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Analysis of the Revisions to the Quarterly National Accounts Since the Introduction of the Flash Estimates in 2005

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Quarterly national account estimates are subject to revisions over time, to account for newly available data and new methods of computation, as well as a revision of their underlying data source. In economically turbulent periods, such as the financial and economic crisis of 2008-09, revisions can be expected to be more pronounced. This is true in particular for the first publication of quarterly national accounts (the so-called Flash Estimates). This analysis finds that revisions of the Flash Estimates compared to their final value were neither biased in any direction nor large in their scope. Moreover, the direction of revisions cannot be forecasted. Accordingly, the first publication shows a high degree of reliability in terms of expected revisions, in spite of the reduction in its publication date (from 70 days to 45 days after the end of a given quarter). The crisis years of 2008 and 2009 had the expected impact in the revisions: during the crisis, the downward course of the GDP was significantly underestimated. Nevertheless the upper turning point was correctly dated and did not have to be corrected even after several revision runs. In a similar vein, the duration of the contraction and the start of the recovery were found to be quite robust vis-à-vis new calculations.

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Ex-post analyses of the reliability of data provide indispensable information for data users since it is only with such information that statistics can be interpreted properly and serve as a basis for policy decisions. On behalf of Statistics Austria, WIFO has since the early 1970s been compiling the quarterly National Accounts for Austria and informs in regular intervals on the reliability of this data set.

As the comprehensive analysis of the revisions to the quarterly National Accounts (NA) by *Bilek-Steindl – Sauer – Scheiblecker* (2009) has shown, these revisions exhibit no systematic under- or over-estimations and may thus be regarded as unbiased. The quarterly accounts have proved a reliable tool for the assessment of the current cyclical position in real time since they indicated rather well accelerations or decelerations in overall economic activity already at the time they were first released.

Whether this finding remains valid has to be reviewed regularly. Such a review of the reliability of the quarterly GDP estimate not only provides evidence on the quality of the statistics to users, but also allows their producers to improve the methodology on the basis of the findings. In view of the changeover from the European System of National and Regional Accounts ESA 95 to ESA 2010[1] (which foresees not only shorter

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[1] For details of ESA 2010, see http://www.statistik.at/web_de/statistiken/volkswirtschaftliche_gesamtrechnungen/esvg_2010/index.html.

release periods, but also some changes in calculation) it is appropriate to update the revision analysis.

The present analysis of quarterly National Accounts revisions differs from that by *Bilek-Steindl – Sauer – Scheiblecker* (2009) in two main regards:

- In 2009, the term "first release" referred to the regular quarterly calculation which was to be published 90 days, since 2005 70 days after the end of each quarter (t+90 and t+70, respectively). For a thorough assessment of the "Flash Estimate"(t+45) that was introduced with the second quarter 2005, there were still too few observations in 2009. The present analysis can rely on longer data series, with "first release" denoting the Flash Estimate.

- In the analysis by *Bilek-Steindl – Sauer – Scheiblecker* (2009), the observation period ended with the third quarter 2008. Thus, the financial market crisis and the Great Recession were only reflected at the very end of the time series – too short for influencing the overall result. The present analysis now includes the entire crisis period plus many quarters before and thereafter. This enables us to assess more closely the impact of the crisis and recession on the revision behaviour and the quality of the quarterly National Accounts, and to evaluate our results also against this backdrop.

1. Revision behaviour in crisis periods

One of the key figures of the National Accounts is total output or Gross Domestic Product (GDP), the major source of income of an economy. While the annual statistic rather focuses on a comprehensive assessment on the level of economic welfare, the quarterly calculation looks more at the change during the year, i.e., at cyclical variations of total output, in order to plan stability policy interventions in due time.

In principle, the accuracy of measuring such output variations should not depend on the business cycle itself. In practice, though, strong variations and changes in economic conditions may indeed have an impact on the reliability of measurement. This holds particularly for the assessment of economic activity during the year as by the quarterly National Accounts, since the latter uses a much more limited data set than the annual accounts.

Empirical studies actually confirm the larger scope for revision in times of crisis. Thus, *Sinclair – Stekler* (2011) find that the margin of revision differs between recession and expansion periods. Analysing the revisions of the quarterly National Accounts during the financial market crisis 2008-09 for 16 of the G-20 countries, *Shrestha – Marini* (2013) show that the need for revision was markedly higher during that period, as the first estimates of GDP were systematically and distinctively higher than later releases. *Shrestha – Marini* (2013) cite two reasons for lower reliability of real-time calculations in times of major economic changes (compared to more stable periods): first, the representativeness of the source data may be impaired by economic turbulence. These source data, like opinion surveys or sample data, normally include firms only above a certain threshold. Yet, cyclical variations may affect firms of different size in a different way. Statistics which deliver reliable information in "normal" cyclical periods, become less reliable when cyclical amplitudes are exceptionally high. This holds particularly true if quarterly and annual National Accounts rely on different source data.

The second problem is related to data processing. The need for simplification in the quarterly accounts often requires relying on assumptions or on econometric methods deriving parameters from economic relations observed "on average" in the past. The accuracy of current economic statistics may be impaired in times of crisis for the following reasons:

- *Amendment of source data not yet received by estimates:* because of the early date of release, the quarterly National Accounts is in most cases built upon an incomplete data set. Many of the time series used do not reach until the end of the reporting period. In such cases, one has to resort to forecasting procedures in

order to prolong the time series needed. Such forecasts[2] are usually much less accurate in times of large cyclical variations than otherwise.

- *Validity of assumptions*: since many statistics about inputs used in the production process only collect annual data, the quarterly National Accounts must rely not only on estimates, but also on assumptions. While sales of output by economic sector are available for shorter periods, figures for intermediate inputs during the year have to be derived from input-output relations. Since the latter also vary heavily when cyclical amplitudes are high, the respective assumptions are subject to a wide margin of uncertainty.

- *Disaggregation models*: the annual National Accounts are rarely compiled by summing up the quarterly data (direct method). In most cases, the annual data are generated from comprehensive business surveys and then allocated to the different quarters using appropriate indicators that are independent from the surveys (indirect method). The disaggregation of the annual data is often based on crude statistics representing only part of the desired aggregate or just hinting at subannual dynamics. Mathematical and statistical procedures serve to distribute annual data over single quarters and months (benchmarking). In many cases, the relation between the indicator and the desired quarterly figure is obtained by observations in the past. Since this relation may change with economic conditions, real-time estimates can be distorted in crisis times.

- *Seasonal adjustment methods*: the statistical procedures recommended for the adjustment of time series for seasonal and calendar effects require for the correction of the most recent values projections of further developments. Univariate time series models usually derive these projections automatically from dynamic reactions in the past. If in the past only few severe recessions have occurred, the trajectory of the time series is difficult to project. Once the observed values deviate from the projected ones, a need for revision arises not only from the difference in the observed values, but also from the change in the seasonal adjustment factors.

2. Data and revision schedule

In Austria, WIFO establishes on behalf of Statistics Austria the quarterly National Accounts, which includes the Flash Estimate (at this time released 45 days after the end of the reporting quarter, t+45) and the regular account (t+70). With each new release of both the Flash Estimate and the regular account, the data for preceding quarters are revised[3]. The revisions concern both the current and the previous year to the extent that Statistics Austria had not yet released the respective annual data. The annual National Accounts are released by Statistics Austria once a year (usually in July), together with the revisions for the last three years. After the release, WIFO integrates the new annual figures into the quarterly National Accounts such that the quarters again add up to the annual values. The first WIFO release that includes the new annual figures is the Flash Estimate of mid-August.

The present analysis refers to the revision of the Austrian quarterly National Accounts between WIFO's first estimate (Flash Estimate) and three subsequent releases (regular quarterly National Accounts, annual release and final release). It is based upon a real-time data set of the regular quarterly accounts and the Flash Estimate reflecting the state of the time series that prevailed at the time of respective release in the past. This data set was established by WIFO for the purpose of the regular analysis of the revisions to the quarterly National Accounts and is amended with each new re-

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[2] These forecasts concern periods in the past for which data are not yet available; for this reason, they are occasionally referred to as "nowcasts" in the literature.

[3] For release dates and revision policy of the quarterly NA, see *Scheiblecker – Steindl – Wüger* (2007) and *Bilek-Steindl – Sauer – Scheiblecker* (2009).

lease. A particular measure like the percentage change from the previous quarter is considered at the following four points of time:

x_t^f "first release"   Flash Estimate ($t+45$),

x_t^q "second release"   regular quarterly National Accounts ($t+70$),

x_t^j "annual release",   i.e., first release after integration of the annual data from Statistics Austria at the time of the August Flash Estimate,

x_t^l "definitive or final release",   i.e., state of the quarterly National Accounts as of second quarter 2013.

Subsequently, the following key revision figures are calculated on the basis of the differences between the rates of change in percent:

$r_t^q = x_t^q - x_t^f$ revision from first to second release,

$r_t^j = x_t^j - x_t^f$ revision from first to annual release,

$r_t^l = x_t^l - x_t^f$ revision from first to final release,

$r_t^{qj} = x_t^j - x_t^q$ incremental revision from second to annual release,

$r_t^{jl} = x_t^l - x_t^j$ incremental revision from annual to final release.

The real-time data set used in the analysis stretches from the second quarter 2005, when WIFO released a Flash Estimate for the first time, until the second quarter 2013 (33 releases in total, respectively 28 releases contrasting the flash estimates with the annual releases).

In order to analyse the impact of the financial market crisis and the Great Recession on the scope of revision of the Austrian quarterly National Accounts, the data are compared once including the eight quarter of the peak crisis years[4] 2008-09, and once excluding them.

Apart from aggregate GDP, the real-time data set also includes components of the demand side of the National Accounts (consumption, investment, foreign trade), the value added of the production of goods and the number of employed (Tables 5 to 8). The data are available in absolute terms as well as adjusted for seasonal and calendar effects. The analysis is carried out on the basis of percentage changes year-on-year (unadjusted series) and quarter-on-quarter (adjusted series).

3.   Key figures for the analysis of revisions

In order to analyse the quality and the revision pattern of the Austrian National Accounts Flash Estimates, the revisions r_t (for the different revision time slots) are examined by means of a number of criteria. Like for *Bilek-Steindl – Sauer – Scheiblecker* (2009), the selection of evaluation criterias follows the procedures adopted by Eurostat, the ECB and by OECD workshops (*ECB – Eurostat*, 2004, *OECD*, 2007, *McKenzie – Tosetto – Fixler*, 2008). To all indicators (except those measuring the robustness to change in the sign of growth rates) the following principle applies: the smaller the revisions or their dispersion, the lower the value of the indicator and hence the more reliable are the figures with regard to their robustness against revision over time.

The *mean revision (predominant direction of revisions, MR)* denotes the mean of the revisions from the first to later releases:

$$MR = \bar{R} = \frac{1}{n} \sum_{t=1}^{n} r_t .$$

A positive sign indicates that the first release is more likely to be revised up, a negative sign indicates the opposite. If the likelihood of upward and downward revisions is about equal, *MR* is close to zero. Revisions (or first releases) are regarded as biased

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[4] The definition of the crisis period as stretching from the first quarter 2008 to the fourth quarter 2009 follows no strict formal criterion. In most quarters, the financial market crisis and the Great Recession are associated with this period; as shown in Figure 1, the extremely severe economic slump falls within this period.

if the mean revision is significantly different from zero, whereby significance is assessed by means of a standard t test. If the time series of the revisions exhibit auto-correlation, a modified t test statistic[5] is calculated (*Di Fonzo, 2005*). For all statistical tests a significance level of 95 percent is applied.

The *standard deviation (volatility of the revisions, σ)* measures the dispersion of the revisions:

$$\sigma_r = \sqrt{\frac{1}{n}\sum_{t=1}^{n}(r_t - \overline{R})^2} \; .$$

The *mean absolute revision (scope of the revisions, MAR)* measures the average of the absolute amounts of the revisions:

$$MAR = \frac{1}{n}\sum_{t=1}^{n}|r_t| \; .$$

By means of the *relative mean absolute revision (relative size of the revisions, RMAR)* the scope of the revisions can be compared between the different National Accounts aggregates. To this end, the *MAR* will be set in relation to the first release of the time series concerned:

$$RMAR = \frac{\sum_{t=1}^{n}|r_t|}{\sum_{t=1}^{n}|x_t^f|} \; .$$

The indicator of the *mean square revision (revision quality, measured by the inequality shares, MSR)* attributes a higher weight to larger revisions than to small ones:

$$MSR = \frac{1}{n}\sum_{t=1}^{n}r_t^2 \; .$$

It also measures the size of the revisions. Furthermore, the *MSR* is often used for decomposing revisions into a systematic and an unsystematic component, whereby the unsystematic component should be as high as possible. According to *Theil* (1961) and *Granger – Newbold* (1973), the *MSR* can be split into three inequality shares. Standardised to 1 holds[6]

1 = *UM* + *UR* + *UD*.

Revisions that oscillate unsystematically around zero feature a low distortion (*UM*) and regression share (*UR*). The former measures the share of the mean square revision that makes this average deviate from zero (similar to the constant term in a linear regression). The regression share (*UR*) is caused by a slope parameter different from zero, and the disturbance share (*UD*) measures the amount of *MSR* that is unexplained by this regression and should thus be close to 1.

Sign test – robustness of the sign of the second derivative: one of the major functions of the quarterly National Accounts is the timely identification of turning points by the sign of the rate of change. In order to judge whether the Austrian quarterly National Accounts fulfils this task we examine to what extent the signals of acceleration or deceleration conveyed by the first release remain visible even after repeated revi-

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[5] The modified t test statistic is calculated as follows:

$$t^{adj} = \frac{\overline{R}}{\sigma_r^{HAC}}\sqrt{n} \; .$$

In the case of auto-correlation of order 1 or order 1 and 2, the HAC-standard deviation (heteroskedasticity auto-correlation consistent) of the revisions according to *Newey – West* (1987) are applied in the first or second form:

$$\sigma_r^{HAC,1} = \sqrt{\frac{1}{n(n-1)}\left\{\sum_{t=1}^{n}(r_t - \overline{R})^2 + \frac{4}{3}\sum_{t=2}^{n}(r_t - \overline{R})(r_{t-1} - \overline{R})\right\}} \; ,$$

$$\sigma_r^{HAC,2} = \sqrt{\frac{1}{n(n-1)}\left\{\sum_{t=1}^{n}(r_t - \overline{R})^2 + \frac{4}{3}\sum_{t=2}^{n}(r_t - \overline{R})(r_{t-1} - \overline{R}) + \frac{2}{3}\sum_{t=3}^{n}(r_t - \overline{R})(r_{t-2} - \overline{R})\right\}} \; .$$

[6] The interpretation of *UM*, *UR* and *UD* follows *Di Fonzo* (2005).

sions. This will be measured by the percentage of concordance in the sign change of the difference between the rates of change reported by the first and the final release. The values of the respective time series in real terms, once unadjusted and once adjusted for seasonal and calendar effects, form the basis for the calculation of the sign changes.

In order to assess the *efficiency of the first release*, we resort to the concept of "news versus noise" (*Mankiw – Shapiro,* 1986), as had been done in *Bilek-Steindl – Sauer – Scheiblecker* (2009). We examine by correlation analysis as well as by a regression approach whether revisions contain new information (news) and/or disturbance elements (noise) like measurement errors. By doing so we test whether a revision is correlated with the preceding or subsequent release, respectively whether in the regression approach the coefficients are together significantly different from zero. The estimation equations for the regression approach read as follows:

$r_t = \alpha + \beta x_t^f + \varepsilon_t$ respectively $r_t = \alpha + \beta x_t^q + \varepsilon_t$.

If the revision r_t of the Flash Estimate in the following period had been foreseeable already at the time of release of the Flash Estimate, i.e., if r_t could be explained by x_t^f and if both α and β are significantly different from zero, the revision may be called noise. If the revision can be explained by subsequent data, as represented by x_t^q, the revision introduces new information ("news") into the accounts. If both or none of the approaches yield parameters significantly different from zero, no clear evidence can be given on the efficiency of the first release.

4. Results of the analysis of the quarterly National Accounts revisions

On the basis of the real-time data set, Figure 1 (unadjusted data) and Figure 2 (adjusted data) show the range of all releases for each quarter for the period from the second quarter 2005 to the second quarter 2013 and the scope of revision between the first and the final release as well as the respective values. The values for the first and the final release normally represent the two corners of the spectrum, though not in all periods. For the adjusted data in particular (inter alia due to the seasonal adjustment procedure), the first and the final release are often clearly within the range. Most of the revisions are apparently upwards, except for the crisis years were they are markedly pointing down, in line with the revision pattern of the annual figures from Statistics Austria (Figure 3).

Figure 1: Real-time releases for growth of real GDP

Unadjusted, percentage changes from previous year
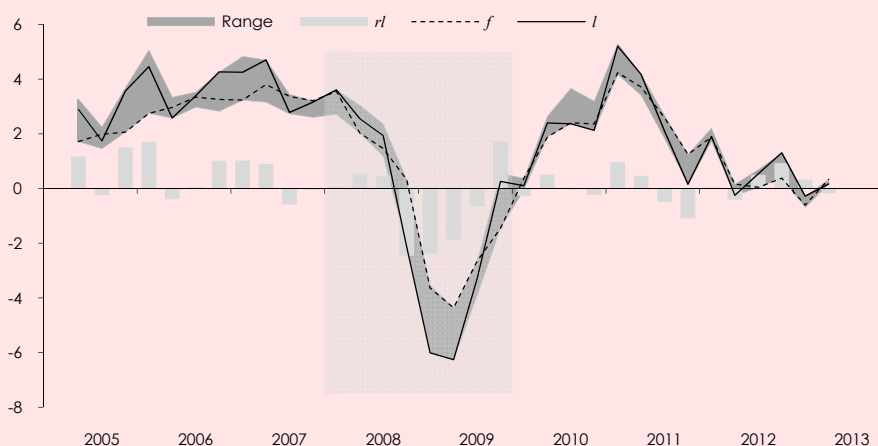
Source: WIFO calculations. Range . . . range of all releases for the respective quarter, *rl* . . . revision from first to final release, *f* . . . first release, *l* . . . final release, shaded area . . . crisis years 2008 and 2009.

Figure 2: Real-time releases for growth of real GDP

Seasonally and calendar adjusted, percentage changes from previous quarter
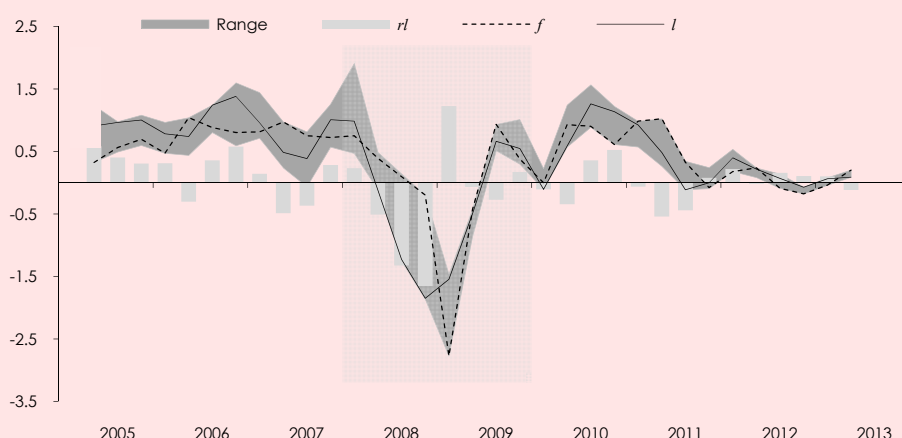
Source: WIFO calculations. Range . . . range of all releases for the respective quarter, *rl* . . . revision from first to final release, *f* . . . first release, *l* . . . final release, shaded area . . . crisis years 2008 and 2009.

Figure 3: Revisions to annual growth of real GDP by Statistics Austria

In percent
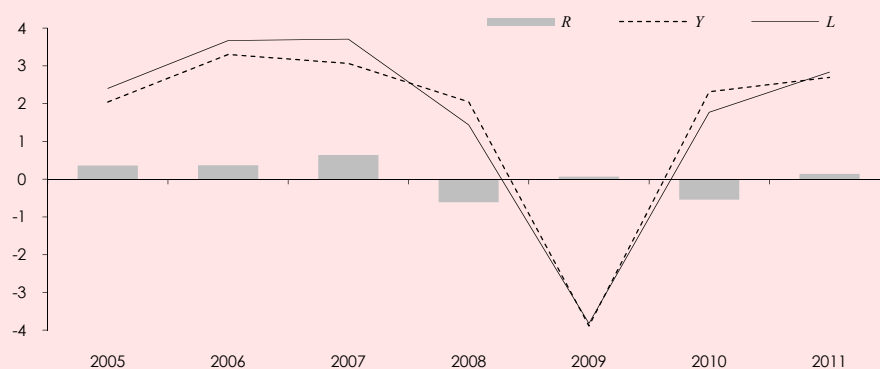
Source: WIFO calculations. *R* . . . revision from first to final release, *Y* . . . first release, *L* . . final release.

The scope of the revisions, as measured by the difference between the values of the Flash Estimate and the final release, is markedly larger for most quarters of the crisis period than for the other periods.

4.1 "Distortion" – predominant direction of revisions

Over the observation period from second quarter 2005 to second quarter 2013, the unadjusted year-on-year growth rates of quarterly GDP were on average (*MR*) revised up by 0.08 percentage points between the Flash Estimate and the final release (Table 1). The data were revised up at slightly more than half of the release dates. The mean upward revision is not statistically significant[7] and can thus be considered "unbiased". If one excludes the crisis years of 2008-09 from the calculation, the mean revision indicator (between first and final release) also shows a positive sign, while being higher, at 0.28 percentage points, and significantly different from zero. However, 0.19 percentage points of the indicator are explained by upward revisions to the annual National Accounts by Statistics Austria. Since the quarterly National Ac-

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[7] Whenever autocorrelation of order 1 or 2 was identified for a revision period, the modified *t*-statistic was calculated.

counts have to be fully consistent with the annual results, these revisions are bound to be reproduced by the quarterly accounts. The size of the revisions to the annual data is shown in Figure 3.

The necessary downward revisions to GDP, notably those of the Flash Estimates from mid-2008 to mid-2009, have strongly pulled down the *MR* indicator.

Table 1: Unbiasedness of GDP revisions

	MR Percentage points		*t* statistic		Autocorrelation		Average change from previous year in percent	
	2Q 2005 to 2Q 2013	Without 2008-09	2Q 2005 to 2Q 2013	Without 2008-09	2Q 2005 to 2Q 2013	Without 2008-09	2Q 2005 to 2Q 2013	Without 2008-09
Unadjusted, volume								
rq	0.02	0.07	0.56	1.44	No	No		
rj	0.03	0.14	0.03	1.16	Order 1	No		
rl	0.08	0.28	0.06	2.02	Order 1	No		
xf							+ 1.45	+ 2.11
xl							+ 1.53	+ 2.39
Seasonally and calendar adjusted, volume								
rq	− 0.02	− 0.00	− 0.62	− 0.14	No	No		
rj	− 0.01	0.03	− 0.15	0.49	No	No		
rl	− 0.01	0.07	− 0.15	0.20	No	Order 1, 2		
xf							+ 0.37	+ 0.52
xl							+ 0.36	+ 0.59

Source: WIFO calculations. *MR* . . . mean revision.

On the basis of the mean revision *MR*, the adjusted quarter-on-quarter growth rates of Austrian GDP exhibit no statistically significant bias into one or the other direction, neither for the whole observation period nor when the years 2008 and 2009 are excluded. Like with the unadjusted data, the number of upward revisions dominate slightly.

4.2 Scope and volatility

As expected, the scope (as measured by the mean absolute revision *MAR*) and the volatility (measured by the standard deviation σ) of the revisions increase with the number of revisions carried out (Table 2). The more complete the recorded information for a particular quarter and hence the lower the need to supplement it with forecasts, the more "accurate" the GDP estimate obtained. For the unadjusted year-on-year rates, the *MAR* indicator for revisions from Flash Estimate to regular quarterly National Accounts is 0.19 percentage points, the standard deviation 0.24 percentage points. Compared with the first annual data release, both *MAR* and standard deviation are substantially higher (0.63 and 0.75 percentage points, respectively). Both indicators increase only marginally further until the final release.

Table 2: Scope and volatility of GDP revisions

	MAR		*MSR* Percentage points		σ	
	2Q 2005 to 2Q 2013	Without 2008-09	2Q 2005 to 2Q 2013	Without 2008-09	2Q 2005 to 2Q 2013	Without 2008-09
Unadjusted, volume						
rq	0.19	0.20	0.06	0.06	0.24	0.24
rj	0.63	0.54	0.56	0.40	0.75	0.62
rl	0.76	0.60	1.02	0.57	1.00	0.70
Seasonally and calendar adjusted, volume						
rq	0.11	0.11	0.02	0.02	0.15	0.15
rj	0.26	0.23	0.11	0.09	0.33	0.30
rl	0.39	0.29	0.28	0.11	0.53	0.33

Source: WIFO calculations. *MAR* . . . mean absolute revision, *MSR* . . . mean squared revision.

The same pattern prevails for the adjusted quarter-on-quarter growth rates. This also holds for the analysis excluding the crisis years of 2008-09, whereby in this case the

revision indicators *MAR*, *MSR* and σ turn out lower. Hence the crisis required distinctly stronger revisions of the quarterly data from the Flash Estimates (Figure 4). This result confirms the international experience whereby the scope of revision rises markedly in a period of sharp cyclical downturn.
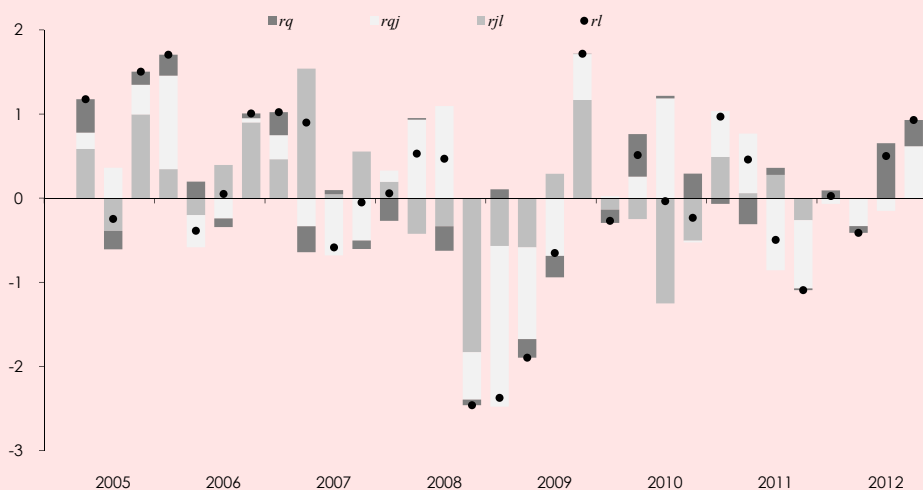
Figure 4: Composition of revisions to growth of real GDP

Unadjusted, percentage changes from previous year

Source: WIFO calculations. *rq* . . . revision from first to second release, *rqj* . . . revision from second to annual release, *rjl* . . . revision from annual to final release, *rl* . . . revision from first to final release.

4.3 Measuring the quality of revisions

The analysis of the quality of the revisions, measured by the *MSR* and a decomposition into a systematic (regression share) and an unsystematic (disturbance share) component, delivers results of similar quality as were found by *Bilek-Steindl – Sauer – Scheiblecker* (2009): the disturbance share (*UD*) of the revisions to the quarterly GDP growth rates is generally close to 1 (independent from the adjustment). Hence there are no or few signs of systematic patterns in the revisions. This holds both for the analysis with and without the crisis years 2008-09.

4.4 "Sign test" – signalling strengthening or receeding business activity

A strengthening or weakening of GDP growth can be read from the sign of the change in growth rates. Business cycle monitoring and short-term forecasting focus in particular on this tendency. An analysis of the unadjusted quarterly GDP data and their change year-on-year shows for the entire observation period (second quarter 2005 to second quarter 2013) concordance of matches the sign between the first and the final release in almost 80 percent of cases. For the seasonally and calendar-adjusted data and their changes from quarter to quarter, signs are consistent to around 60 percent. Both values are virtually unchanged from the previous comprehensive analysis (*Bilek-Steindl – Sauer – Scheiblecker*, 2009). Yet, if one takes into account that *Bilek-Steindl – Sauer – Scheiblecker* (2009) denoted the results of the regular quarterly National Accounts (*t*+70 respectively *t*+90) as first release, the introduction of the Flash Estimate and the shortening of the deadline for the first release to *t*+45 have not detracted from the results. Indeed, tendencies of acceleration or deceleration of business activity can now be identified more timely, a factor of key importance for the assessment of the cyclical situation in real time.

An analysis abstracting from the crisis period tends to weaken somewhat the robustness of the sign. Thus, in 2008 and 2009, the signs of the second derivative, i.e., the change in the respective growth rate, are highly consistent between first and final data release. For the unadjusted data, the concordance is 100 percent, for the adjusted quarterly GDP data, signs were identical in 6 out of 7 cases. These high values are not surprising as such, given the pronounced cyclical movement of these two

years, with the severe slump followed by a strong rebound as from mid-2009. Such strong movements in one or the other direction, signalled by most of the business cycle indicators, makes a change in the direction of the cycle rather unlikely. The lower turning point (measured here as the turn from negative to positive quarterly change), dated by the Flash Estimate to the third quarter 2009 for the unadjusted GDP series, is the same as incorporating annual National Accounts figures as well as for the final release. The seasonally and calendar-adjusted series shows for the first release the lower turning point lagged by one quarter vis-à-vis the final release (second quarter 2009 rather than first quarter 2009).

During the crisis of 2008-09, the Flash Estimate for the quarterly National Accounts signalled the cyclical downturn in a highly reliable and timely way, even if it underestimated the amplitude of the recession. Likewise, the incipient recovery in 2009 was identified more or less accurately.

Table 3: "Noise" and "News" – correlation method

					Revision period							
			Noise						News			
	rq		rqj		rjl		rq		rqj		rjl	
	2Q 2005 to 2Q 2013	Without 2008-09	2Q 2005 to 2Q 2013	Without 2008-09	2Q 2005 to 2Q 2013	Without 2008-09	2Q 2005 to 2Q 2013	Without 2008-09	2Q 2005 to 2Q 2013	Without 2008-09	2Q 2005 to 2Q 2013	Without 2008-09
Releases												
f	0.05	− 0.21										
q			0.46**	0.08			0.16	− 0.03				
j					0.27	0.20			0.66**	0.49**		
l											0.48**	0.61**

Source: WIFO calculations. ** . . . significant at the 5 percent level.

Table 4: "Noise" and "News" – regression method

					Revision period							
			Noise						News			
	rq		rqj		rjl		rq		rqj		rjl	
	2Q 2005 to 2Q 2013	Without 2008-09	2Q 2005 to 2Q 2013	Without 2008-09	2Q 2005 to 2Q 2013	Without 2008-09	2Q 2005 to 2Q 2013	Without 2008-09	2Q 2005 to 2Q 2013	Without 2008/09	2Q 2005 to 2Q 2013	Without 2008-09
Releases												
f	0.01	− 0.04										
q			0.15**	0.04			0.02	− 0.01				
j					0.07*	0.11			0.18***	0.21***		
l											0.12***	0.27***
Constant	0.02	0.15	− 0.24	− 0.04	− 0.06	− 0.12	− 0.00	0.08	− 0.29**	− 0.45**	− 0.14	− 0.61**
N	33	25	31	23	27	19	33	25	31	23	27	19
Adj. R^2	− 0.03	0.00	0.18	− 0.04	0.03	− 0.02	− 0.01	− 0.04	0.42	0.21	0.20	0.33
F statistic	0.19	1.08	3.63	0.19	1.83	1.29	0.70	0.96	14.07	4.65	5.09	7.27
p value	0.83	0.35	0.04	0.83	0.18	0.30	0.50	0.40	0.00	0.02	0.01	0.01

Source: WIFO calculations. * . . . significant at the 10 percent level, ** . . . significant at the 5 percent level, *** . . . significant at the 1 percent level.

4.5 "News versus Noise" – efficiency of the releases

The results for the measurement of efficiency of the different releases show the following (Tables 3 and 4): the revisions of the unadjusted year-on-year growth rates between the Flash Estimate and the regular quarterly National Accounts give no significant evidence for either news or noise. The same holds, if one excludes the crisis years 2008-09. The revisions from the second release to the annual release exhibit statistically significant news as well as noise signals, whether one uses the correlation or the regression method. A clear-cut attribution to news or noise cannot be made here. A clearer picture can be gained from the analysis abstracting from the crisis period: there, only the news coefficients are statistically significant, such that the revisions include signals of news. The comprehensive revisions of the National Accounts in the crisis years 2008-09 had a visible impact on the efficiency of the first and second releases for the whole observation period. A similar picture emerges from the revisions between the annual release and the release at the end of the observation period (i.e., the final release as of the second quarter 2013). For the whole

observation period, no clear hints to news or noise can be identified. If one, how-ever, excludes the years 2008-09, significant signals for news can be discerned. Like in *Bilek-Steindl – Sauer – Scheiblecker* (2009), the revisions required by the integration of the annual National Accounts data from Statistics Austria, deliver the strongest hints to news.

5. Revision indicators for components of the quarterly National Accounts

Indicators for the revision of the components of GDP on a quarterly basis and for the employment time series are presented in Tables 5 to 8.

Figure 5: RMAR of National Accounts components

Percentage points, unadjusted, volume
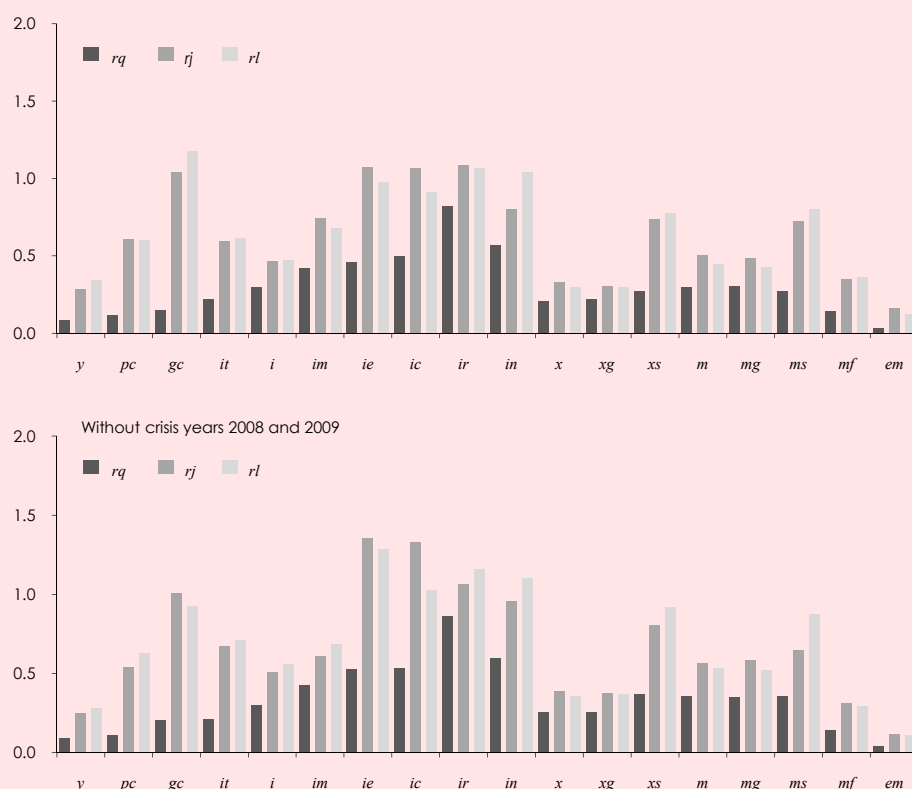
Source: WIFO calculations. *RMAR* . . . relative mean absolute revision. y . . . Gross Domestic Product, pc . . . private consumption expenditure (including private non-profit organisations), gc . . . government consumption expenditure, it . . gross fixed investment, i . . . equipment investment, im . . . machinery investment, ie . . . transport equipment investment, ic . . . construction investment, ir . . . residential investment, in . . . non-residential investment, x . . . exports, xg . . . goods exports, xs . . . services exports, m . . . imports, mg . . . goods imports, ms . . . services imports, mf . . . manufacturing (value added), em . . . employment (employees).

The mean revisions (*MR*) to the unadjusted real-time data for the demand components of aggregate demand prove rather small, as far as consumption (both private and public) and foreign trade (notably of goods) are concerned. Data for investment (except the overall aggregate of gross fixed capital formation) were subject to more substantial revisions. However, significantly different from zero were only the revisions to residential investment (with a tendency towards upward revision). The relative mean absolute revision (*RMAR*) of the different demand components (Figure 5) confirms this pattern. Statistically significant are also the revisions from the Flash Estimate to the final release for manufacturing (biased downwards) and employment (slightly biased upwards). Results change only marginally, if one excludes the crisis period, with *MR* sometimes being higher. On the basis of the adjusted data, none of *MR* of either series is statistically significant.

Scope and volatility of the revisions (*MAR* and *σ*) are in line with those of overall GDP: the longer the period between the releases, the larger are the revisions. In the majority of cases, differences are largest between the second and the annual release. This pattern is observed independently from the data base (adjusted or unadjusted, with or without the crisis period). Concerning the quality of the revisions, most demand aggregates of GDP exhibit the dominance of an unsystematic component, i.e., a value of *UD* close to 1. Only part of the investment time series and the employment series show a systematic bias, i.e., *UM* not close to zero, especially for longer revision periods. Unlike with the unadjusted data, the regression share (*UR*) prevails in the seasonally- and calendar-adjusted data, if the latter are subject to a systematic bias. This holds, for example, for residential and non-residential investment and to some extent also for the export series.

6. Summary and conclusions

Economic statistics constitute an important base for decisions by policy, companies and private households. Since such data sets are usually subject to revision over time, users ought to be aware of the reliability of pending revisions.

For many years, WIFO has been compiling the Quarterly National Accounts on behalf of Statistics Austria. In regular intervals, the Institute carries out analyses of the revisions in order to assess the reliability of this data base.

The last analysis by *Bilek-Steindl – Sauer – Scheiblecker* (2009) came to the conclusion that revisions did not exhibit a systematic pattern, that their size was altogether small and their direction was unpredictable. The present analysis also includes the Flash Estimate that was introduced in 2005 and is released already 45 days after the end of each quarter.

As the empirical investigation shows, first data releases are subject to heightened uncertainty in times of large cyclical fluctuation. For this reason, the crisis years of 2008 and 2009 have been analysed separately. As it turned out, the downturn of the economy during the crisis has indeed been underestimated in its extent by the Flash Estimate. Nevertheless, the upper turning point of the cycle had been dated correctly and did not change with the following data revisions. This accurate identification in real time in 2008 provided a timely signal to policy of the incipient recession. Also the duration of the fall in GDP and the starting point in time of the recovery proved highly resilient to the subsequent revisions.

Whereas for the entire period from 2005 to 2013 no significant bias in the direction of the revisions could be detected, a statistically significant underestimation of GDP growth at the time of the first compared with the final data release was identified in the series excluding the crisis years. However, this also holds for the annual data from Statistics Austria for the same period. The revisions to the annual data had to be incorporated into the quarterly accounts, thus leading to a significant underestimation of the final results also in the latter.

The major indicators of the reliability of the quarterly National Accounts suggest neither an improvement nor a deterioration in revision behaviour compared with the analysis carried out in 2009. Nevertheless, apart from the introduction of the Flash Estimate – counted as first release in the present context – also the delay for the regular data release has been shortened from $t+90$ to $t+70$. In this respect, our results point to an improvement in the quality of the estimates.

WIFO intends to submit analyses of the revisions to the quarterly National Accounts at regular intervals also in the future. However, due to the changeover to ESA 2010, the collection of first release data in real time has to start afresh. The next assessment will not be carried out after five years, as in the past, since the time series available by that time will not be sufficiently long. Moreover, comparability with the results of previous analyses will be limited, as with the new edition of ESA the delays for data release will once again be shortened, to $t+30$ for the Flash Estimate and $t+60$ for the regular account.

Table 5: Statistical indicators, unadjusted, volumes

	MR	Auto-correlation	t statistic	MSR	UM	UR	UD	MAR	σ	RMAR	Sign test[1] +	−
Gross Domestic Product												
rq	0.02	No	0.56	0.06	0.01	0.00	0.99	0.19	0.24	0.08		
rj	0.03	Order 1	0.03	0.56	0.00	0.15	0.82	0.63	0.75	0.28		
rl	0.08	Order 1	0.06	1.02	0.01	0.23	0.77	0.76	1.00	0.34	37.50	40.63
Private consumption expenditure total												
rq	− 0.05	No	− 1.66	0.04	0.08	0.04	0.88	0.14	0.19	0.12		
rj	0.19	No	1.10	1.08	0.04	0.00	0.96	0.76	1.02	0.61		
rl	0.15	No	0.86	1.02	0.02	0.01	0.97	0.75	1.00	0.60	34.38	40.63
Government consumption expenditure												
rq	− 0.00	No	− 0.03	0.24	0.00	0.00	1.00	0.17	0.49	0.15		
rj	0.16	No	0.63	2.17	0.01	0.06	0.93	1.19	1.46	1.04		
rl	0.52	No	1.66	3.47	0.08	0.00	0.92	1.34	1.79	1.18	40.63	28.13
Gross fixed investment												
rq	0.05	No	0.30	0.96	0.00	0.01	0.99	0.79	0.98	0.22		
rj	0.62	Order 1, 2	0.01	6.39	0.06	0.00	0.94	2.14	2.45	0.60		
rl	0.10	Order 1, 2	0.03	6.81	0.00	0.00	1.00	2.20	2.61	0.61	25.00	46.88
Equipment investment												
rq	− 0.62	No	− 1.43	6.52	0.06	0.00	0.94	1.92	2.48	0.30		
rj	− 0.02	No	− 0.02	17.63	0.00	0.02	0.99	3.02	4.20	0.46		
rl	0.74	No	1.07	16.21	0.03	0.01	0.96	3.06	3.96	0.47	31.25	46.88
Machinery investment												
rq	− 0.44	No	− 0.86	8.82	0.02	0.10	0.88	2.19	2.94	0.42		
rj	0.27	Order 1, 2	0.00	25.63	0.00	0.06	0.94	3.87	5.06	0.74		
rl	1.26	No	1.79	18.04	0.09	0.08	0.83	3.53	4.06	0.68	34.38	40.63
Transport equipment investment												
rq	− 1.19	No	− 1.08	41.75	0.03	0.01	0.96	4.75	6.35	0.46		
rj	− 0.95	Order 1, 2	0.00	199.46	0.00	0.08	0.93	11.17	14.09	1.07		
rl	0.09	Order 1, 2	0.01	157.66	0.00	0.01	0.99	10.11	12.56	0.97	46.88	34.38
Construction investment												
rq	0.71	No	2.09	4.38	0.12	0.12	0.76	1.65	1.97	0.50		
rj	1.74	Order 1, 2	0.00	21.10	0.14	0.08	0.78	3.55	4.25	1.07		
rl	− 0.32	Order 1, 2	− 0.07	12.95	0.01	0.13	0.86	3.03	3.58	0.91	34.38	34.38
Residential investment												
rq	1.20	No	2.34	10.13	0.14	0.03	0.83	2.44	2.95	0.82		
rj	1.89	No	3.37	13.88	0.26	0.00	0.74	3.22	3.21	1.08		
rl	1.83	Order 1, 2	0.42	16.62	0.20	0.13	0.67	3.17	3.64	1.07	34.38	34.38
Non-residential investment												
rq	− 0.44	No	− 0.93	7.62	0.03	0.06	0.91	2.00	2.72	0.57		
rj	− 0.62	No	− 1.15	10.17	0.04	0.06	0.91	2.82	3.13	0.80		
rl	− 2.49	Order 1, 2	− 0.53	20.02	0.31	0.00	0.69	3.66	3.72	1.04	34.38	40.63
Exports												
rq	− 0.19	No	− 0.49	4.69	0.01	0.02	0.97	1.38	2.16	0.21		
rj	0.03	No	0.07	7.44	0.00	0.01	0.98	2.15	2.73	0.33		
rl	0.35	No	0.77	7.21	0.02	0.01	0.98	1.97	2.66	0.30	31.25	46.88
Goods exports												
rq	− 0.22	No	− 0.52	5.83	0.01	0.01	0.98	1.64	2.41	0.22		
rj	0.06	No	0.12	9.59	0.00	0.00	1.00	2.29	3.10	0.30		
rl	0.27	No	0.50	9.97	0.01	0.00	0.99	2.26	3.15	0.30	31.25	37.50
Services exports												
rq	− 0.14	No	− 0.23	11.58	0.00	0.01	0.99	1.27	3.40	0.27		
rj	0.05	Order 1, 2	0.00	18.22	0.00	0.03	0.97	3.43	4.27	0.74		
rl	0.75	Order 1, 2	0.11	24.41	0.02	0.07	0.91	3.58	4.88	0.77	28.13	25.00
Imports												
rq	− 0.13	No	− 0.38	3.88	0.00	0.04	0.96	1.57	1.97	0.30		
rj	0.21	No	0.36	11.07	0.00	0.00	0.99	2.62	3.32	0.50		
rl	0.54	Order 1	0.14	10.52	0.03	0.01	0.97	2.33	3.20	0.45	31.25	34.38
Goods imports												
rq	− 0.01	No	− 0.02	4.71	0.00	0.03	0.97	1.77	2.17	0.31		
rj	0.37	No	0.58	13.37	0.01	0.00	0.98	2.82	3.64	0.49		
rl	0.71	No	1.22	11.60	0.04	0.01	0.95	2.46	3.33	0.42	31.25	37.50
Services imports												
rq	− 0.59	No	− 1.07	10.24	0.03	0.05	0.92	1.22	3.14	0.27		
rj	− 0.35	No	− 0.53	14.96	0.01	0.02	0.98	3.21	3.85	0.72		
rl	− 0.11	No	− 0.13	23.11	0.00	0.07	0.93	3.56	4.81	0.80	21.88	25.00
Manufacturing												
rq	− 0.08	No	− 0.40	1.31	0.00	0.07	0.92	0.82	1.14	0.14		
rj	− 0.45	No	− 0.95	7.57	0.03	0.03	0.93	2.05	2.71	0.35		
rl	− 0.96	No	− 2.07	8.06	0.11	0.00	0.88	2.13	2.67	0.37	37.50	40.63
Employment (employees)												
rq	− 0.02	Order 1, 2	− 0.33	0.01	0.05	0.00	0.95	0.05	0.11	0.03		
rj	0.22	Order 1	0.83	0.10	0.48	0.00	0.52	0.23	0.22	0.16		
rl	0.14	No	4.56	0.05	0.39	0.00	0.61	0.18	0.17	0.12	37.50	43.75

Source: WIFO calculations. − [1] Degree of consistency of sign between first and final release in percent.

Table 6: Statistical indicators, unadjusted, volumes – without crisis years 2008 and 2009

	MR	Auto-correlation	t statistic	MSR	UM	UR	UD	MAR	σ	RMAR	Sign test[1] +	Sign test[1] −
Gross Domestic Product												
rq	0.07	No	1.44	0.06	0.08	0.04	0.88	0.20	0.24	0.09		
rj	0.14	No	1.16	0.40	0.05	0.00	0.94	0.54	0.62	0.25		
rl	0.28	No	2.02	0.57	0.14	0.04	0.82	0.60	0.70	0.28	39.13	34.78
Private consumption expenditure total												
rq	− 0.02	No	− 0.54	0.03	0.01	0.00	0.99	0.13	0.16	0.11		
rj	0.24	No	1.40	0.81	0.07	0.00	0.92	0.65	0.87	0.54		
rl	0.28	Order 1	0.23	1.08	0.07	0.00	0.93	0.77	1.00	0.63	30.43	39.13
Government consumption expenditure												
rq	− 0.01	No	− 0.05	0.31	0.00	0.00	1.00	0.22	0.56	0.20		
rj	0.02	No	0.08	1.98	0.00	0.07	0.93	1.09	1.41	1.01		
rl	0.30	No	1.06	2.03	0.04	0.00	0.95	1.00	1.39	0.92	43.48	21.74
Gross fixed investment												
rq	0.20	No	1.15	0.79	0.05	0.00	0.95	0.72	0.87	0.21		
rj	1.36	No	3.05	6.85	0.27	0.20	0.55	2.29	2.23	0.67		
rl	0.49	Order 1, 2	0.14	7.82	0.03	0.03	0.94	2.42	2.75	0.71	26.09	47.83
Equipment investment												
rq	− 0.65	No	− 1.33	6.49	0.07	0.07	0.86	1.95	2.46	0.30		
rj	0.64	No	0.71	20.59	0.02	0.22	0.77	3.29	4.49	0.51		
rl	1.04	No	1.19	20.30	0.05	0.03	0.91	3.60	4.38	0.56	30.43	43.48
Machinery investment												
rq	− 0.43	No	− 0.69	9.99	0.02	0.17	0.81	2.40	3.13	0.42		
rj	1.17	No	1.38	19.26	0.07	0.46	0.47	3.47	4.23	0.61		
rl	1.40	No	1.62	20.63	0.10	0.12	0.78	3.90	4.32	0.69	34.78	39.13
Transport equipment investment												
rq	− 1.50	No	− 1.20	41.38	0.05	0.00	0.95	4.70	6.26	0.53		
rj	− 1.07	Order 1, 2	0.01	232.80	0.00	0.07	0.93	12.12	15.22	1.35		
rl	1.00	Order 1, 2	0.05	192.89	0.01	0.04	0.96	11.49	13.85	1.28	47.83	30.43
Construction investment												
rq	1.13	No	3.47	3.92	0.32	0.02	0.65	1.53	1.63	0.53		
rj	2.87	No	3.67	23.57	0.35	0.12	0.54	3.83	3.91	1.33		
rl	0.30	Order 1, 2	0.06	11.55	0.01	0.22	0.77	2.96	3.38	1.03	34.78	30.43
Residential investment												
rq	1.68	No	3.24	9.61	0.30	0.01	0.70	2.30	2.60	0.86		
rj	2.53	No	5.68	11.37	0.56	0.02	0.42	2.84	2.23	1.06		
rl	1.76	No	2.46	15.83	0.19	0.11	0.69	3.10	3.57	1.16	39.13	34.78
Non-residential investment												
rq	− 0.47	No	− 0.88	7.44	0.03	0.00	0.97	1.84	2.69	0.60		
rj	− 0.27	No	− 0.42	10.94	0.01	0.23	0.78	2.96	3.30	0.96		
rl	− 1.86	No	− 2.46	17.73	0.20	0.00	0.80	3.40	3.78	1.10	34.78	34.78
Exports												
rq	− 0.05	No	− 0.11	5.51	0.00	0.09	0.91	1.46	2.35	0.26		
rj	0.69	No	1.30	7.46	0.06	0.24	0.70	2.20	2.64	0.39		
rl	0.88	No	1.67	7.78	0.10	0.17	0.73	2.05	2.65	0.36	30.43	47.83
Goods exports												
rq	− 0.03	No	− 0.06	6.40	0.00	0.08	0.92	1.65	2.53	0.25		
rj	0.55	No	0.86	10.48	0.03	0.14	0.82	2.44	3.19	0.38		
rl	0.72	No	1.11	11.00	0.05	0.10	0.85	2.40	3.24	0.37	30.43	34.78
Services exports												
rq	− 0.18	No	− 0.23	15.19	0.00	0.01	0.98	1.57	3.89	0.37		
rj	1.28	No	1.57	18.21	0.09	0.31	0.61	3.41	4.07	0.80		
rl	1.60	Order 1, 2	0.23	28.32	0.09	0.38	0.53	3.91	5.07	0.92	30.43	21.74
Imports												
rq	− 0.08	No	− 0.18	4.18	0.00	0.08	0.92	1.60	2.04	0.36		
rj	1.16	No	1.88	10.95	0.12	0.20	0.69	2.55	3.10	0.56		
rl	1.27	Order 1	0.34	11.59	0.14	0.11	0.75	2.40	3.16	0.53	26.09	30.43
Goods imports												
rq	0.10	No	0.23	4.78	0.00	0.08	0.92	1.75	2.18	0.35		
rj	1.28	No	1.78	14.49	0.11	0.14	0.75	2.94	3.59	0.59		
rl	1.44	No	2.19	12.98	0.16	0.07	0.76	2.61	3.30	0.52	26.09	34.78
Services imports												
rq	− 0.75	No	− 1.04	13.42	0.04	0.06	0.90	1.53	3.59	0.36		
rj	0.82	No	1.24	11.52	0.06	0.46	0.51	2.77	3.29	0.65		
rl	0.65	No	0.65	25.57	0.02	0.48	0.50	3.75	5.02	0.87	17.39	17.39
Value added of goods production												
rq	− 0.15	No	− 0.63	1.50	0.02	0.17	0.82	0.83	1.22	0.15		
rj	− 0.22	No	− 0.43	6.58	0.01	0.05	0.93	1.79	2.56	0.31		
rl	− 0.65	No	− 1.52	4.97	0.08	0.08	0.84	1.70	2.13	0.30	39.13	34.78
Employment (employees)												
rq	− 0.03	Order 1	− 0.41	0.02	0.06	0.02	0.91	0.06	0.12	0.04		
rj	0.15	No	3.89	0.06	0.38	0.01	0.62	0.17	0.19	0.12		
rl	0.12	No	3.75	0.04	0.36	0.00	0.64	0.17	0.17	0.11	39.13	39.13

Source: WIFO calculations. – [1] Degree of consistency of sign between first and final release in percent.

Table 7: Statistical indicators, seasonally and calendar-adjusted, volumes

	MR	Auto-correlation	t statistic	MSR	UM	UR	UD	MAR	σ	RMAR	Sign test[1]	
											+	−
Gross Domestic Product												
rq	− 0.02	No	− 0.62	0.02	0.01	0.10	0.89	0.11	0.15	0.18		
rj	− 0.01	No	− 0.15	0.11	0.00	0.06	0.95	0.26	0.33	0.43		
rl	− 0.01	No	− 0.15	0.28	0.00	0.06	0.94	0.39	0.53	0.64	25.00	34.38
Private consumption expenditure total												
rq	− 0.00	No	− 0.20	0.01	0.00	0.11	0.89	0.05	0.07	0.17		
rj	− 0.02	No	− 0.56	0.05	0.01	0.14	0.80	0.17	0.21	0.60		
rl	− 0.01	Order 1, 2	− 0.03	0.05	0.00	0.19	0.81	0.16	0.21	0.57	18.75	34.38
Government consumption expenditure												
rq	0.06	Order 1, 2	0.30	0.10	0.03	0.16	0.81	0.14	0.32	0.26		
rj	− 0.01	No	− 0.13	0.30	0.00	0.09	0.91	0.39	0.54	0.71		
rl	0.00	No	0.01	0.24	0.00	0.02	0.98	0.35	0.49	0.63	34.38	37.50
Gross fixed investment												
rq	0.05	No	0.45	0.37	0.01	0.08	0.91	0.37	0.60	0.44		
rj	− 0.01	Order 1, 2	− 0.01	0.58	0.00	0.05	0.96	0.52	0.76	0.62		
rl	− 0.08	Order 1	− 0.07	1.03	0.01	0.16	0.83	0.76	1.01	0.91	28.13	37.50
Equipment investment												
rq	0.11	No	0.43	2.26	0.01	0.05	0.92	0.73	1.50	0.67		
rj	− 0.16	Order 1, 2	− 0.00	2.60	0.01	0.01	0.98	1.21	1.60	1.11		
rl	0.11	Order 1, 2	0.05	2.44	0.00	0.08	0.92	1.21	1.56	1.11	25.00	28.13
Machinery investment												
rq	− 0.01	No	− 0.05	1.27	0.00	0.10	0.90	0.60	1.13	0.62		
rj	− 0.11	Order 1, 2	− 0.01	1.74	0.01	0.02	0.98	1.02	1.32	1.05		
rl	0.12	Order 1	0.08	1.66	0.01	0.07	0.92	1.05	1.28	1.08	21.88	40.63
Transport equipment investment												
rq	0.12	No	0.57	1.52	0.01	0.01	0.98	0.87	1.23	0.53		
rj	− 0.02	Order 1, 2	− 0.00	11.65	0.00	0.16	0.85	2.75	3.41	1.67		
rl	0.08	Order 1, 2	0.02	11.46	0.00	0.19	0.81	2.70	3.38	1.64	25.00	18.75
Construction investment												
rq	0.10	No	1.09	0.26	0.04	0.13	0.79	0.36	0.50	0.52		
rj	0.40	No	2.30	1.15	0.14	0.24	0.64	0.86	1.00	1.23		
rl	− 0.06	No	− 0.37	0.94	0.00	0.41	0.58	0.72	0.97	1.03	31.25	28.13
Residential investment												
rq	0.16	No	1.45	0.44	0.06	0.10	0.84	0.49	0.64	0.63		
rj	0.24	No	1.25	1.26	0.05	0.47	0.50	0.79	1.10	1.01		
rl	0.41	Order 1	0.31	1.34	0.12	0.74	0.13	0.78	1.09	0.99	28.13	31.25
Non-residential investment												
rq	0.13	No	1.19	0.42	0.04	0.25	0.71	0.47	0.63	0.54		
rj	0.64	Order 1	0.40	2.29	0.18	0.28	0.55	1.23	1.37	1.42		
rl	− 0.20	Order 1, 2	− 0.10	2.78	0.01	0.24	0.74	1.34	1.65	1.55	28.13	18.75
Exports												
rq	− 0.16	No	− 0.98	0.86	0.03	0.24	0.74	0.54	0.91	0.40		
rj	− 0.27	Order 1, 2	− 0.00	2.02	0.04	0.15	0.81	0.94	1.40	0.70		
rl	− 0.22	Order 1, 2	− 0.11	2.15	0.02	0.10	0.88	1.03	1.45	0.77	31.25	37.50
Goods exports												
rq	− 0.11	No	− 0.64	1.01	0.01	0.13	0.86	0.69	1.00	0.41		
rj	− 0.54	Order 1, 2	− 0.00	3.91	0.08	0.22	0.72	1.23	1.90	0.73		
rl	− 0.44	Order 1, 2	− 0.18	3.67	0.05	0.05	0.90	1.28	1.86	0.76	25.00	34.38
Services exports												
rq	0.16	No	1.58	0.35	0.07	0.17	0.76	0.36	0.57	0.34		
rj	0.20	Order 1, 2	− 0.01	1.47	0.03	0.18	0.80	0.94	1.20	0.90		
rl	0.22	Order 1, 2	0.14	1.31	0.04	0.16	0.80	0.86	1.12	0.82	25.00	28.13
Imports												
rq	− 0.05	Order 1	− 0.05	0.76	0.00	0.04	0.96	0.57	0.87	0.63		
rj	− 0.26	Order 1, 2	− 0.00	2.27	0.03	0.11	0.86	1.04	1.49	1.16		
rl	− 0.22	Order 1, 2	− 0.09	2.72	0.02	0.08	0.90	1.18	1.64	1.32	25.00	31.25
Goods imports												
rq	− 0.23	Order 1	− 0.18	1.19	0.04	0.13	0.82	0.73	1.07	0.70		
rj	− 0.43	Order 1, 2	− 0.00	2.80	0.07	0.16	0.77	1.18	1.62	1.13		
rl	− 0.36	Order 1, 2	− 0.15	2.79	0.05	0.09	0.86	1.20	1.63	1.15	31.25	25.00
Services imports												
rq	0.10	No	1.21	0.24	0.04	0.00	0.96	0.31	0.48	0.47		
rj	0.23	Order 1, 2	− 0.00	1.56	0.03	0.04	0.93	1.05	1.23	1.61		
rl	0.06	Order 1, 2	0.03	1.85	0.00	0.01	0.99	1.10	1.36	1.68	28.13	34.38
Value added of goods production												
rq	− 0.08	No	− 0.66	0.48	0.01	0.20	0.78	0.43	0.69	0.28		
rj	0.04	Order 1, 2	− 0.01	1.26	0.00	0.00	1.00	0.91	1.12	0.58		
rl	− 0.19	No	− 0.78	2.02	0.02	0.15	0.83	1.06	1.41	0.68	21.88	31.25
Employment (employees)												
rq	− 0.01	No	− 0.84	0.00	0.02	0.01	0.97	0.02	0.05	0.06		
rj	0.02	Order 1, 2	− 0.04	0.03	0.02	0.04	0.95	0.11	0.17	0.28		
rl	0.02	Order 1, 2	0.11	0.02	0.02	0.26	0.72	0.09	0.12	0.22	37.50	34.38

Source: WIFO calculations. – [1] Degree of consistency of sign between first and final release in percent.

Table 8: Statistical indicators, seasonally and calendar-adjusted, volumes – without crisis years 2008 and 2009

	MR	Auto-correlation	t statistic	MSR	UM	UR	UD	MAR	σ	RMAR	Sign test[1]	
											+	−
Gross Domestic Product												
rq	− 0.00	No	− 0.14	0.02	0.00	0.09	0.91	0.11	0.15	0.20		
rj	0.03	No	0.49	0.09	0.01	0.09	0.84	0.23	0.30	0.42		
rl	0.07	Order 1, 2	0.20	0.11	0.04	0.03	0.93	0.29	0.33	0.53	26.09	26.09
Private consumption expenditure total												
rq	0.01	No	0.71	0.00	0.02	0.11	0.87	0.04	0.07	0.16		
rj	− 0.02	Order 1, 2	0.12	0.04	0.01	0.01	0.95	0.14	0.19	0.52		
rl	− 0.02	Order 1, 2	− 0.08	0.04	0.01	0.06	0.93	0.15	0.20	0.54	17.39	43.48
Government consumption expenditure												
rq	0.03	No	1.00	0.02	0.04	0.08	0.88	0.08	0.13	0.19		
rj	0.01	Order 1	0.02	0.18	0.00	0.26	0.70	0.33	0.43	0.81		
rl	− 0.01	No	− 0.22	0.11	0.00	0.07	0.92	0.24	0.33	0.58	30.43	34.78
Gross fixed investment												
rq	0.14	No	1.60	0.22	0.09	0.01	0.89	0.29	0.44	0.41		
rj	0.26	Order 1, 2	0.04	0.39	0.17	0.25	0.60	0.42	0.57	0.60		
rl	0.13	Order 1, 2	0.12	0.54	0.03	0.06	0.91	0.58	0.72	0.83	26.09	39.13
Equipment investment												
rq	0.25	No	0.76	2.75	0.02	0.20	0.74	0.76	1.64	0.71		
rj	0.30	Order 1, 2	0.01	2.35	0.04	0.38	0.60	1.11	1.50	1.04		
rl	0.32	Order 1, 2	0.15	2.59	0.04	0.15	0.81	1.23	1.58	1.15	26.09	34.78
Machinery investment												
rq	0.04	No	0.18	1.59	0.00	0.19	0.81	0.69	1.26	0.70		
rj	0.24	Order 1	0.18	1.32	0.04	0.50	0.46	0.94	1.13	0.95		
rl	0.32	Order 1, 2	0.21	1.48	0.07	0.08	0.85	1.03	1.17	1.04	26.09	39.13
Transport equipment investment												
rq	0.21	No	0.77	1.83	0.02	0.05	0.93	0.94	1.34	0.73		
rj	0.56	Order 1, 2	0.01	9.46	0.03	0.24	0.74	2.58	3.02	2.01		
rl	0.34	Order 1, 2	0.07	10.69	0.01	0.26	0.73	2.56	3.25	1.99	26.09	17.39
Construction investment												
rq	0.17	No	1.92	0.22	0.13	0.00	0.87	0.33	0.43	0.62		
rj	0.65	Order 1	0.82	0.85	0.49	0.09	0.43	0.75	0.66	1.43		
rl	0.14	Order 1, 2	0.14	0.51	0.04	0.37	0.59	0.54	0.70	1.04	30.43	21.74
Residential investment												
rq	0.25	No	2.43	0.34	0.19	0.05	0.76	0.45	0.52	0.68		
rj	0.39	No	2.42	0.79	0.19	0.39	0.44	0.63	0.80	0.96		
rl	0.30	Order 1, 2	0.30	0.66	0.14	0.65	0.21	0.63	0.75	0.96	26.09	30.43
Non-residential investment												
rq	0.29	No	3.05	0.31	0.27	0.08	0.65	0.42	0.47	0.60		
rj	1.04	No	4.73	2.30	0.47	0.10	0.43	1.26	1.10	1.80		
rl	0.27	Order 1	0.17	1.63	0.04	0.20	0.76	1.10	1.25	1.56	26.09	17.39
Exports												
rq	0.01	No	0.07	0.46	0.00	0.00	1.00	0.43	0.68	0.34		
rj	0.27	No	1.85	0.61	0.12	0.11	0.74	0.56	0.73	0.44		
rl	0.33	No	1.80	0.94	0.12	0.18	0.71	0.68	0.91	0.54	30.43	34.78
Goods exports												
rq	0.08	No	0.48	0.63	0.01	0.01	0.98	0.58	0.79	0.36		
rj	− 0.01	No	− 0.05	0.98	0.00	0.01	0.96	0.69	0.99	0.43		
rl	0.14	No	0.56	1.60	0.01	0.16	0.82	0.96	1.26	0.59	26.09	30.43
Services exports												
rq	0.20	No	1.85	0.34	0.12	0.27	0.61	0.34	0.55	0.35		
rj	0.60	No	4.34	0.83	0.43	0.42	0.15	0.66	0.69	0.68		
rl	0.51	Order 1, 2	0.46	1.01	0.25	0.35	0.39	0.68	0.87	0.70	30.43	21.74
Imports												
rq	0.11	No	0.69	0.61	0.02	0.09	0.89	0.51	0.78	0.55		
rj	0.33	No	1.72	1.03	0.11	0.06	0.82	0.72	0.96	0.78		
rl	0.37	No	1.65	1.36	0.10	0.06	0.84	0.87	1.11	0.94	21.74	30.43
Goods imports												
rq	0.00	No	0.01	0.62	0.00	0.01	0.99	0.58	0.79	0.54		
rj	0.11	Order 1, 2	0.03	0.94	0.01	0.01	0.97	0.74	0.96	0.69		
rl	0.21	No	0.96	1.20	0.04	0.02	0.95	0.84	1.08	0.78	30.43	21.74
Services imports												
rq	0.12	No	1.13	0.31	0.05	0.02	0.94	0.37	0.55	0.60		
rj	0.83	No	7.13	1.02	0.67	0.07	0.26	0.86	0.58	1.40		
rl	0.46	Order 1	0.31	1.78	0.12	0.23	0.65	1.04	1.25	1.70	26.09	30.43
Value added of goods production												
rq	− 0.16	No	− 1.13	0.54	0.05	0.10	0.85	0.44	0.72	0.31		
rj	0.19	Order 1, 2	0.03	1.22	0.03	0.24	0.68	0.89	1.09	0.63		
rl	− 0.10	No	− 0.48	1.11	0.01	0.57	0.42	0.83	1.05	0.60	17.39	26.09
Employment (employees)												
rq	− 0.01	No	− 0.74	0.00	0.02	0.02	0.96	0.03	0.05	0.08		
rj	0.02	No	1.36	0.01	0.07	0.14	0.78	0.07	0.09	0.17		
rl	0.02	No	1.37	0.00	0.07	0.02	0.91	0.05	0.07	0.13	34.78	30.43

Source: WIFO calculations. – [1] Degree of consistency of sign between first and final release in percent.

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