustment the official specification files have been used.**
- **Direct rather than indirect seasonal adjustment has been performed.**
- **Seasonal adjustment has been rerun with the latest data and information available.**
- **Period covered is from the beginning of 1991 to the end of 2006.**
- **Analysis of revisions is based on the six-year period from 1996 to 2001.**

3. Decomposition approach

- **Fixed effects heterogeneous panel regression model:**

- **(8)** $r_{i,t}^{a} = \alpha_{i,t} + \beta_i^{s} \cdot r_{i,t}^{s} + \beta_i^{u} \cdot r_{i,t}^{u} + \nu_{i,t}$

- **Slope coefficients are allowed to vary across time series to capture their unique properties.**

- **Estimated slope coefficients β_i could be used to calculate curve elasticities ε_i, employing average absolute revisions R_i:**

- **(9)** $\varepsilon_i^{s} = \beta_i^{s} \cdot \frac{\overline{R}_i^{s}}{\overline{R}_i^{a}} \qquad \varepsilon_i^{u} = \beta_i^{u} \cdot \frac{\overline{R}_i^{u}}{\overline{R}_i^{a}}$

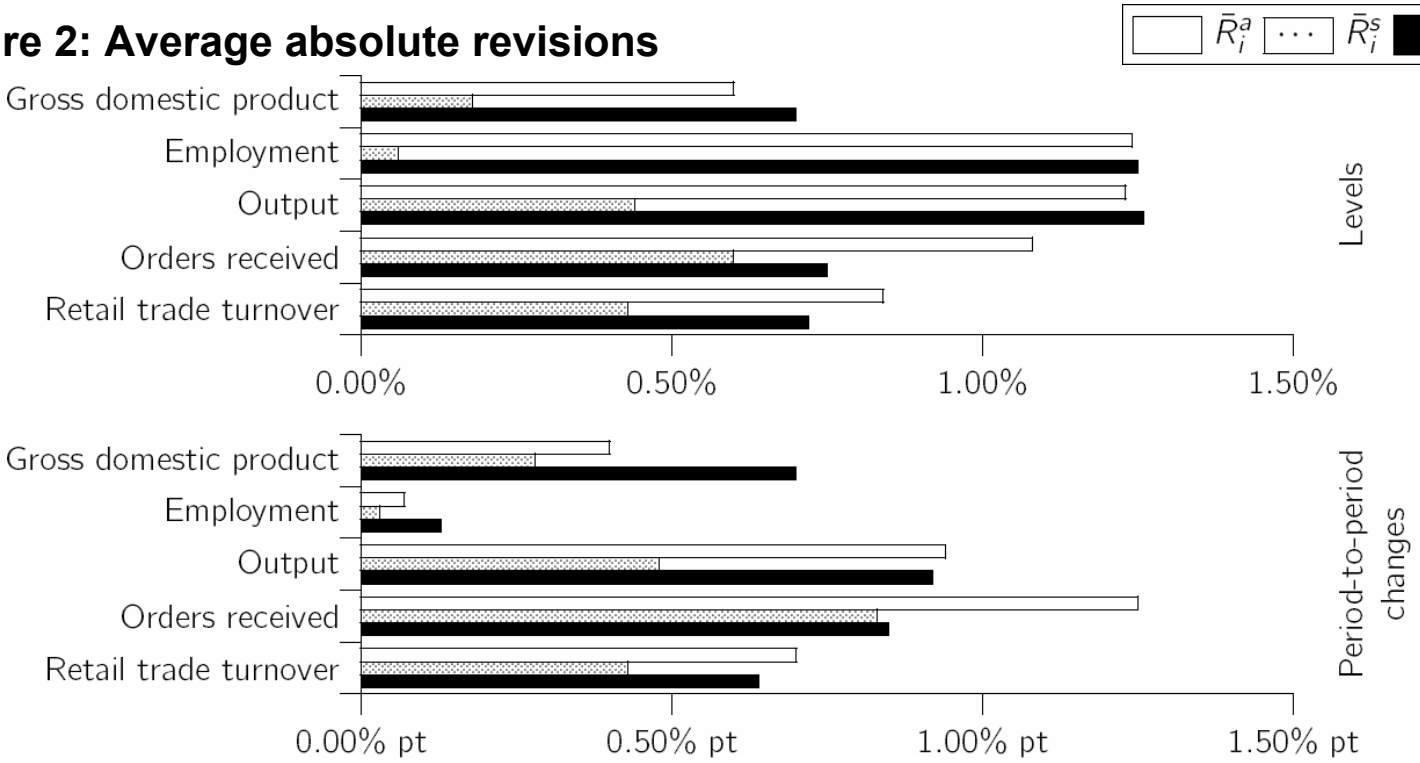
4. Variance decomposition

- **Investigated time series are important business cycle indicators for Germany:**

1. **Real gross domestic product (quarterly, flow, index)**
2. **Employment (monthly, stock, persons)**
3. **Output in the manufacturing sector (monthly, flow, index)**
4. **Orders received by the manufacturing sector (monthly, flow, index)**
5. **Retail trade turnover (monthly, flow, index)**

4. Variance decomposition

Figure 2: Average absolute revisions



4. Variance decomposition

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Table 2: Regression results for levels

Time series	ε_i^s	ε_i^u	ε_i^u / ε_i^s
Gross domestic product	0.46***	0.85	1.86**
Employment	0.05***	0.91*	17.46***
Output	0.33***	0.92**	2.81***
Orders received	0.55***	0.69***	1.25*
Retail trade turnover	0.49***	0.69***	1.40**

4. Variance decomposition

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Table 3: Regression results for period-to-period changes

Time series	ε_i^s	ε_i^u	ε_i^u / ε_i^s
Gross domestic product	0.95	0.78	0.83
Employment	0.34**	0.23***	0.65
Output	0.48***	0.71***	1.49***
Orders received	0.65***	0.59***	0.91
Retail trade turnover	0.56***	0.62***	1.11

4. Variance decomposition

- **260 observations were included. Coefficients of determination are high for both models at $R^2 = 0.99$. Statistical tests indicate model adequacy.**
- **Results for levels clearly indicate the importance of unadjusted real time data revisions and those for period-to-period changes do not contradict them.**
- **However, it is worth taking a closer look at the latter. At the end of the time series a two or three-period moving average is often used in practice. This lowers standard errors as noise is partially smoothed out.**

4. Variance decomposition

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Table 4: Ratios of elasticities of period-to-period changes of moving averages

Time series	MA(1)	MA(2)	MA(3)
Gross domestic product	0.83	1.95**	1.17
Employment	0.65	0.97	1.05
Output	1.49***	1.17	1.21
Orders received	0.91	0.72	0.71
Retail trade turnover	1.11	1.18	1.09

4. Variance decomposition

- **For short-term business cycle analysis, predicting the correct sign of period-to-period changes is crucial. By calculating moving averages, the likelihood of estimating the wrong sign decreases.**

- **Thus, revisions of unadjusted real time data become more important as their elasticity increases absolutely and relatively, and the revisions themselves do not have such a big influence as the sign does not change extraordinarily often.**

5. Summary

- **It can be concluded that revisions of unadjusted real time data should not be neglected when explaining revisions of seasonally adjusted real time data for Germany as their elasticities were greater than those of seasonal adjustment.**

- **Furthermore, this analysis confirmed a well-known result for the recent past: the current domain of uncertainty of seasonal adjustment depends heavily on the time series analysed and their properties.**