STAFF MEMO

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Abstract

I investigate revisions of growth rates in nominal and real quarterly GDP for mainland Norway, as well as for the GDP deflator, from 2004 to 2016. Several measures from alternative revision periods are computed. Mean revisions of real GDP are small and close to zero, while nominal GDP and the deflator are under-predicted on average when they are first published. For all three variables, mean absolute revisions are quite substantial. Revisions can, in general, be explained by the arrival of new information, although revisions of the deflator in particular are also characterized as reducing noise.

1 Introduction

Statistics Norway publish national accounts data for each quarter around 50 days after the end of the quarter. When figures for a new quarter are published, previously published figures for earlier quarters are revised. Data for all quarters of year $(t-2)$ are final in August of year (t), when year $(t-2)$ becomes the new base year. The base year is moved forward every year (with some exceptions). Hence, figures for the first quarter of any given year are final after 10 quarters, while figures for the fourth quarter of any year are final after 7 quarters. In this analysis, I regard the figures for the 11th releases as final.[1]

Monetary policy is conducted in real time. It is therefore important to know to what extent early releases of economic data are likely to be revised between the first and the final release and whether the revisions can be predicted. Revisions of growth rates in nominal and real quarterly GDP for mainland Norway, as well as for the GDP deflator, are investigated here.

Mean revisions of seasonally adjusted real growth in GDP are very close to zero, hence there is no tendency for the first released data to either over- or under-predict the final data. First releases of nominal GDP and the deflator somewhat under-predict final figures. In absolute terms, revisions are quite substantial for both real and nominal GDP as well as for the deflator. Revisions are at least as large from the 5th to the 11th release as from the first to the 5th release. When revisions are scaled by the size of the actual growth rates, I find the largest revisions in the deflator, particularly in the four-quarter growth rates.

For some measures, results differ depending on whether the data are seasonally adjusted or unadjusted. This is most notable for mean revisions. Seasonal adjustment appears to reduce bias in the first releases for quarterly as well as for four-quarterly growth in real GDP.

Even if revisions are sizable, early estimates could still be efficient estimates of the

[1] Prior to 2016, data were final and the new base year was changed each November.

"true" or final data. This will be the case if revisions are characterized as containing news. If, on the other hand, revisions mainly reduce noise in earlier estimates, early information can be used to forecast the revisions and hence improve the estimate of the "true" data. It turns out that revisions of quarterly, seasonally adjusted growth rates from the first release to final data are mainly characterized as containing news, even if some preliminary revisions also reduce noise. This means that the first released growth rates of real and nominal GDP and the deflator can be interpreted as efficient forecasts of the final data. The results depend on whether the data are seasonally adjusted. Revisions of unadjusted growth rates reduce noise to a greater extent than is the case for seasonally adjusted data.

In section 2, I first discuss some aspects of the revision process. In section 3, several measures are constructed to illustrate the size and nature of the revisions: mean revision (MR), mean absolute revision (MAR), relative mean absolute revision (RMAR), root mean square revision (RMSR), noise-to-signal ratio (N/S) and sign revision (SR). The measures are computed for alternative revision periods. In section 4, the "news-vs-noise" hypotheses are tested formally. Finally, I summarize the results in section 5.

2 Revisions of Quarterly National Accounts

Quarterly national accounts (QNA) series are published as unadjusted data by Statistics Norway (SN). Seasonally adjusted data are also published in order to facilitate analysis of business cycle developments. Until November 2011, data from the start of QNA compilation (first quarter of 1978) to the last published quarter were seasonally adjusted at a disaggregate level (the indirect method), and the adjusted data were then added up to obtain the main aggregates. For the base year, which is changed every year, and the following years, this method ensured consistency between the main aggregate and its disaggregate components. For the period prior to the base year, however, chain-linked disaggregated series were no longer additive. Hence, an increasing wedge between the levels of unadjusted and seasonally adjusted data appeared moving back in time, see figure 1. Also, substantial revisions to quarterly seasonally adjusted data regularly occurred many years after the unadjusted data were understood to be final.

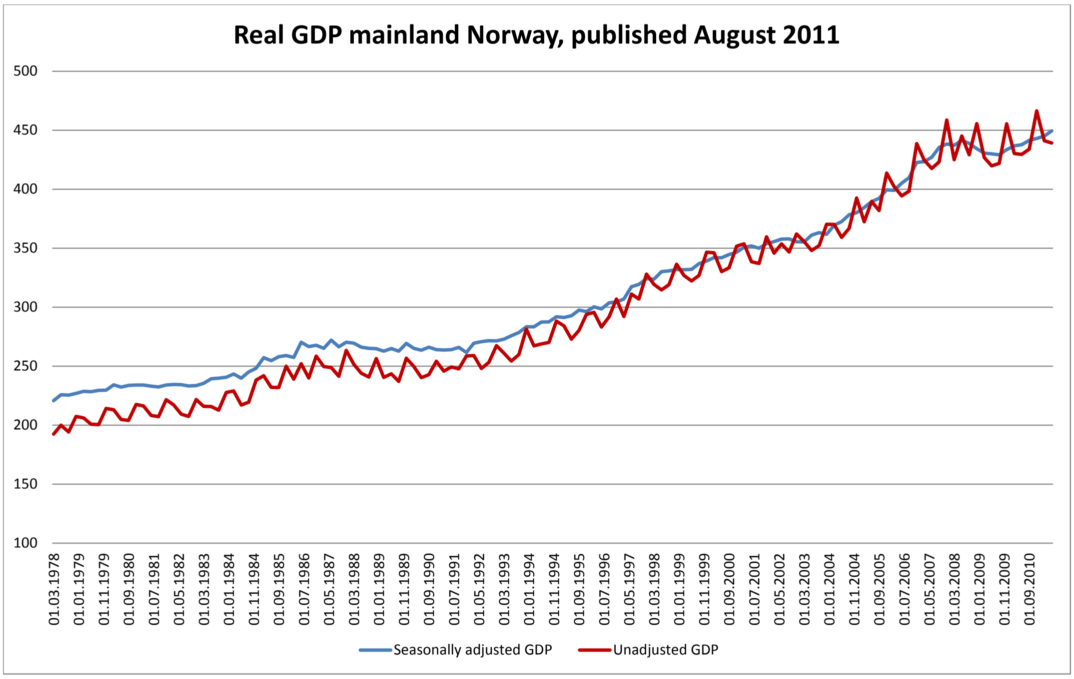


Figure 1. *Seasonally adjusted and unadjusted real mainland GDP*

There were two main problems associated with the resulting seasonally adjusted data. Econometric models based on seasonally adjusted data would rely on levels that deviated from the levels of the unadjusted data, hence average historical growth rates would be systematically different. Furthermore, turning points of historical economic cycles would move around.

In November 2011, SN changed their seasonal adjustment method for obtaining main aggregates by using seasonally adjusted main aggregates (the direct method) for data prior to the base year. The published seasonally adjusted series are now a combination of the direct method, for the years prior to the year before the base-year, and the indirect method, for the year before the base-year and the following years. When the base year is changed, historical seasonal factors are kept unchanged. Revisions in seasonally adjusted final data are thus solely due to revisions in unadjusted data.[2]

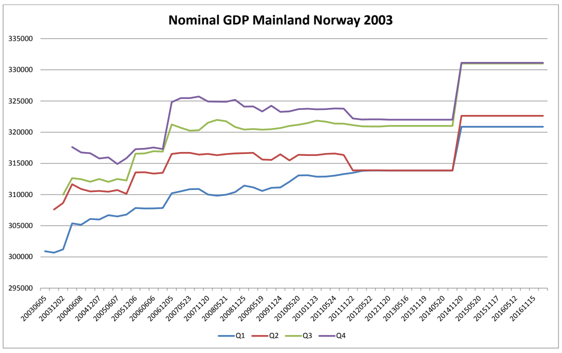
Revisions of unadjusted data are of the following types:

- Information-based changes throughout the year
- Base year changes every year
- Main revisions
  - Main revisions in the investigated period (2004 - 2016):
    * 2006: Changes in the treatment of financial intermediation services
    * 2011: New grouping of industries (SN2007).
    * 2014: New treatment of research and development expenses (2008SNA and ESA2010).

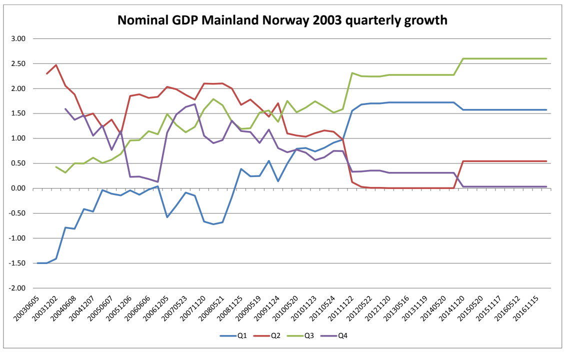
When quarterly national accounts for the second quarter of year t are published in August, figures for the year t-2 become final, and the year t-2 is the new base year. Prior to 2016 this revision occurred in November, when national accounts for the third quarter were published. Hence, for most of the period, data for the first quarter of year t-2 will be final with the 11th release, while data for the fourth quarter will be final with the 8th release. To avoid revisions occurring from 11 quarters onwards, which could be substantial for seasonally adjusted data for most of the period analyzed here, I concentrate on revisions up to 11 quarters after the initial release and regard these releases as approximate final data. The main revisions in 2006, 2011 and 2014 are not treated separately. As a check of the results, part of the analysis was redone, with the vintage prior to the main revision in 2014 as the last vintage. According to Statistics Norway, the 2014 revision increased the level of GDP by 1.5 to 2.1 percent. This exercise did not change any results. See the appendix for details. The revision in 2011 resulted in only minor level changes.

Figure 2 shows revisions to quarterly, seasonally adjusted GDP (mainland Norway) for 2003, from the vintage released in June 2003 to the vintage released in February 2017.

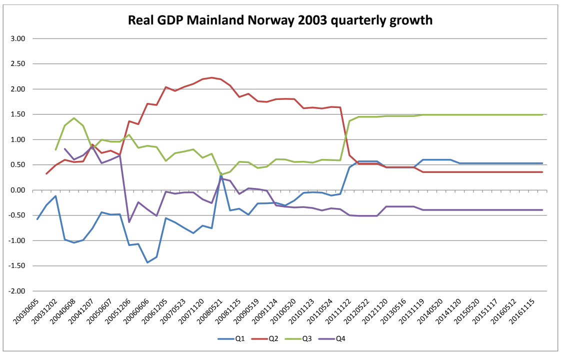
[2]This is explained in detail on Statistics Norway's website.



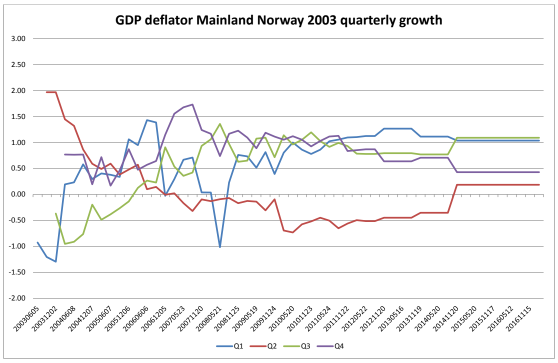
(a) Nominal level



(b) Nominal growth



(c) Real growth



(d) Deflator growth

Figure 2. *Revisions of seasonally adjusted mainland GDP, 2003*

The upper part of the panel illustrates revisions to nominal GDP levels and quarterly growth. We see shifts in nominal levels connected to the main revisions in 2006 and 2014. The change in the method of seasonal adjustment from November 2011 is likewise clearly evident. Measured as quarterly growth rates, we find the largest revision of the growth rate for the first quarter of 2003, which starts at -1.50 percent and is currently a good 1.50 percent - a change of 3 percentage points. On the other hand, growth in the second quarter starts at 2.3 percent and is currently 0.5 percent. Upwards and downwards revisions within a year would reduce average revisions for the year as a whole, but average annual growth in 2003 is still subject to large revisions varying between -1 to $2\frac{3}{4}$ percentage points since 2004.

The lower part of the panel shows revisions of seasonally adjusted real growth and growth in the deflator. For 2003, the increased level of nominal GDP in 2014 was primarily due to revisions of the price level. Real growth rates did not change.[3] In the May 2008 release, we see that real growth in the first quarter of 2003 increases temporarily by 1 percentage point from the previous release. An opposite movement in the deflator means that the nominal growth rate for this quarter was virtually unchanged. There are no revisions in the corresponding unadjusted growth rates, which again illustrates the problems connected to seasonal adjustment prior to November 2011.

3 The nature of revisions

Let y_t^τ denote the release of the value for y_t obtained at time τ. y_t is a quarterly growth rate, either a quarter-to-quarter rate or the growth from the same quarter the year before (the four-quarter growth rate). The first release of national accounts data is published around 50 days after the end of the quarter, and we denote this y_t^{t+1}. The first revision is published after one quarter, i.e. when the first release of y_{t+1} is published. Revisions from p to s are denoted $R_t^{s,p} = y_t^{t+s} - y_t^{t+p},\ s > p,\ s = 2, 5, 11,\ p = 1, 2, 5$.

The first vintage analyzed here was published in June 2004. The last vintage was published in February 2017. Since we lose 10 observations at the end of the sample, the total number of observations is 42.

[3]This was not the case for revisions of the following years, where real growth as well as growth in the deflator are revised. See appendix for revisions of the quarters of 2004.

We analyze the following revision periods:

Initial to 11th release: Revisions from the initial to the 11th release cover the whole revision process.

Initial to 2nd release: With the second release, the statistical agency has collected more information, and some forecasted values can be replaced by actual indicator values.

2nd to 5th release: With the 5th release, Statistics Norway has collected a larger set of more precise annual data.

Initial to 5th release: Revisions over the early part of the revision period.

5th to 11th (or "final") release: Remaining revisions in the latter part of the revision period.

Even if national accounts data are considered to be final after 11 releases, we observe revisions in subsequent releases, due to base year changes. Revisions of growth rates should be minor, since the base year is changed every year and the revised series are constructed by chaining backwards with historical growth in fixed prices. This would in particular be the case for unadjusted data. For seasonally adjusted data, revisions can be substantial in vintages published prior to November 2011, but revisions should be minor thereafter.

The measures we consider illustrate the size and nature of the revisions:

Mean revision (MR): The size of the mean revision will indicate if the preliminary releases on average are over- or underestimated. For different values of s and p, we compute

$$\frac{1}{T}\sum_{t=1}^{T} R_t^{s,p},$$

where $T = T - max(s)$.[4]

Mean absolute revision (MAR): The size of the mean absolute revision measures the average size of the revisions, regardless of the sign of the revisions. For different values of s and p, we compute

$$\frac{1}{T}\sum_{t=1}^{T} |R_t^{s,p}|,$$

where $T = T - max(s)$.

Relative mean absolute revision (RMAR): The relative mean absolute revision is the MAR scaled by the size of the earlier estimates. With this measure we can compare revisions over different variables and different transformations. In addition, it can be interpreted as the expected proportion of the earlier estimate that is likely to be revised over the revision interval being considered. For different values of s and p, we compute

$$\frac{\sum_{t=1}^{T} |R_t^{s,p}|}{\sum_{t=1}^{T^s} |y_t^{t+p}|},$$

where $T = T - max(s)$.

[4] The number of observed revisions is equal for all revision periods.

Root mean square revision (RMSR): The root mean square revision combines the spread of revisions around their mean with the degree of bias in the revisions. If there is no bias, the RMSR is equal to the standard deviation. The RMSR is computed as

$$\sqrt{\frac{1}{T}\sum_{t=1}^{T}(R_t^{s,p})^2},$$

where $T = T - max(s)$.

Noise/signal ratios (N/S): The noise-to-signal ratio is the RMSR divided by the standard deviation of the later vintage. A ratio greater than 1 indicates that revisions are noisy compared to the "signal", or the later vintage. The N/S is computed as

$$\frac{\sqrt{\frac{1}{T}\sum_{t=1}^{T}(R_t^{s,p})^2}}{\sqrt{\frac{1}{T}\sum_{t=1}^{T}(y_t^{t+s}-\bar{y}^{t+s})^2}},$$

where $\bar{y}^{t+s}$ denotes the mean of the end release y_t^{t+s} and $T = T - max(s)$.

Sign revisions (SR): For fixed s and p, we calculate the frequency over time with which y_t^{t+s} and y_t^{t+p} have the same sign. Formally,

$$\frac{1}{T}\sum_{t=1}^{T} 1_{[\text{sign}(y_t^{t+s})=\text{sign}(y_t^{t+p})]}(t),$$

where $1_{[\cdot]}(\cdot)$ denotes the indicator function and $T = T - max(s)$.

Figures 3 to 8 demonstrate the six measures for the five revision periods. Each figure has four parts, with quarterly growth in the upper part and four-quarter growth in the lower part. On the left-hand side, growth rates are seasonally adjusted, while growth rates on the right-hand side are unadjusted. We would expect that measures calculated for unadjusted and seasonally adjusted four-quarter growth rates would be quite similar, but this is not always the case.

In all figures, the first bar shows the total revision from the initial to the 11th release. The three following bars show revisions from the initial to the 5th release in detail, while the final bar shows revisions from the 5th to the 11th release. The three variables, nominal and real GDP and the GDP deflator, are shown together in all the figures.

Figure 3(a) illustrates that mean revisions of quarterly, seasonally adjusted real GDP growth rates are close to 0. Growth in nominal GDP and the deflator tend to be underestimated at the first release and subsequently revised upwards by 0.1 percentage point from the first to the 11th release. Measured in per cent of average growth rates for the respective series, nominal GDP is revised by around 5 percent, while revisions of the deflator are larger at around 9 percent. Revisions occur throughout the revision period. Finally, note that nominal GDP and the deflator are revised downwards from the first to the second release.

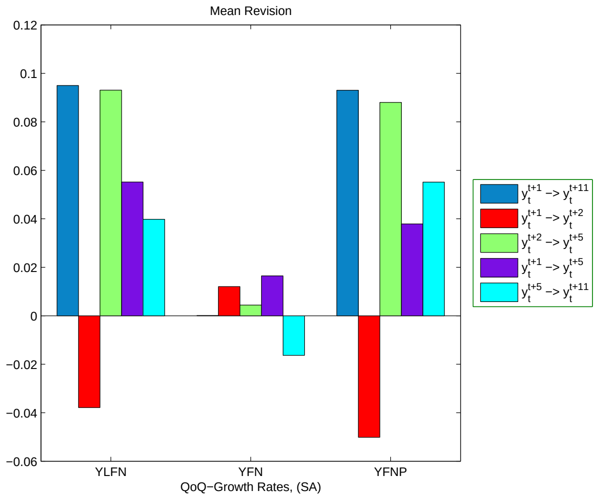
In figure 3(b) it is interesting to note that for unadjusted data, revisions are larger for real GDP than for nominal GDP and the deflator. Moreover, unadjusted growth in the deflator is slightly overestimated at the first release, contrary to results for seasonally adjusted growth. Hence, seasonal adjustment may change the magnitude and the direction of mean revisions.

In the lower part of the panel, results for four-quarter rates are roughly similar to results for quarterly growth rates.

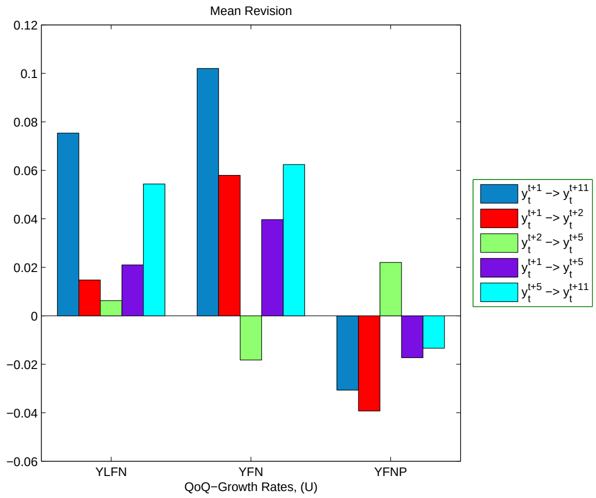
Mean revisions are only indicative of the overall tendency to over- or underpredict. Revisions in opposite directions cancel each other out. The actual sizes of the revisions are illustrated by calculating the mean absolute revisions (MAR), see figure 4. The pattern of revisions looks quite similar for all variables in all panels. Revisions are distributed quite evenly through the revisions period. The magnitude of the revisions is also relatively similar when comparing unadjusted and seasonally adjusted growth rates. There is a tendency for the mean absolute revisions to be smaller for real GDP than for the two other variables, and for revisions of seasonally adjusted quarterly rates to be smaller than for unadjusted rates.

To further illustrate the actual sizes of the revisions, we compute relative mean absolute revisions (RMAR), see figure 5. After scaling mean absolute revisions from figure 4 by the size of the earlier estimates, it becomes clear that quarterly seasonally adjusted growth rates are revised more than the corresponding unadjusted growth rates, with the notable exception of the deflator. The GDP deflator tends to be more heavily revised than real and nominal GDP for all alternative growth rates and adjustments. When scaled by the size of earlier estimates, it is no longer true that mean absolute revisions are markedly larger for nominal GDP than for real GDP.

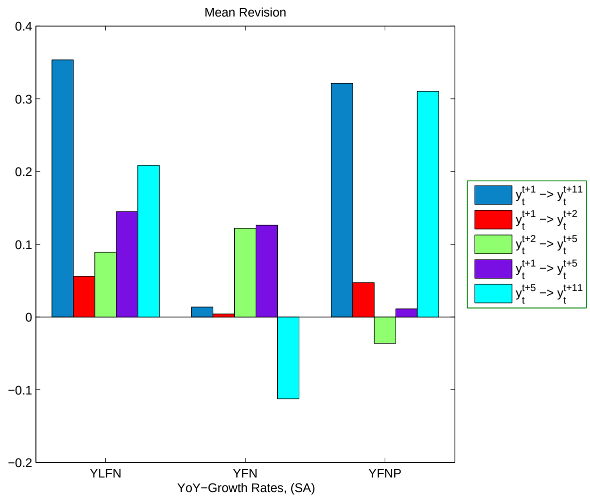
The measures RMSR, N/S and SR depicted in figures 6 to 8, respectively, shed further light on the revisions. The RMSR can be interpreted as the standard deviation of the revisions, adjusted for bias. RMSRs are larger for nominal GDP than for real GDP. The noise-to-signal ratios - RMSR divided by the standard deviation of the later vintage - in figure 7 illustrate that for seasonally adjusted quarterly growth rates, the three variables are almost equally noisy, in particular measured over the complete revision period. The ratios are all below 1, indicating that revisions are not noisy compared with the signal, i.e. the later vintage. The results are different for unadjusted quarterly growth rates and for the four-quarter rates. For the deflator, the RMSR from the first to the 11th release is larger than the standard deviation of the 11th release, indicating that information from the first releases can be interpreted as noisy. Contrary to the results for the deflator, noise-to-signal ratios for nominal and real GDP are low, in particular for unadjusted quarterly growth. Finally, sign ratios in figure 8 are below 1 for the quarterly growth rates for all variables, suggesting that an increase in the level of GDP or the deflator may later be revised to a decline (and vice versa).



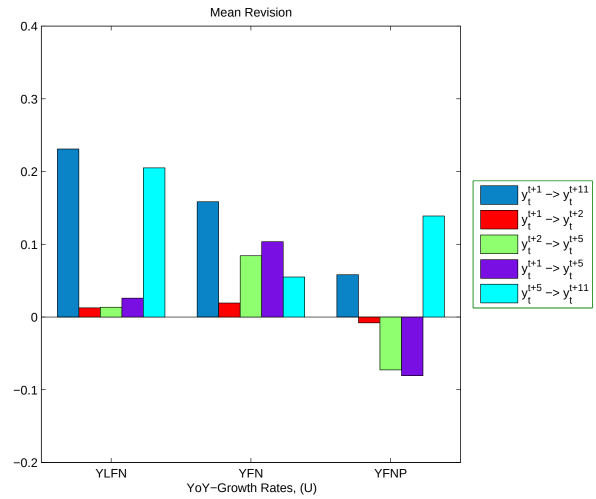
(a) Quarterly growth, seasonally adjusted



(b) Quarterly growth, unadjusted

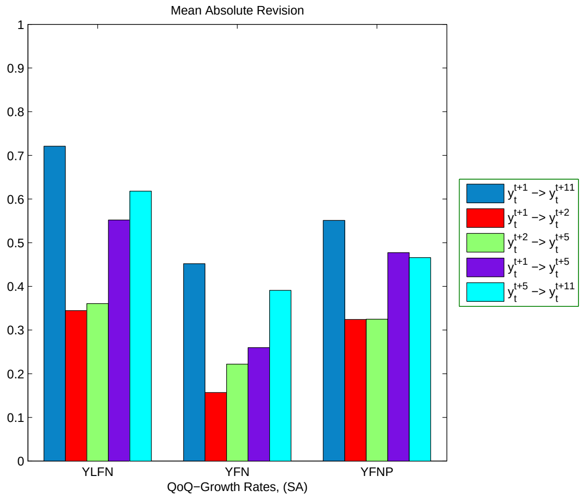


(c) Four-quarter growth, seasonally adjusted

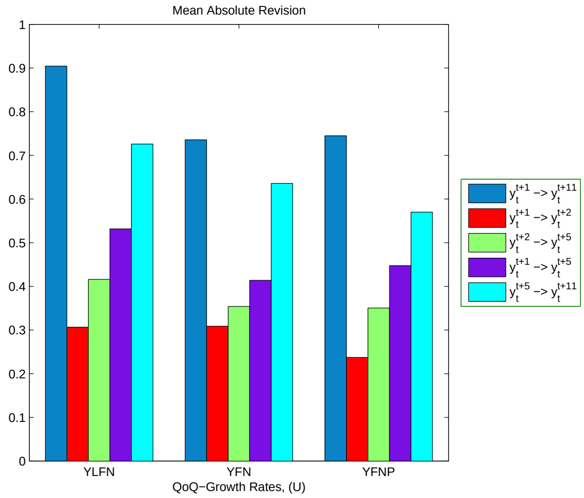


(d) Four-quarter growth, unadjusted

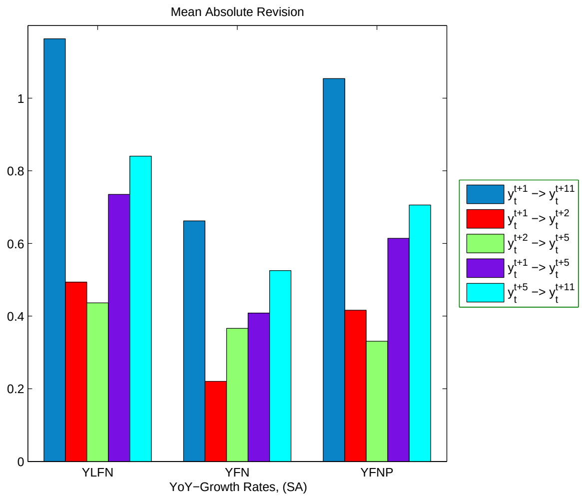
Figure 3. *Mean revisions (MR). GDP mainland Norway. Nominal (YLFN), real (YFN) and deflator (YFNP). Percent*



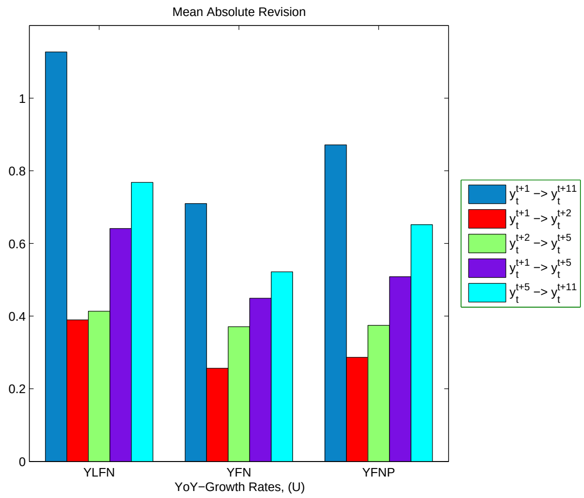
(a) Quarterly growth, seasonally adjusted



(b) Quarterly growth, unadjusted

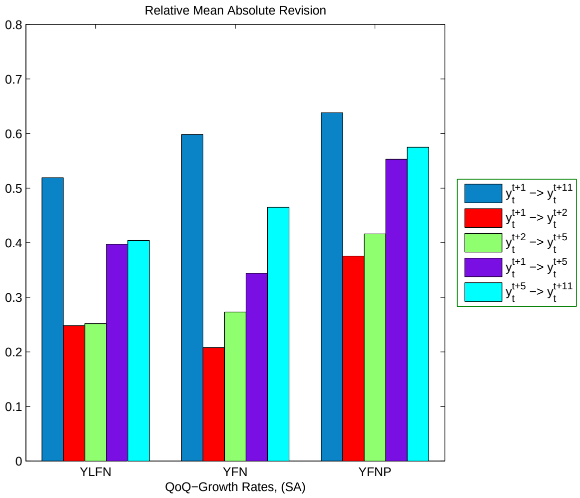


(c) Four-quarter growth, seasonally adjusted

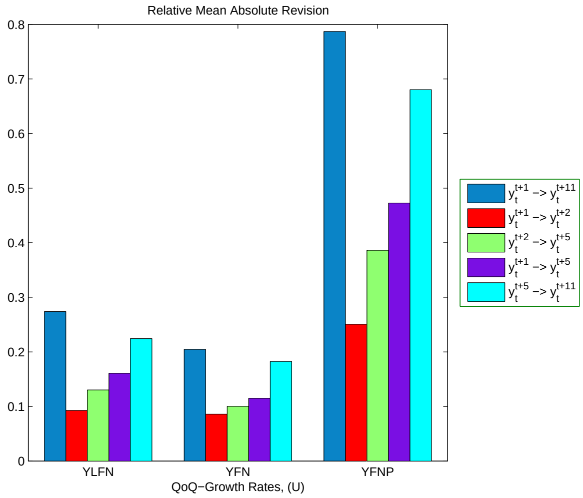


(d) Four-quarter growth, unadjusted

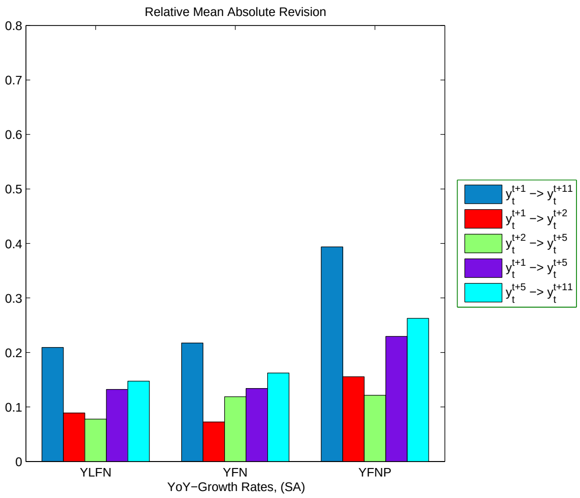
Figure 4. *Mean absolute revisions (MAR). GDP mainland Norway. Nominal (YLFN), real (YFN) and deflator (YFNP). Percent*



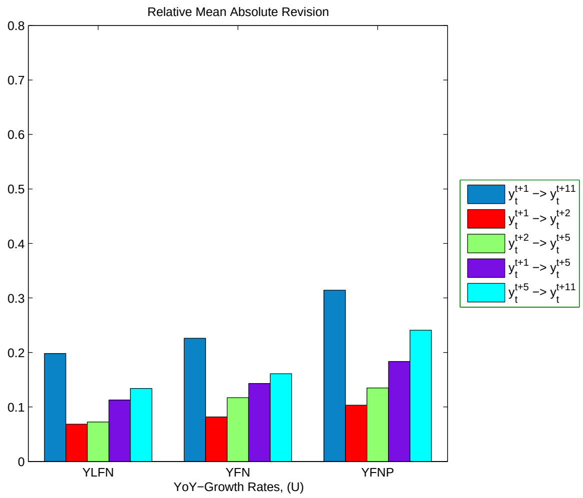
(a) Quarterly growth, seasonally adjusted



(b) Quarterly growth, unadjusted

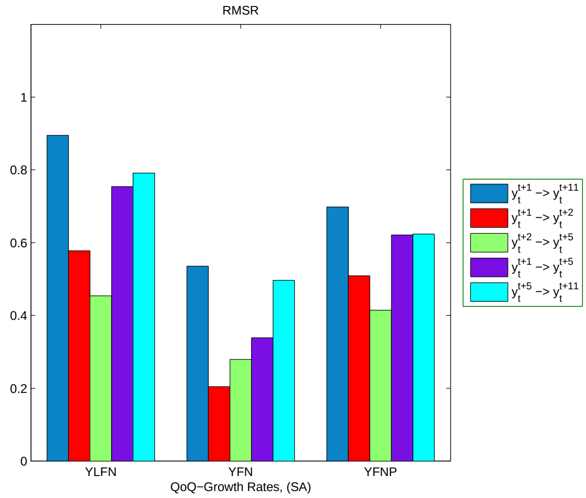


(c) Four-quarter growth, seasonally adjusted

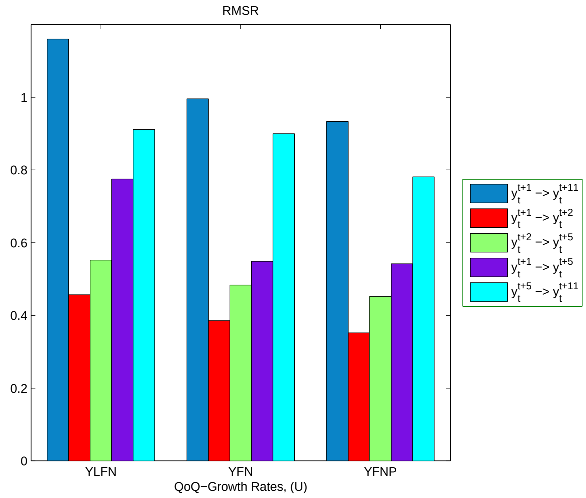


(d) Four-quarter growth, unadjusted

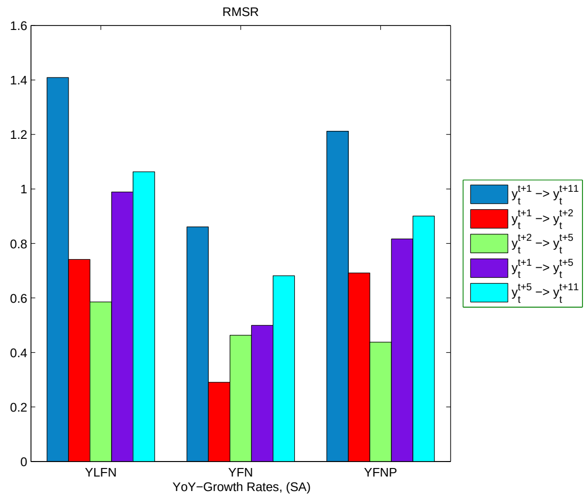
Figure 5. *Relative mean absolute revisions (RMAR). GDP mainland Norway. Nominal (YLFN), real (YFN) and deflator (YFNP). Proportion*



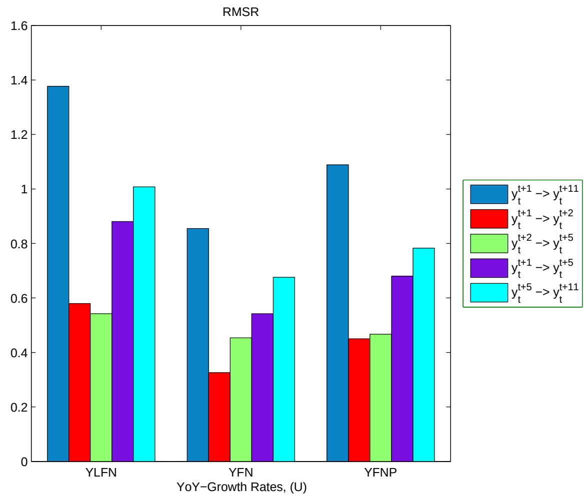
(a) Quarterly growth, seasonally adjusted



(b) Quarterly growth, unadjusted

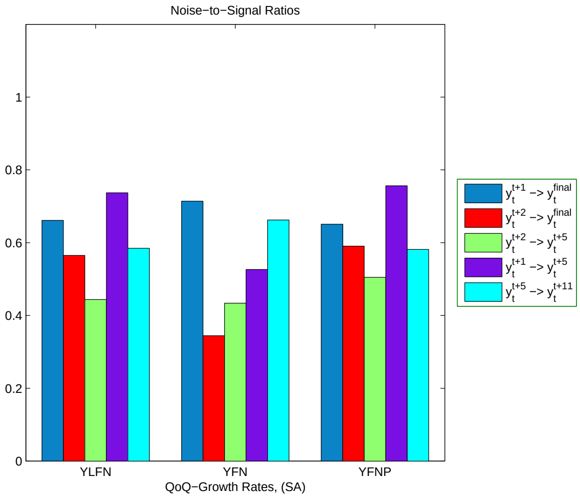


(c) Four-quarter growth, seasonally adjusted

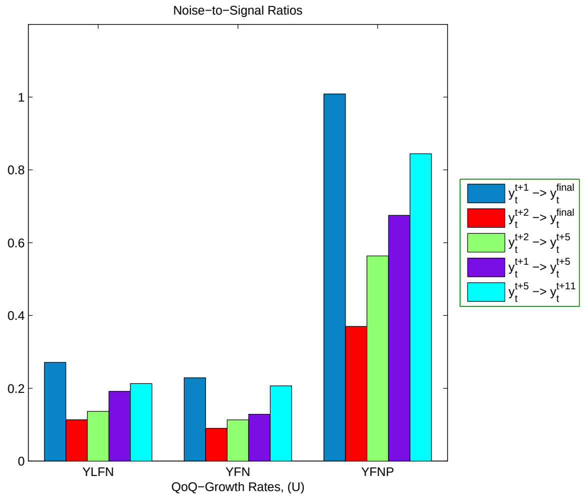


(d) Four-quarter growth, unadjusted

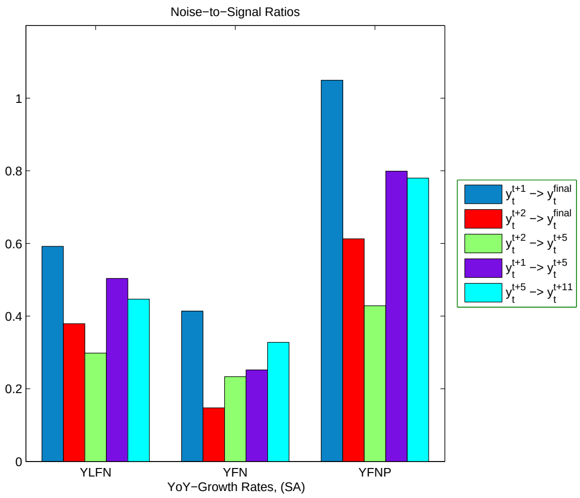
Figure 6. *Root mean square revisions (RMSR). GDP mainland Norway. Nominal (YLFN), real (YFN) and deflator (YFNP). Percent*



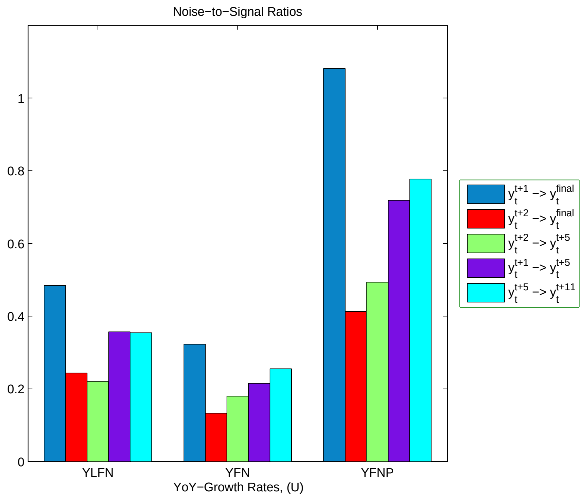
(a) Quarterly growth, seasonally adjusted



(b) Quarterly growth, unadjusted

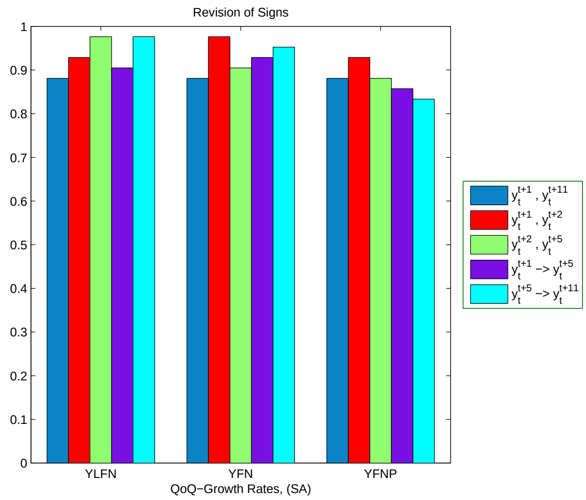


(c) Four-quarter growth, seasonally adjusted

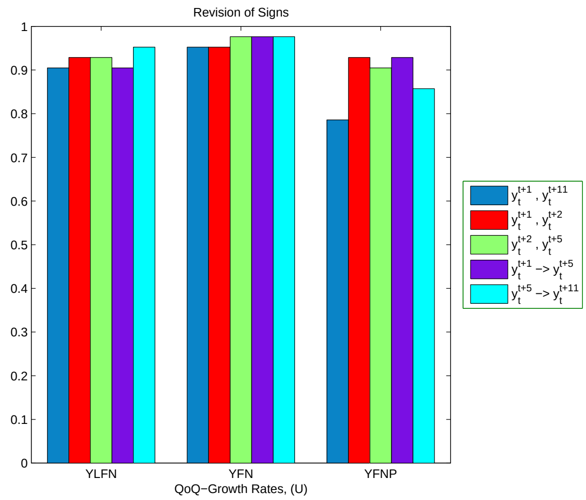


(d) Four-quarter growth, unadjusted

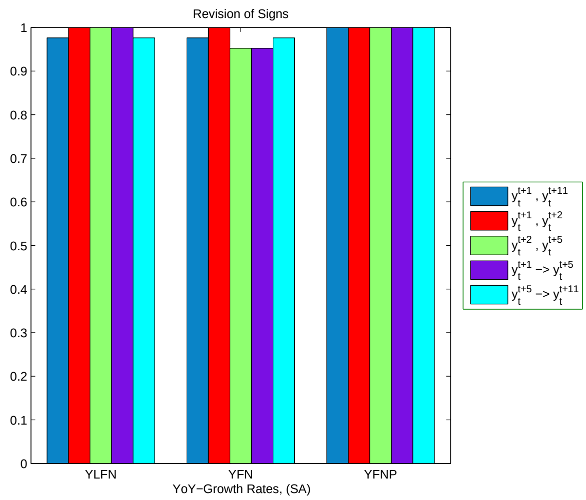
Figure 7. *Noise-to-signal ratios (NS). GDP mainland Norway. Nominal (YLFN), real (YFN) and deflator (YFNP). Percent*



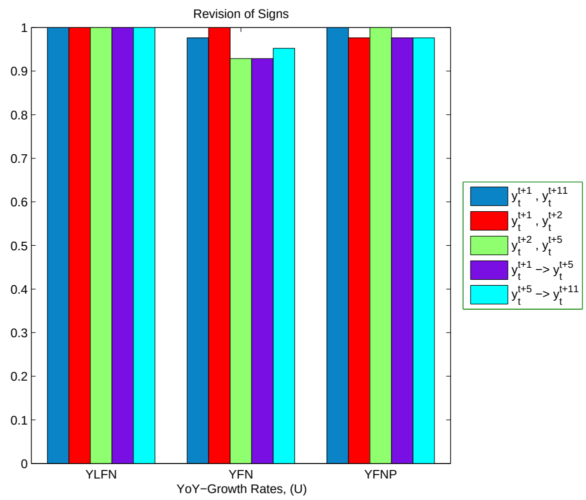
(a) Quarterly growth, seasonally adjusted



(b) Quarterly growth, unadjusted



(c) Four-quarter growth, seasonally adjusted



(d) Four-quarter growth, unadjusted

Figure 8. *Sign ratios (SR). GDP mainland Norway. Nominal (YLFN), real (YFN) and deflator (YFNP). Percent*

4 News and noise

The concept of "news versus noise" analysis was originally introduced by Mankiw et al. (1984), with an application to revisions of the money stock. See also Croushore and Stark (2003) for an application to revisions of national accounts data. When a revision to an economic variable is characterized by "noise", the new release of the data eliminates (or reduces) noise in earlier releases. At the other end of the spectrum, revisions contain "news" if the new release incorporates information that was not available earlier. In this case, the early release is an efficient estimate of later releases. The distinction has important consequences for modeling the revision process. If revisions reduce noise in earlier estimates of the "true" or final data, there is a measurement error in early estimates that is reduced over time. Revisions are correlated with earlier releases and uncorrelated with the revised data. Revisions are then (partially) predictable, and an improved estimate of the final value can be obtained from the history of observed revisions. If, on the other hand, revisions can be characterized as containing news, the revisions are correlated with the revised data and uncorrelated with earlier releases of the data. Hence, revisions cannot be predicted, and the preliminary release can then be interpreted as an efficient estimate of the later releases.

These two polar opposites of the revision process can be investigated by running OLS regressions of the revisions on alternative releases of the data. To test the hypothesis that revisions from the *p-th* published value to the *s-th* published value are news, and therefore unpredictable, the following regression is run for four alternative revision periods:

$$y_t^{t+s} - y_t^{t+p} = \alpha_1 + \beta_1 y_t^{t+p} + \varepsilon_t. \tag{1}$$

s > p, s = 2, 5, 11, p = 1, 5 and ε_t is a white noise residual. Again, y_t^τ denotes the release of the value for the quarterly variable y_t obtained at time τ. The first release of national accounts data is published in the quarter after the actual value, y_t^{t+1}.

Unpredictability of revisions, or the news hypothesis, is equivalent to the hypothesis $H0_1 = (\alpha_1, \beta_1) = (0, 0)$, i.e. revisions are uncorrelated with earlier releases. The F test statistic

$$\frac{T\hat{\beta}'(\hat{V}_{\hat{\beta}})^{-1}\hat{\beta}}{2}, \tag{2}$$

is assumed to have a $F(2, T-2)$ distribution, where $\hat{V}_{\hat{\beta}}$ is a heteroscedasticity and autocorrelation consistent estimate of the asymptotic variance of $\sqrt{T}(\hat{\beta}-\beta)$ (Newey and West, 1987). If we cannot reject the hypothesis that revisions are uncorrelated with the earlier release, the "news" hypothesis is supported.

Similarly, the hypothesis that revisions from the *p-th* published value to the *s-th* published value reduce noise, and are therefore partly predictable, is equivalent to stating that the revision is uncorrelated with the later releases. The following regression is run for four alternative revision periods:

$$y_t^{t+s} - y_t^{t+p} = \alpha_2 + \beta_2 y_t^{t+s} + \varepsilon_t, \tag{3}$$

s > p, s = 2, 5, 11, p = 1, 5 and ε_t is a white noise residual. Predictability of revisions, or the noise-reducing hypothesis, is equivalent to the hypothesis $H0_2 = (\alpha_2, \beta_2) = (0, 0)$. If we cannot reject the hypothesis that revisions are uncorrelated with the later release, the "noise" hypothesis is supported.

If the hypothesis $H0_2$ is rejected while $H0_1$ could not be rejected, this will be a strong indication that the revisions are characterized by news and therefore cannot be predicted. The opposite, a rejection of $H0_1$ combined with an acceptance of $H0_2$, is a strong indication that revisions reduce noise and are therefore partly predictable. If both hypotheses are rejected or both hypotheses are accepted, there are no clear indications of either news or noise.

The distinction "news versus noise" has implications for the standard deviation of y_t^τ. If revisions contain news, the standard deviation should be non-decreasing from earlier to later releases. Efficient forecasts incorporate all new information as it becomes available, hence there is a tendency for increased volatility. Standard deviations of releases that reduce noise in earlier releases should, on the other hand, decline. Before presenting results from the formal tests, we will inspect the standard deviations in tables 1 (quarterly rates) and 2 (four-quarter growth rates).

Table 1. Quarterly growth

Standard deviations of seasonally adjusted releases

	1	2	3	4	5	6	7	8	9	10	11
YLFN	0.92	1.02	0.955	0.995	1.02	0.874	0.885	0.95	1.06	1.21	1.35
YFN	0.484	0.594	0.594	0.622	0.644	0.648	0.581	0.626	0.7	0.762	0.75
YFNP	0.871	0.862	0.86	0.826	0.821	0.707	0.741	0.792	0.864	0.945	1.07
Standard deviations of unadjusted releases											
YLFN	4.18	4.02	4.02	4.01	4.04	4.08	4.07	4.16	4.21	4.2	4.28
YFN	4.33	4.27	4.25	4.24	4.27	4.34	4.33	4.32	4.35	4.36	4.35
YFNP	0.923	0.952	0.926	0.831	0.803	0.81	0.838	0.837	0.84	0.922	0.925

QoQ growth rates

To simplify, I abstract from the intermediary releases and compare standard deviations for three periods:

- Initial to fifth release - early period
- Fifth to eleventh release - late period
- Initial to eleventh release - whole period

Standard deviations increase in both the early and the late period for seasonally adjusted nominal and real quarterly growth in GDP, see the upper part of table 1. These results favor the news hypothesis overall. New releases of quarterly seasonally adjusted growth rates of the deflator reduce noise in the early period, but contain news in the late period and over the complete revision cycle. For unadjusted quarterly growth rates in the lower part of the table, new releases tend to reduce noise in the early period, but contain news over the complete revision cycle. The results are similar for all variables.

For four-quarter growth rates of nominal and real GDP in table 2, seasonally adjusted and unadjusted, standard deviations increase in the early as well as in the late period, indicating that revisions contain news over both periods. Again, the deflator stands out: Standard deviations decrease in the early period and increase in the second period,

Table 2. Four-quarterly growth

Standard deviations of seasonally adjusted releases											
	1	2	3	4	5	6	7	8	9	10	11
YLFN	1.76	1.96	1.97	1.94	1.96	1.94	2.11	2.26	2.45	2.35	2.38
YFN	1.88	1.97	1.99	1.97	1.98	1.99	2.09	2.2	2.22	2.17	2.08
YFNP	1.23	1.13	1.08	1.04	1.02	0.965	1.04	1.17	1.24	1.18	1.15
Standard deviations of unadjusted releases											
YLFN	2.36	2.38	2.49	2.45	2.47	2.52	2.7	2.86	2.93	2.94	2.84
YFN	2.44	2.45	2.55	2.54	2.52	2.56	2.68	2.8	2.81	2.74	2.65
YFNP	1.15	1.09	1.01	0.994	0.946	0.905	0.899	1.04	1.11	1.08	1.01

YoY growth rates

for unadjusted as well as for seasonally adjusted numbers. In contrast to the results for quarterly rates, revisions of the deflator over the whole period tend to reduce noise. Most of the results from these simple standard deviations of alternative releases are in line with the noise-to-signal ratios in figure 7.

The formal testing of the "news versus noise" hypothesis is reported in tables 3 to 5, one table for each of the three variables. Quarterly and four-quarterly growth rates of seasonally adjusted and unadjusted data are tested. The left-hand side of the table (columns two to five) reports the results for four-quarterly growth rates, and the right-hand side of the table (columns six to nine) reports the results for quarterly growth rates.

P-values from regressions (1) and (2) for revisions from the initial and from the fifth release are reported. For each revision the two hypotheses $H0_1$ and $H0_2$ are tested. I investigate three revisions from the initial release; from the first to the second release, from the first to the fifth release and from the first to the eleventh release. From the fifth release there will be just one revision, from the fifth to the eleventh release. P-values from testing the news hypothesis $H0_1$ (that revisions are uncorrelated with earlier releases) are reported in the first column and in the last line (except the last entry in the line), i.e.

Table 3.

Variable: YLFN

	Seasonally Adjusted							
	yoy growth				qoq growth			
	Initial	2nd	5th	11th	Initial	2nd	5th	11th
Initial to 2nd	0.599*	0	0	0	0.563*	0.074†	0.130†	0.321†
Initial to 5th	0.755*	:	0	0.018	0.303*	:	0	0.034
Initial to 11th	0.460*	:	:	0	0.758*	:	:	0
5th to 11th	0.335*	0.458*	0.441*	0	0	0.492*	0.885*	0
	Seasonally Unadjusted							
	yoy growth				qoq growth			
Initial to 2nd	0.928*	0.208†	0.092†	0.175†	0.168*	0.393†	0.326†	0.034
Initial to 5th	0.933*	:	0.020	0.013	0.341*	:	0.926†	0.821†
Initial to 11th	0.789*	:	:	0	0.783*	:	:	0.362†
5th to 11th	0.308*	0.236*	0.133*	0	0.468*	0.491*	0.472*	0.043

An asterisk ($\star$) below the diagonal line means that we cannot reject the news hypothesis. A dagger ($\dagger$) above the line means that we cannot reject the noise hypothesis.

Table 4.

Variable: YFN

	Seasonally Adjusted							
	yoy growth				qoq growth			
	Initial	2nd	5th	11th	Initial	2nd	5th	11th
Initial to 2nd	0	0	0	0	0	0	0	0
Initial to 5th	0.473*	:	0.11†	0.040	0.135*	:	0	0
Initial to 11th	0.997*	:	:	0.020	0.889*	:	:	0
5th to 11th	0.715*	0.718*	0.715*	0.061†	0.886*	0.773*	0.439*	0.011
	Seasonally Unadjusted							
	yoy growth				qoq growth			
Initial to 2nd	0.982*	0.416†	0.590†	0.886†	0.191*	0.481†	0.310†	0.057†
Initial to 5th	0.685*	:	0.207†	0.242†	0.565*	:	0.924†	0.787†
Initial to 11th	0.707*	:	:	0.019	0.585*	:	:	0.361†
5th to 11th	0.821*	0.884*	0.828*	0.060†	0.695*	0.706*	0.703*	0.224†

An asterisk ($\star$) below the diagonal line means that we cannot reject the news hypothesis. A dagger ($\dagger$) above the line means that we cannot reject the noise hypothesis.

Table 5.
Variable: YFNP

	Seasonally Adjusted							
	yoy growth				qoq growth			
	Initial	2nd	5th	11th	Initial	2nd	5th	11th
Initial to 2nd	0.079⋆	0.170†	0.180†	0.484†	0.340⋆	0.065†	0.146†	0.580†
Initial to 5th	0	:	0.696†	0.831†	0.156⋆	:	0.138†	0.898†
Initial to 11th	0	:	:	0	0.517⋆	:	:	0
5th to 11th	0.033	0	0.010	0	0	0.014	0.535⋆	0
	Seasonally Unadjusted							
	yoy growth				qoq growth			
Initial to 2nd	0.169⋆	0.696†	0.408†	0.448†	0.430⋆	0	0	0.678†
Initial to 5th	0.011	:	0.412†	0.418†	0.072⋆	:	0.243†	0.922†
Initial to 11th	0	:	:	0.048	0	:	:	0
5th to 11th	0	0	0.015	0	0.463⋆	0.287⋆	0.228⋆	0

An asterisk (⋆) below the diagonal line means that we cannot reject the news hypothesis. A dagger (†) above the line means that we cannot reject the noise hypothesis.

below the diagonal line. P-values from testing the noise hypothesis $H0_2$ are reported in the upper triangle and the last entry in the last line, i.e. above the diagonal line. Results from regressions where the dependent variable is a release that falls inside the investigated revision period are not reported.

The entries in the upper part of table 3 will be described here in some detail: On the left side of the table, the entry in the first line of the column headed "Initial" is the p-value from regression (1), p=1 and s=2 (the hypothesis $H0_1$, or the news hypothesis) for four-quarterly growth in seasonally adjusted nominal mainland GDP. Given a significance level of 5 percent, a p-value of 0.599 means that we cannot reject the news hypothesis: Revisions from the initial to the second release are not correlated with the initial releases, hence revisions arise from new information. A p-value of 0.05 or higher is indicated by an asterisk when testing the news hypothesis. In the next three columns, we report results from regression (2) (the hypothesis $H0_2$ or noise hypothesis), where revisions from $(t+1)$ to $(t+2)$ are regressed on the 2nd, the 5th and the 11th revision, respectively. That is, we test if revisions from the first to the second release are uncorrelated with later releases. A p-value higher than the chosen significance level of 5 per cent would indicate that we cannot reject the noise hypothesis. Since the p-values are 0, the hypothesis is rejected. These results support the news hypothesis for revisions from the first to the second releases: The news hypothesis cannot be rejected, while the noise hypothesis is rejected for the three later releases of the data. We find the same results for all revision periods, concluding that revisions of four-quarter growth of seasonally adjusted, nominal GDP are characterized by news. Early releases are efficient estimates of the final data. This is in line with the increasing standard deviations in table 2.

The results are more mixed for quarterly growth rates, on the right-hand side of the table. In the first entry of the first line, a p-value of 0.563 means that we cannot reject the news hypothesis for revisions from the first to the second release. But at the same time we cannot reject the noise hypothesis for this revision. A p-value higher than 5 percent for the noise hypothesis is indicated by a dagger. Hence, there is no clear conclusion about the nature of this revision: On the one hand, we could not reject the hypothesis $H0_1$, confirming results from table 1 that revisions from the first to the second release are characterized by news. On the other hand, nor could we reject the hypothesis $H0_2$, which indicates that revisions reduce noise. We conclude that revisions from the first to the second release contain news but also reduce noise. Revisions from the initial to the fifth release and from the initial to the eleventh release are again characterized by news, while the results for revisions from the fifth to the eleventh release are mixed. The news hypothesis was rejected when tested against the first release, while it could not be rejected when tested against the second and the fifth releases, respectively. At the same time, the noise hypothesis is rejected.

For real GDP, table 4 illustrates that revisions of quarterly, seasonally adjusted growth rates are mainly characterized by news, while revisions of four-quarterly growth rates based on seasonally adjusted figures contain both news and are reducing noise for some revision periods. When testing revisions from initial to second releases, both hypotheses are rejected, for both types of growth rates. Similar to the results for nominal GDP, revisions of unadjusted growth rates are characterized by news as well as by reducing noise.

Early revisions of the deflator contain news but also reduce noise, see table 5. Testing of later revisions tends to reject both hypotheses. Revisions from the initial to the final release of quarterly, seasonally adjusted growth rates are nevertheless characterized by news. When testing the four-quarterly growth of the deflator, both hypotheses are rejected for revisions from the first to the final release, as well as for revisions from the fifth to the final release.

The results are not conclusive overall, but it is possible to discern a pattern for the seasonally adjusted quarterly growth rate: Revisions of real GDP are characterized by news, for most revision periods. Subsequent releases of revised data contain new information not available in the earlier releases. Early releases are efficient estimators of later releases. In contrast, early revisions of nominal GDP and the deflator also reduce noise. Subsequent releases of revised data then eliminate noise in earlier releases, and earlier releases are then *not* efficient estimators of later releases. Hence, early revisions can, to some extent, be forecasted. However, since revisions from the initial to the final (eleventh) release are characterized by news for all variables, the main conclusion is that the first releases are in fact efficient forecasts of the final released data.

5 Conclusion

When forecasting, the aim is to make a good forecast of the "true" value of the variable. The "true" value is not available in real time, when forecasts are made. Calculating simple measures shows that mean revisions are relatively small compared to absolute revisions. When accounting for average growth rates, absolute revisions of seasonally adjusted quarterly growth are of a similar magnitude for all three variables.

If revisions are characterized as news, the best possible forecast of the preliminary data is also the best possible forecast of the revised data. On the other hand, if revisions mainly reduce noise, then we can get a better forecast of the "true" value of the variable by taking advantage of the fact that revisions are (to some extent) forecastable. Testing revisions of real and nominal GDP and the deflator indicate that first releases of seasonally adjusted data can be interpreted as efficient forecasts of the final data. Earlier revisions may also reduce noise, or they are neither characterized by news nor by noise reduction.

References

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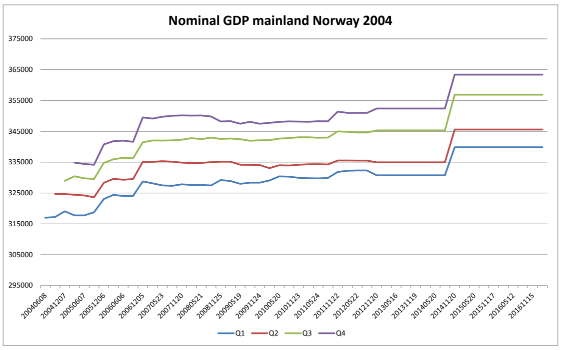
Mankiw, N. G., D. E. Runkle, and M. D. Shapiro (1984). Are preliminary announcements of the money stock rational forecasts? *Journal of Monetary Economics 14*, 15–27.

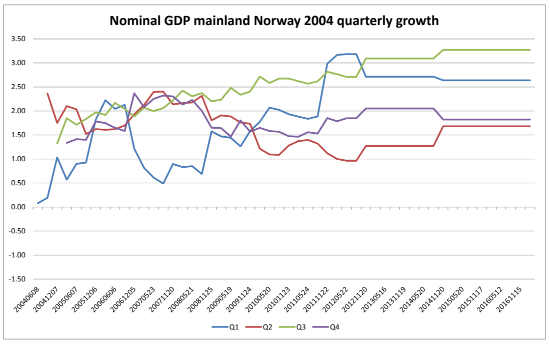
Newey, W. K. and K. D. West (1987). A simple, positive semi-definite, heteroskedasticity and autocorrelation consistent covariance matrix. *Econometrica 55*(3), 703–08.

6 Appendix

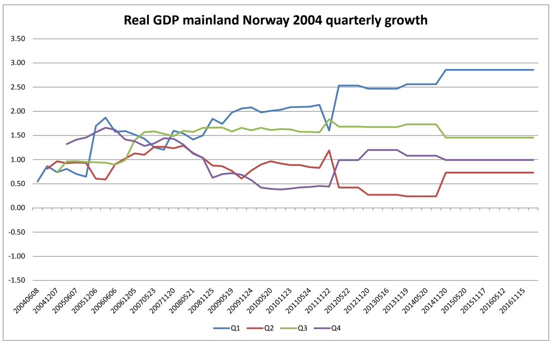
6.1 Revisions of seasonally adjusted mainland GDP, 2004



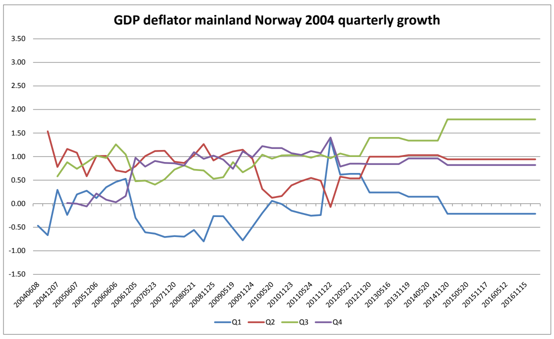
(a) Nominal level



(b) Nominal growth



(c) Real growth



(d) Deflator growth

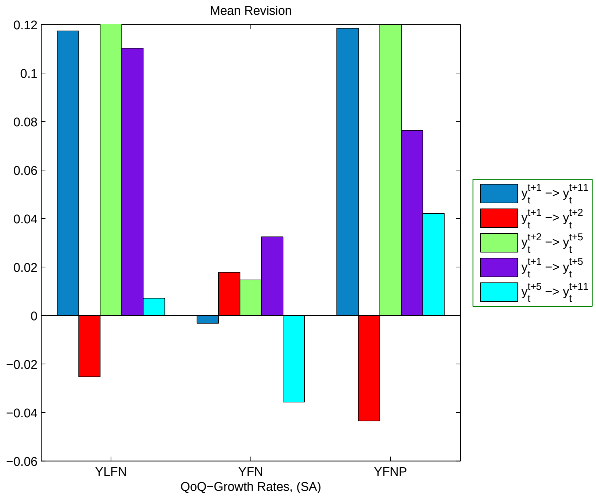
Figure 9. *Revisions of seasonally adjusted mainland GDP, 2004*

The 4 panels in figure 9 illustrate how revisions affect nominal levels and growth rates for the quarters of 2004. The most notable difference compared with revisions of 2003 numbers in figure 2 is the impact of the main revision in 2014 on real growth rates. For 2003, real growth rates did not change with this revision.

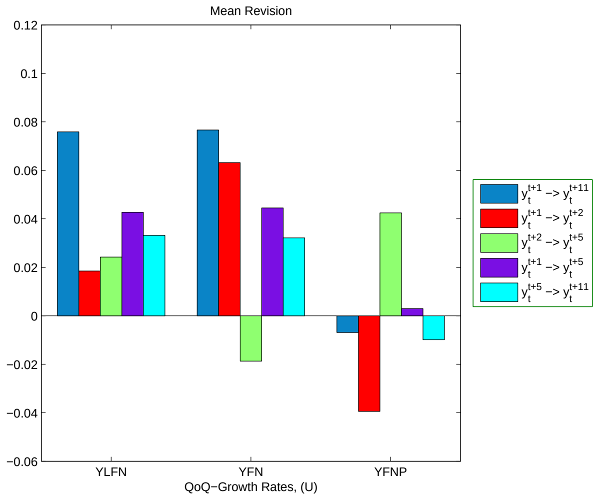
6.2 Measures of revisions for sample ending in 2014

The measures illustrated in the appendix are calculated on a sample where the vintage published in August 2014, prior to the main revision in 2014, is the last one included. To facilitate comparison with results from the full sample, the same scales have been used as in the figures in the text. The main conclusions from comparing the "short" and the "long" samples are:

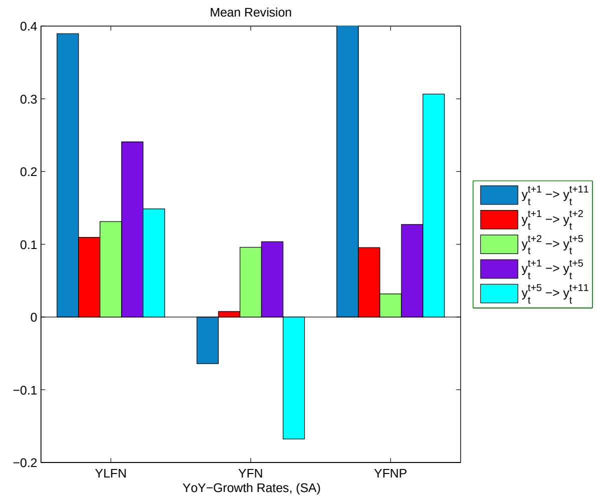
- Mean revisions are larger in the short sample for seasonally adjusted series and approximately the same for unadjusted series.
- Mean absolute revisions are larger for the short sample.
- Relative mean absolute revisions are of the same size in the two samples.
- Root mean square revisions are slightly larger in the short sample.
- Noise-to-signal ratios are of the same magnitude in both samples.



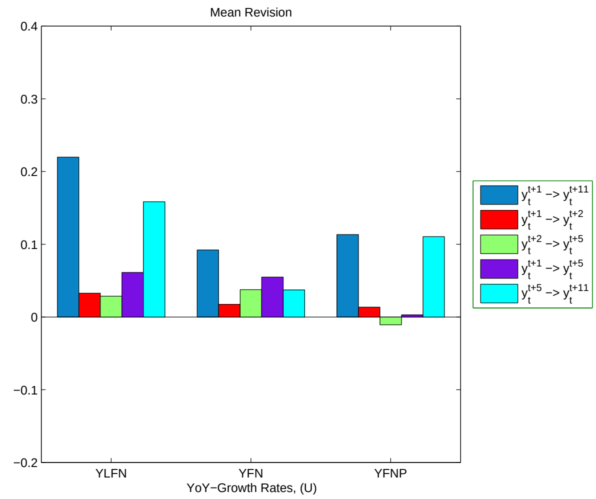
(a) Quarterly growth, seasonally adjusted



(b) Quarterly growth, unadjusted

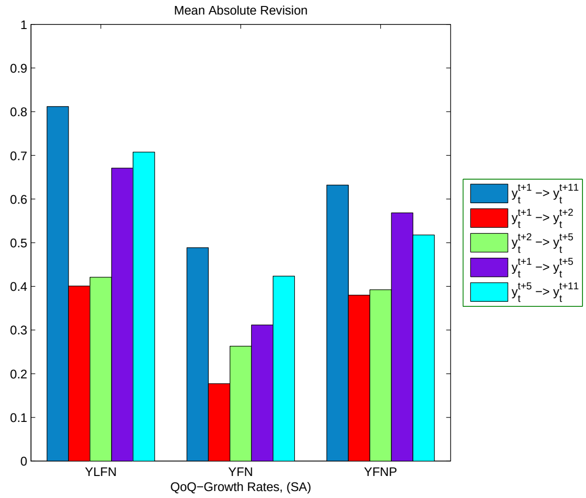


(c) Four-quarter growth, seasonally adjusted

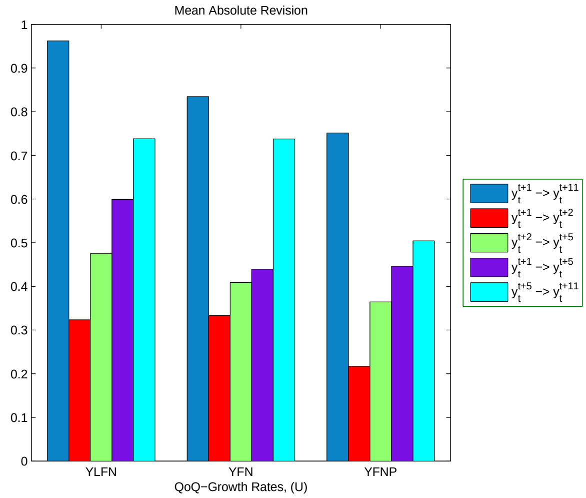


(d) Four-quarter growth, unadjusted

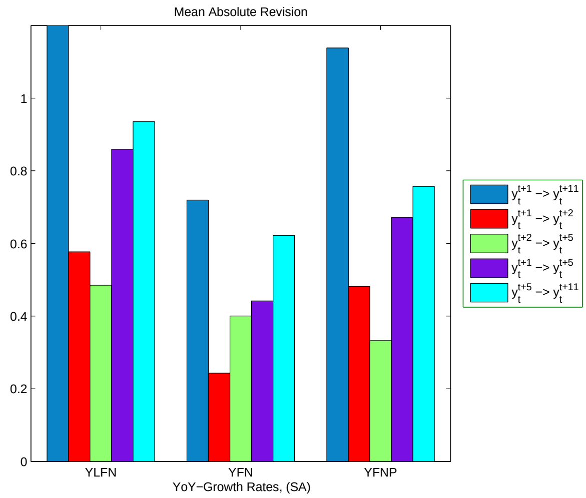
Figure 10. *Mean revisions (MR). GDP mainland Norway. Nominal (YLFN), real (YFN) and deflator (YFNP). Percent. Sample ends in 2014*



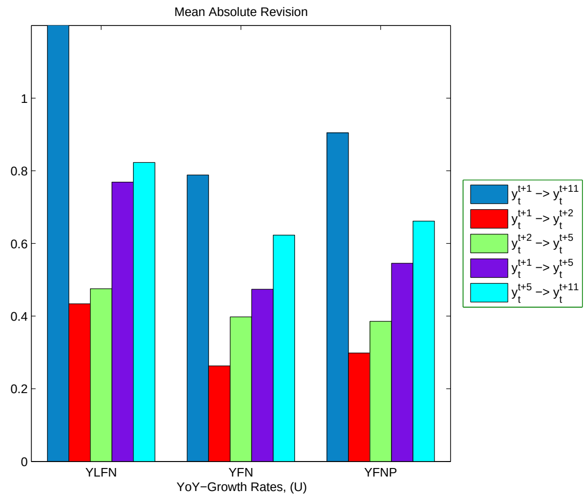
(a) Quarterly growth, seasonally adjusted



(b) Quarterly growth, unadjusted

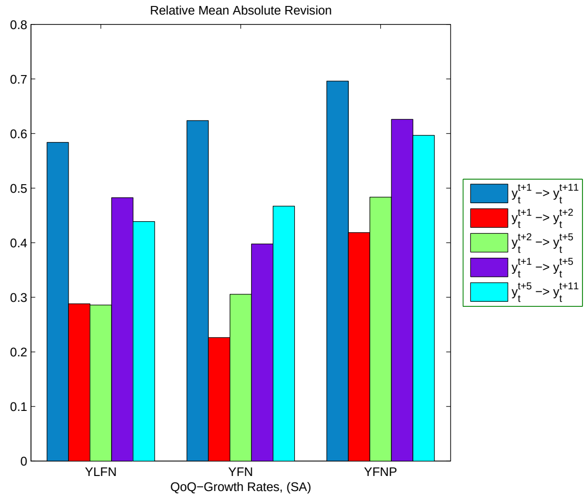


(c) Four-quarter growth, seasonally adjusted

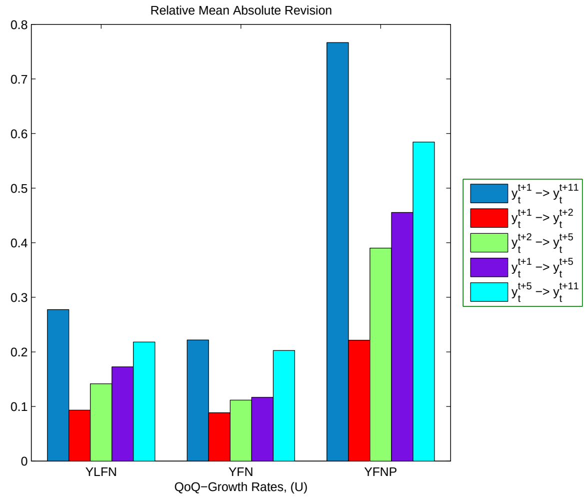


(d) Four-quarter growth, unadjusted

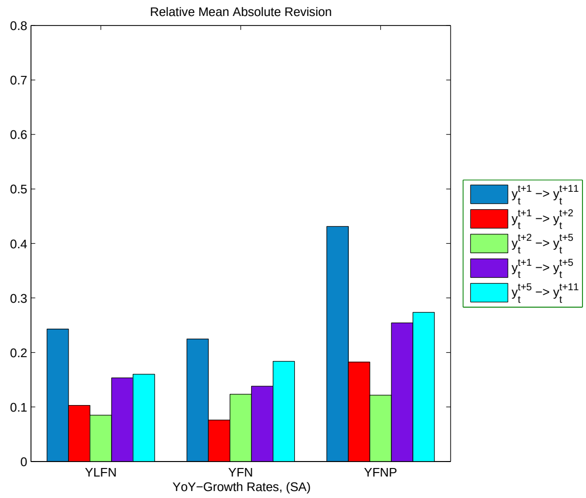
Figure 11. *Mean absolute revisions (MAR). GDP mainland Norway. Nominal (YLFN), real (YFN) and deflator (YFNP). Percent. Sample ends in 2014*



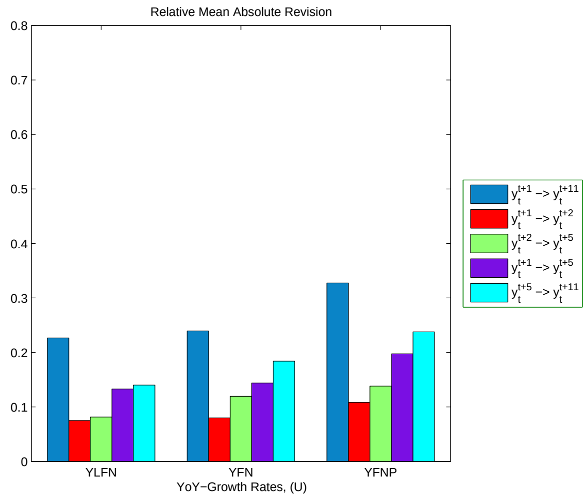
(a) Quarterly growth, seasonally adjusted



(b) Quarterly growth, unadjusted

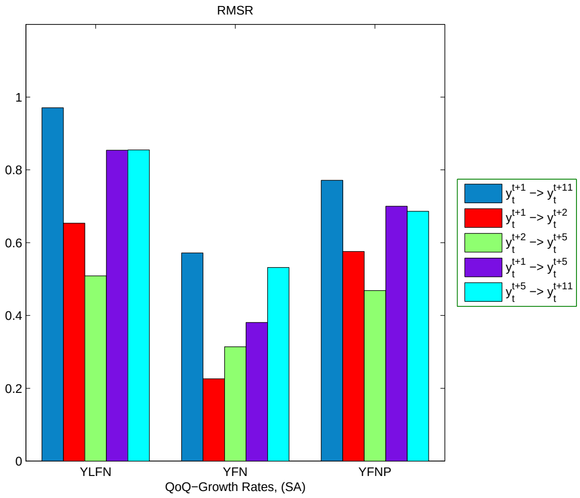


(c) Four-quarter growth, seasonally adjusted

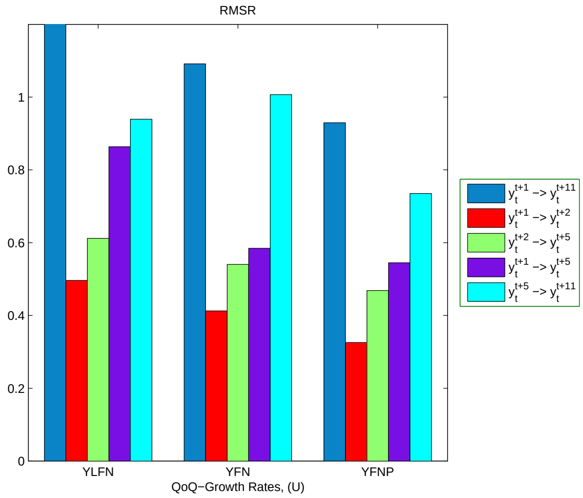


(d) Four-quarter growth, unadjusted

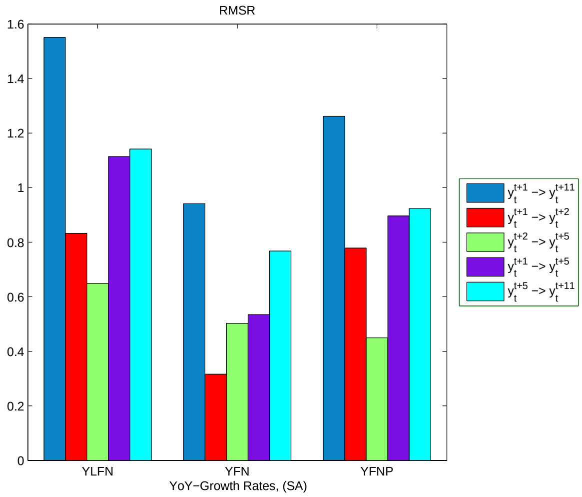
Figure 12. *Relative mean absolute revisions (RMAR). GDP mainland Norway. Nominal (YLFN), real (YFN) and deflator (YFNP). Proportion. Sample ends in 2014*



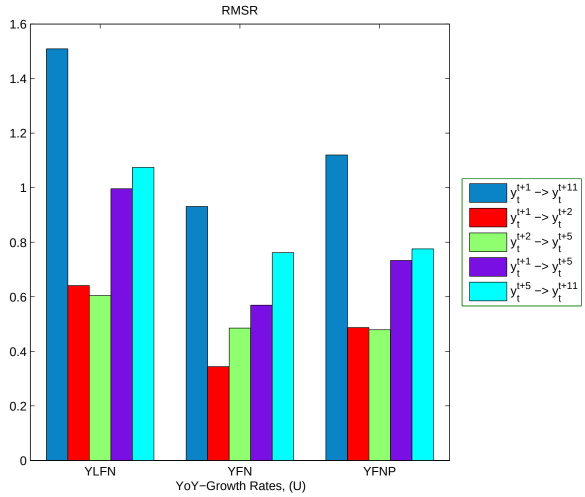
(a) Quarterly growth, seasonally adjusted



(b) Quarterly growth, unadjusted

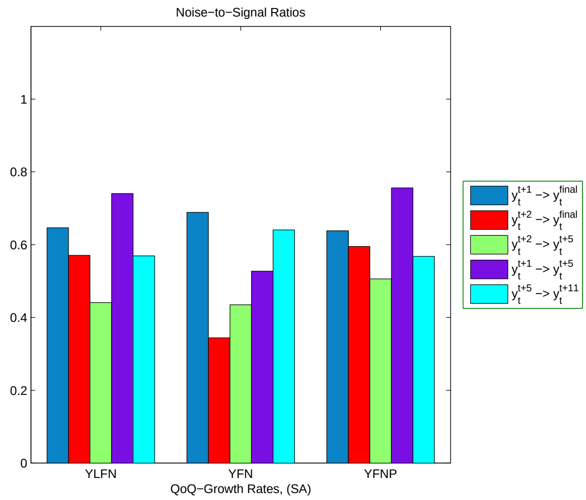


(c) Four-quarter growth, seasonally adjusted

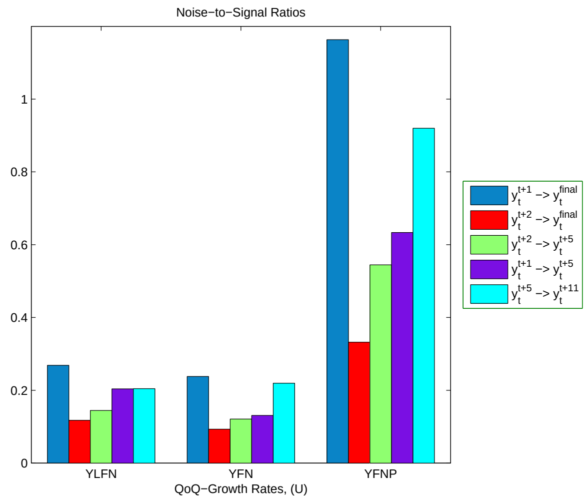


(d) Four-quarter growth, unadjusted

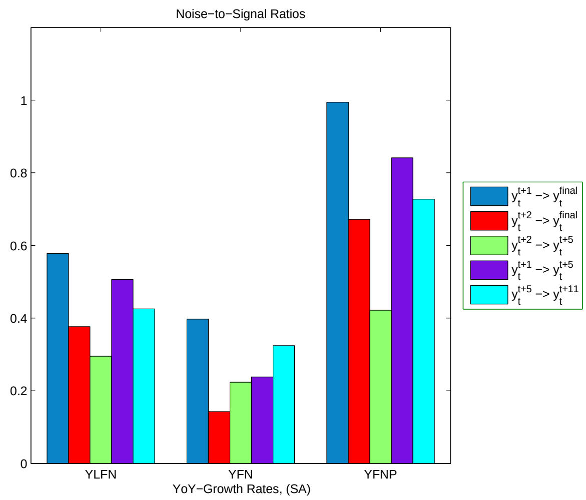
Figure 13. *Root mean square revisions (RMSR). GDP mainland Norway. Nominal (YLFN), real (YFN) and deflator (YFNP). Percent. Sample ends in 2014*



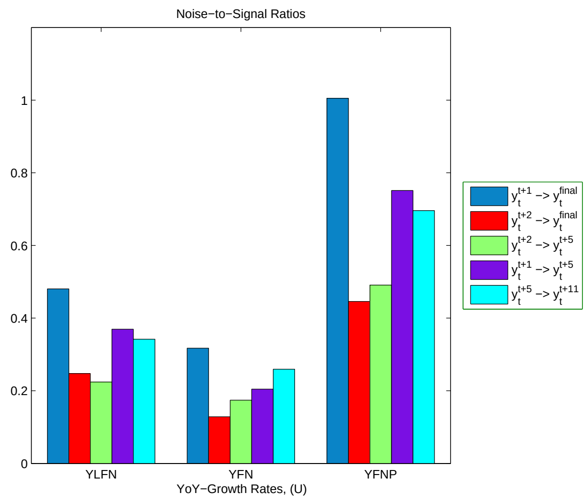
(a) Quarterly growth, seasonally adjusted



(b) Quarterly growth, unadjusted

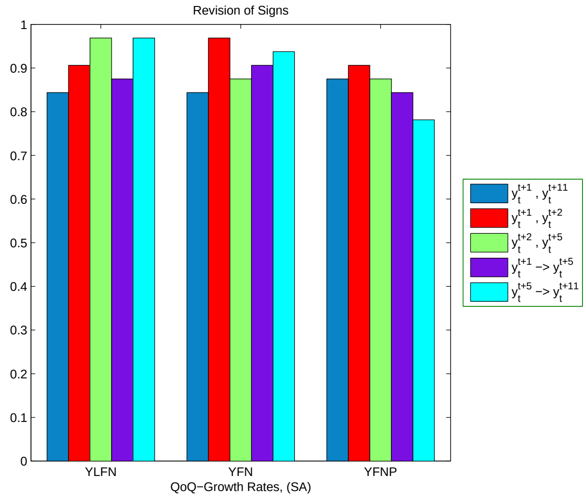


(c) Four-quarter growth, seasonally adjusted

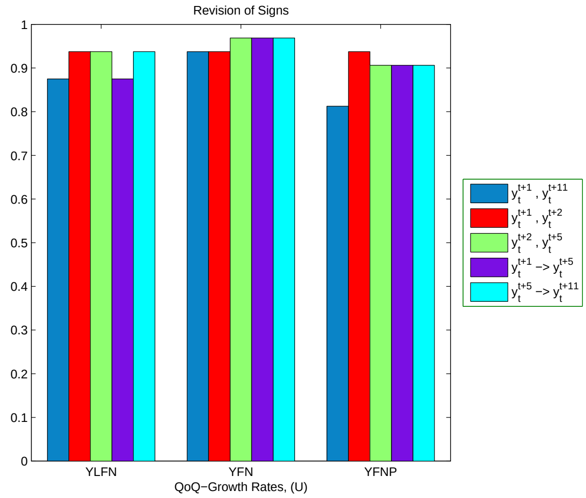


(d) Four-quarter growth, unadjusted

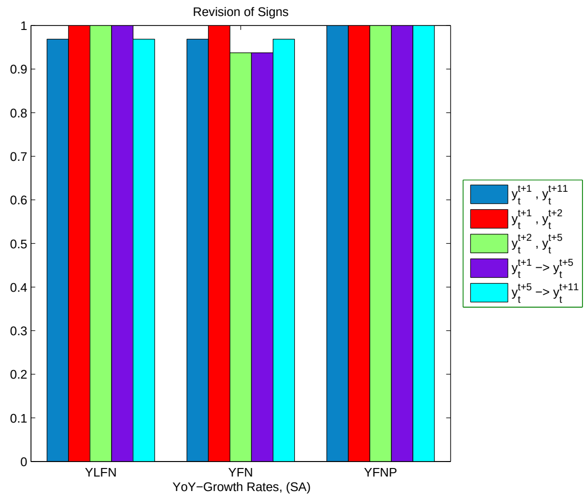
Figure 14. *Noise-to-signal ratios (NS). GDP mainland Norway. Nominal (YLFN), real (YFN) and deflator (YFNP). Percent. Sample ends in 2014*



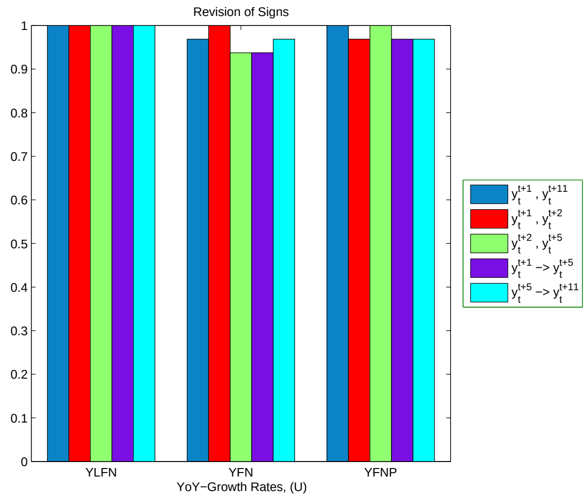
(a) Quarterly growth, seasonally adjusted



(b) Quarterly growth, unadjusted



(c) Four-quarter growth, seasonally adjusted



(d) Four-quarter growth, unadjusted

Figure 15. *Sign ratios (SR). GDP mainland Norway. Nominal (YLFN), real (YFN) and deflator (YFNP). Percent. Sample ends in 2014*