Dutch GDP Data Revisions: Are They Predictable and Where Do They Come from?

By Olivier Roodenburg* and Ard H. J. den Reijer**

Abstract

This paper examines whether the preliminary releases of GDP incorporate efficiently all available information or whether the preliminary estimates contain information that can be useful in predicting forthcoming GDP data revisions. Forecast rationality tests are applied to distinguish between these two characterisations. We analyse the revision over three horizons; the very short-term revision after one quarter, the short-term revision after two years, and the long-term revision. We find evidence of predictability for all short- and long-term revisions of Dutch GDP data. Our evidence for the revisions of the seasonally adjusted quarter-on-quarter growth rates are in line with the findings for G7 countries.

Moreover, we analyse the revisions of the six expenditure components and ten production components that constitute GDP. Only the preliminary releases of household consumption and the construction sector seem to explain the GDP data revisions. However, the general conclusion is that the forecast rationality hypothesis is rejected for almost all components separately, while almost no individual component's preliminary data release can forecast the revisions of GDP.

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1. Introduction

Every quarter, Statistics Netherlands (CBS) releases new estimates of gross domestic product (GDP) in the Netherlands. Data revisions between the time that CBS publishes its initial and final estimates of GDP are numerous. Preliminary estimates are available soon after the end of the respective quarters, but these estimates may contain some measurement error and may differ from the final data. Macroeconomic forecasts may be affected strongly if they are based on preliminary data. The quality of the preliminary data directly affects the quality of the forecasts.

Data revisions are distinguished by two polar characterisations as introduced by Mankiw *et al.* (1984) and Mankiw and Shapiro (1986), namely the noise and the news characterisation. The revisions are biased under the noise characterisation, which implies that the preliminary estimates are correlated with the revisions. The preliminary estimates contain information that can be useful in predicting forthcoming GDP data revisions. In contrast with the noise characterisation, revisions are unbiased in the news characterisation. GDP estimates released after the preliminary estimates reflect news. There is no correlation between the preliminary estimate and its revision, because the estimate contains all available information. Forecast rationality tests are applied to distinguish between these two characterisations.

Many studies analysed the revision errors. Faust *et al.* (2005) considered G7 GDP announcements and found some evidence for the predictability of GDP data revisions for the UK, Italy and Japan. Mankiw and Shapiro (1986) already found little evidence against the null hypothesis of forecast rationality using a short sample of US GNP data. York and Atkinson (1997) analysed the behaviour of revisions for the seven largest OECD countries and they found that revisions of GDP growth were large but not significantly different from zero, so there was no systematic bias in the preliminary national accounts figures. Palis *et al.* (2003) studied Brazilian GDP data revisions and also found some evidence that revisions are predictable.

Reliability is the extent to which provisional estimates predict final estimates. Therefore, a reliable statistic is one for which the difference between the preliminary and the final estimate, that is the revision, is uncorrelated with the preliminary estimates. A preliminary estimate is reliable if it represents the final estimate well, even if the final estimates are wrong. Accuracy refers to the extent to which the final estimate of a statistic describes reality. Kazemier and Van Rooijen (2002) studied a wider set of national accounts statistics using a broad range of attributes that make up for the quality of a statistic. They stressed, amongst other things, that there exists a trade-off between reliability and timeliness of publication. The focus of this paper is solely on the reliability of Dutch GDP figures.

Swanson and Van Dijk (2001) examined the entire revision process for seasonally adjusted and unadjusted industrial production data and the producer price in-

dex. They found that reporting agencies overstate respectively understate initial estimates in a recession and an expansion phase. Taking into account this asymmetry, they found strong evidence of predictability in subsequent revisions.

The first estimate of quarterly GDP in the Netherlands is released by CBS after about 45 days and this is the so-called flash estimate. CBS introduced the flash estimate in 1991, which was released at about 56 days after the appropriate quarter. In 2001 this period was cut down to 45 days. Due to its timely release, the first flash estimate is only based on direct source data for approximately 35% of GDP (Van de Ven and Van Leeuwen 2004). Shearing (2003) stated that forecasting the services sector has been the only possible way of including this component of GDP in the flash estimate. Furthermore, the lack of information is replaced by judgmental adjustments, which involve assumptions about the likely values taken by specific GDP components. Around 60 days after the flash estimate CBS produces a regular estimate that is based on more information. The difference between the flash and the regular estimate is called an information based revision. There are also structural data revisions due to restructuring the economic data accounting system, such as changes in aggregation method or estimation method, changes in base years and changes in definitions. A change in the definition of GDP alters the behaviour of the estimated GDP series relative to a former definition. For example, the European System of Accounts 1995 (ESA95) increases the level of GDP, because intangible fixed assets such as software are included.

In this paper, we want to test whether GDP data revisions in the Netherlands are predictable for quarterly observations. We explore the quality of the first Dutch GDP data releases by applying the forecast rationality test. At a more disaggregate level, we analyse the predictability of revisions of six expenditure components and ten production components. The six expenditure components are consumption by households and government, investment by businesses and government, exports and imports of goods and services. The ten production components correspond with the International Standard Industrial Classification of all Economic Activities (ISIC) at the one-digit level. Finally, we explore whether the initial releases of the components can forecast the revisions in GDP.

The paper is structured as follows. Section 2 describes summary statistics of the data. In section 3, we present the econometric model, describe the estimation process and discuss the estimation results. Section 4 presents the results for the components of GDP. Moreover, an extended estimation procedure is applied to relate the revisions of GDP data to the initial releases of the components. Finally, section 5 concludes.

2. Data

Quarterly data for GDP growth rates are gathered from CBS publications and run from 1986 to 2002 (68 quarters). CBS began to report quarterly GDP from 1985 onwards. In 1999, CBS released for the first time GDP according to ESA95, which implied shifts in concepts, methods, definitions and classifications. ESA95 achieves a harmonisation of the national accounts for the 15 European Union member states as requested by Eurostat in accordance to EU regulation. The adoption of ESA95 will not have serious implications if it induces a level shift in GDP, which then only results in an outlier for the growth rates.

We use both seasonally adjusted data (SA) and non-seasonally adjusted data (NSA). The only available published data are the SA growth rates, which are defined as the quarter-on-quarter (q-o-q) percentage change, and the NSA growth rates, which are defined as the year-on-year (y-o-y) or the four-quarter percentage change. The q-o-q growth rate compares the level of GDP in one quarter to the level of GDP in the previous quarter and the y-o-y growth rate compares it to the same quarter of the previous year. The latter measure is widely used, because it is an implicit seasonal adjustment procedure and it looks at developments over the entire previous year. For SA q-o-q growth rates, it is not always clear which seasonal adjustment procedure has been used and whether it is adjusted for working days. The y-o-y growth rate is also not corrected for differences in working days. For example, the leap year 2004 adds an extra working day to the end of February while Christmas and Boxing Day fall during a weekend. Secondly, y-o-y growth rates are not corrected for a base effect. This means that one outlier in q-o-q growth rates will show up in four outliers in y-o-y growth rates. Finally, the y-o-y growth rates do not identify turning points quickly.

We transformed the q-o-q SA growth rates straightforwardly[1] to y-o-y SA growth rates in order to analyse the part of the revisions induced by the seasonal- and working day correction procedures. The growth rates are represented in Figure 1 to give a first impression of how the series change over time.

Following Faust *et al.* (2005) and Palis *et al.* (2003), we compute a short-term and a long-term revision. Moreover, we add a very short-term revision. We use the first published figures to construct the preliminary data for GDP growth. Then the very short-term revision compares GDP growth based on the preliminary data with the revised estimate one quarter later. The short-term revision is the revision between the preliminary estimate and the revised estimate after a period of two years. Most of these revisions in between take place as more and more information become available. The long-term revision is the revision between the preliminary estimate and the final vintage of the data, in our case the fourth quarter of 2002 (2002q4). This long-term revision does not only occur when more information

[1] We construct an index for the observed SA growth rates q-o-q with base year 1984q4, thus the first computed growth rate y-o-y starts in 1985q4.

becomes available but also includes redefinitions, such as changes in the base year. The long-term revision coincides with the short-term revision concerning 2000q4 and with the very short-term revision concerning 2004q3. The summary statistics of the revisions are presented in Table 1 and are shown in Figure 2.

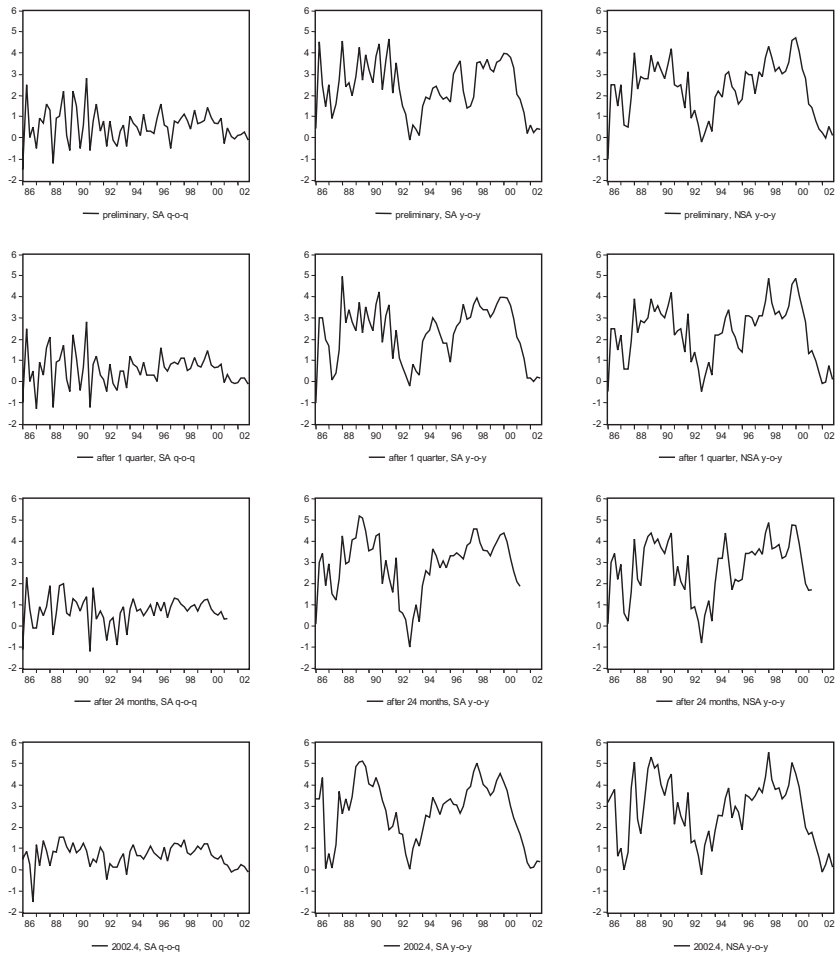

Figure 1: Original GDP Growth Series.

The first row shows growth rates for the preliminary estimates, the second row the revised estimates after 1 quarter, the third row revised estimates after 24 months and the last row shows final estimates, that is the estimates in 2002q4. E.g. the GDP growth rate for 1986q1 in the first row comes from the vintage released in 1986q1, in the second row from the vintage released in 1986q2, in the third row from the vintage released in 1988q1 and in the bottom row from the vintage released in 2002q4.

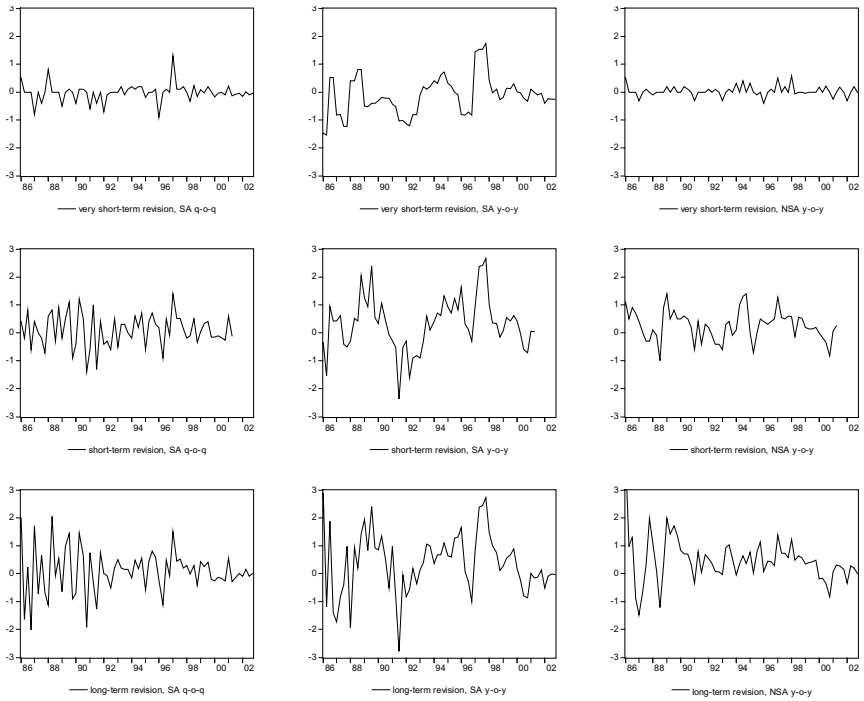

Figure 2: Revisions of Dutch GDP Data

Revisions for the very short-term (revision between the preliminary estimate and the revised estimate after 1 quarter) are displayed in the first row of the figure. The revisions for the short-term (revision between the preliminary estimate and the revised estimate after 8 quarters) and long-term (revision between the preliminary estimate and the final figure, in our case in 2002q4) are presented in the second row and the last row, respectively.

In case the preliminary estimates contain only news and no noise, the means of the revisions should be zero. From Table 1 it follows that the mean, the standard deviation and the root mean squared error of the long-term revisions are larger than the ones for the short-term and the very short-term revisions for all three series. The revisions are all positive on average, except the very short-term revision implying there is a downward bias in the preliminary estimates. So, initial Dutch GDP announcements tend to be pessimistic as the data get revised upwards during subsequent releases of the data. In contrast to Faust *et al.* (2005) we do not report a *t*-value for testing whether the mean revision is equal to zero, i.e. testing the forecast efficiency hypothesis under the untested assumption of forecast independence. This test is only valid if the mean and the variance are constant and, furthermore, the observations should be distributed independently. From Figure 2 we can see immediately that the variance is not constant over time, hence the *t*-value is an invalid statistic.

Before we test the forecast efficiency hypothesis in Section 3, a first indication can be given from Table 1. The means for the very short-term revision, the SA short-term revision q-o-q and the SA long-term revision q-o-q are close to zero. For the remaining four series, that is the y-o-y short-term and long-term revisions, there is a stronger indication for the presence of a biased mean in the revisions.

Table 1

Summary Statistics of the Revisions

	SA q-o-q	SA y-o-y	NSA y-o-y
	Very short-term revision 1986q1 – 2002q4		
Mean	-0.02	-0.13	0.04
Mean Absolute	0.17	0.53	0.10
RMSE	0.30	0.69	0.17
Median	0.00	-0.14	0.00
Maximum	1.30	1.74	0.57
Minimum	-0.90	-1.53	-0.40
Std. Dev.	0.31	0.69	0.17
	Short-term revision 1986q1 – 2000q4		
Mean	0.09	0.34	0.26
Mean Absolute	0.48	0.77	0.47
RMSE	0.58	0.96	0.53
Median	0.08	0.41	0.30
Maximum	1.41	2.66	1.40
Minimum	-1.40	-2.36	-1.00
Std. Dev.	0.59	0.97	0.54
	Long-term revision 1986q1 – 2002q4		
Mean	0.09	0.38	0.47
Mean Absolute	0.59	0.90	0.67
RMSE	0.79	1.09	0.79
Median	0.15	0.37	0.41
Maximum	2.06	2.87	4.17
Minimum	-2.01	-2.77	-1.48
Std. Dev.	0.80	1.10	0.80

Note: RMSE stands for root mean square error. The revisions are measured in percentage points.

3. The Econometric Model

An alternative way of studying revisions is based on a simple relationship between the revision of the data (r_t) and preliminary data (x_t^p) and is given by Mincer and Zarnowitz's (1969) equation

$$r_t^s = \alpha + \beta x_t^p + u_t \ , \tag{1}$$

where α and β are regression coefficients, u_t is the regression error and $r_t^s \equiv x_t^s - x_t^p$, where $s = f, t+8$ or $t+1$. The three subsequent revisions, r_t^s, are equal to:

i) long-term revision: $r_t^f = x_t^f - x_t^p$, where x_t^f denotes the final data as the vintage published in 2002q4;

ii) short-term revision: $r_t^{t+8} = x_t^{t+8} - x_t^p$, where x_t^{t+8} is the revised estimate after a period of 8 quarters from the preliminary estimate;

iii) very short-term revision: $r_t^{t+1} = x_t^{t+1} - x_t^p$, where x_t^{t+1} is the revised estimate after 1 quarter from the preliminary estimate.

A test of unbiasedness of the revised data is obtained by testing the hypothesis $H_0 : \alpha = \beta = 0$ in (1). This test is called the Mincer-Zarnowitz forecast rationality test because it is a test of news versus noise. So, preliminary estimates are considered as different forecasts of the final one, conditional on the available information at the time they are made. If the null hypothesis is not rejected, then the revisions are accepted as unbiased (the news characterisation) so that the revisions and the preliminary estimates are uncorrelated with each other. Thus the news that is released after the preliminary estimates, i.e. revisions, cannot be predicted over time. However, if the null hypothesis is rejected the revisions are biased (the noise characterisation). Then the revisions and the preliminary estimates are correlated with each other. Therefore the estimates contain information, which is useful to predict GDP data revisions. Figure 3 shows scatter plots of preliminary GDP growth rates against the very short-term, short-term and long-term revisions, which are useful for ascertaining the relationships between the two variables. The NSA short-term revisions y-o-y show a positive relationship between preliminary GDP growth rates and the revisions, that is high preliminary GDP growth rates tend to be revised upward and low preliminary GDP growth rates tend to be revised downward. According to the figures an inverse relationship is characterised by the SA short-term and long-term revision q-o-q.

Table 2 shows the results of the Mincer-Zarnowitz regressions. Before testing $H_0 : \alpha = \beta = 0$, we have to analyse the regression errors. Inference from the Mincer-Zarnowitz regression is only allowed if the errors follow a white noise process, which implies that $E(u_t | x_t^p, I_{t-1}) = 0$ with $I_{t-1} = \left(x_{t-1}^p, \ldots, x_{t-h}^p, r_{t-1}, \ldots, r_{t-h}\right)$ for some time horizon h. To check this property Table 2 reports four diagnostic tests, namely the Breusch-Godfrey (BG) Lagrange multiplier test for serial correlation of

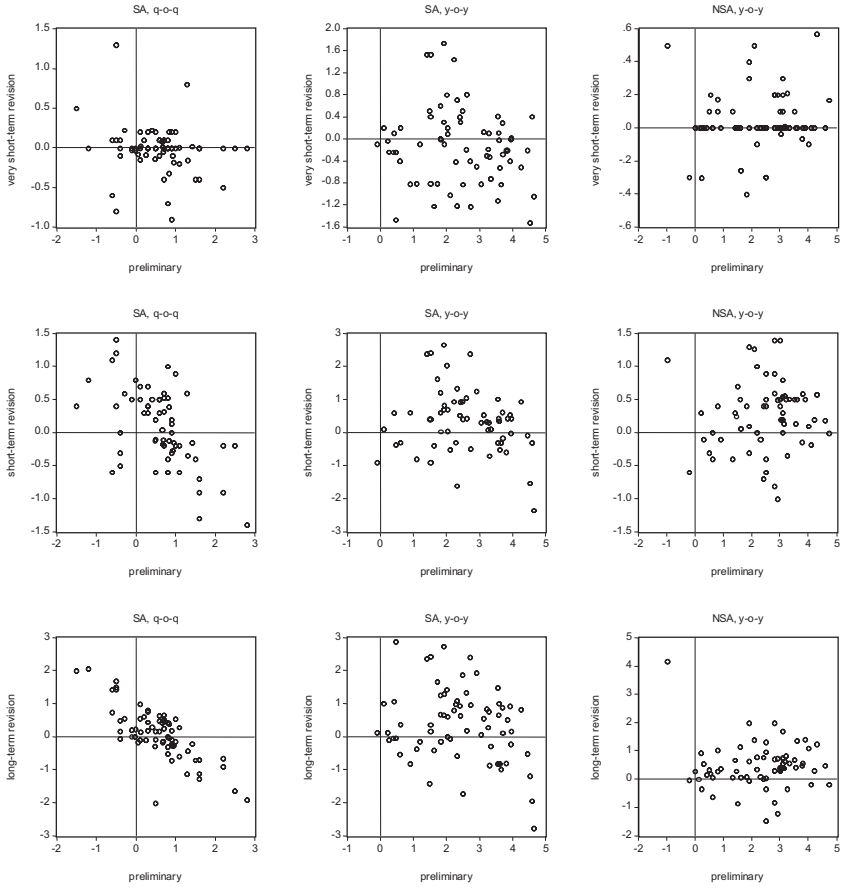

Figure 3

Relationships between the Preliminary GDP Growth Rates and the Revisions. The different scatterplots reveal relationships between the preliminary GDP growth rates and the revisions. As can be seen there is a weak positive relationship for the NSA short-term revision y-o-y. A clear negative relationship can be seen for the SA short-term revision q-o-q and the long-term revision q-o-q.

AR(1) and AR(4) errors, Ramsey's reset test whether the equation is linear or not, White's test for heteroscedasticity (H) and a test for ARCH(1) and ARCH(4) errors. The diagnostics suggest that there is no strong evidence of misspecification in the estimated equations for the SA very short-term revision q-o-q, NSA very short-term revision y-o-y and the SA short- and long-term revision q-o-q[2]. Thus for the remaining five series we can already reject the hypothesis of unbiasedness without

[2] However only the ARCH LM statistic up to order four is significant at the 5% level of significance for three of them, we do not reject the white noise process of these residuals.

using the Mincer-Zarnowitz forecast efficiency test, because $E(u_t|x_t^p, I_{t-1}) \neq 0$. This already suggests that r_t is not independent of past information.

For the SA very short-term revision q-o-q and the NSA very short-term revision y-o-y the test for $H_0 : \alpha = \beta = 0$ is a valid test and we can see that the null hypothesis cannot be rejected for both series. The two F-statistics for testing $H_0 : \alpha = \beta = 0$ have a p-value of 0.23 and 0.13 respectively. This indicates that the null hypothesis cannot be rejected, but the results for the very short-term revision however indicate a low $\bar{R}^2$. For the SA short- and long-term revisions q-o-q, we can also use the Mincer-Zarnowitz forecast efficiency test. For both series there is strong evidence that the null hypothesis has to be rejected, because both F-statistics have a p-value of 0.00. The coefficient estimates suggest that an increase in the GDP growth rate by one percentage point associates with a downward revision of 0.40 respectively 0.78 percentage point in the following quarter. The two $\bar{R}^2$ have a value of respectively 0.31 and 0.61. Compared to Faust et al.'s (2005) results for the G7 countries, both the parameter estimates and the two $\bar{R}^2$ are rather high and therefore provide evidence that revisions of GDP growth rates are also predictable for the Netherlands.

As a robustness check, we extend the simple linear regression model (1) by adding the lagged revision, the lagged preliminary estimate and three seasonal dummies. We reject for all revisions, except the SA very short-term revision q-o-q, the forecast rationality hypothesis using the F-statistic of the joint hypothesis that the 7 parameters of the extended model are equal to zero. The extended model confirms the previous qualitative results with one minor exception. The extended analysis also rejects the forecast rationality of the NSA very short-term revision y-o-y at the 5% level, although not at the 1% significance level.

4. Decomposition of Dutch GDP

The previous section shows that revisions of GDP are predictable to some extent. A natural extension is then to explore the major causes of revisions in the source data. In the National Accounts framework, GDP can be compiled in three ways: i) Production approach: the sum of value added (i.e. output minus intermediate consumption) of all industries; ii) Expenditure approach: the sum of final consumption, capital formation and exports minus imports; iii) Income approach: the sum of remuneration of employees, operating surplus of enterprises and taxes less subsidies on production. Although there is an accounting identity between the three approaches, Van de Ven and Van Leeuwen (2004) state that the original source data for each of the abovementioned items need in practice to be balanced in the framework of the national accounts. They describe that in the Netherlands, supply (output and imports) and use (intermediate consumption, final consumption, capital formation and exports) are balanced in a supply and use table. In the subsequent compilations of GDP, more detail is added, more source data is avail-

Table 2

Mincer-Zarnowitz Regression

	Very short-term revision			Short-term revision			Long-term revision		
	SA q-o-q	SA y-o-y	NSA y-o-y	SA q-o-q	SA y-o-y	NSA y-o-y	SA q-o-q	SA y-o-y	NSA y-o-y
α	0.02	0.06	0.02	0.34	0.78	0.17	0.53	0.90	0.52
	(0.39)	(0.28)	(0.33)	(3.66)	(1.52)	(0.83)	(5.78)	(2.21)	(1.54)
β	-0.07	-0.08	0.01	-0.40	-0.17	0.04	-0.78	-0.22	-0.02
	(-1.32)	(-1.27)	(0.47)	(-4.68)	(-1.08)	(0.52)	(-11.25)	(-1.51)	(-0.16)
F	1.50	1.98	2.12	10.95*	1.56	4.90*	63.75*	2.85	8.98*
p-value	0.23	0.15	0.13	0.00	0.22	0.01	0.00	0.07	0.00
$\bar{R}^2$	0.02	0.01	-0.01	0.31	0.03	-0.01	0.61	0.05	-0.01
Serial correlation LM test									
BG(1)	0.90	0.00*	0.57	0.39	0.00*	0.00*	0.16	0.00*	0.00*
BG(4)	0.24	0.00*	0.80	0.40	0.00*	0.02*	0.11	0.00*	0.01*
Ramsey's reset test									
1 term	0.54	0.07	0.17	0.10	0.00*	0.78	0.65	0.00*	0.03*
2 terms	0.81	0.18	0.20	0.21	0.00*	0.18	0.26	0.00*	0.00*
White heteroscedasticity test									
H	0.37	0.11	0.22		0.71				
ARCH LM test									
ARCH(1)	0.37		0.08	0.10			0.64		
ARCH(4)	0.02*		0.00*	0.14			0.04*		

Notes: The sample begins in 1986q1 and ends in 2002q4 and the short-term revision ends in 2000q4. Newey-West HAC consistent covariance t-values are given in parentheses for the coefficient estimates. We report probability values for the diagnostics. The F-statistic and its p-value are used as a test whether the two coefficients are equal to zero. BG(h) denotes the Breusch-Godfrey test statistic for up to h-th order autocorrelation. H is White's test for heteroscedasticity and Ramsey' s reset test tests whether the equation is linear or not. ARCH(h) tests whether there is no ARCH up to order h in the residuals.

* Significantly different from zero at the 5% level of significance.

able and data on income is added into the process of confronting and reconciling data from different sources.

During a time span of about two and a half years, GDP is compiled six times. The GDP growth in a quarter is reported as the flash estimate, the regular estimate and subsequently adjusted four times to match the yearly growth figures. Additional revisions of GDP growth rates are caused by benchmark revisions and seasonal adjustment procedures. CBS publishes on its website[3] a real-time data set covering the six compilation moments for GDP, six expenditure components and the

[3] See http: / / www.cbs.nl / NR / rdonlyres / 1796CC48-94E6-45D8-A3B7-756E2FEF0A50 / 0 / Draaitabelcor04102006.xls

value added of ten production components. The six expenditure components are consumption by households and government, investment by businesses and government, exports and imports of goods and services. The ten production components correspond with the International Standard Industrial Classification of all Economic Activities (ISIC) at the one-digit level. The data set starts in 1990 and consists of y-o-y growth rates, which are not corrected for seasonal and working day effects. So, the real-time data set covers the NSA y-o-y GDP growth rates reported in Table 1 for the overlapping sample period. The preliminary data (x_t^p) defined in (1) equals the regular estimate of GDP. The real-time data set does not cover the revised estimate after one quarter (x_t^{t+1}). The revised estimate after two years (x_t^{t+8}) equals CBS's fifth compilation moment[4]. While the final data are defined in (1) as the vintage of the data published in 2002q4, the final data this section are defined as the vintage published in 2006q2[5].

We extend the Mincer-Zarnowitz regression (1) with the lagged revision and the lagged preliminary estimate: $r_t^s = \alpha + \beta x_t^p + \gamma_1 r_{t-1}^s + \phi_1 x_{t-1}^p + u_t$, where $s = f$ or $t+8$. The results for all the expenditure and production components are presented in Table 3. For almost all components, we can reject the hypothesis of forecast rationality $\alpha = \beta = \gamma_1 = \phi_1 = 0$ according to the p-value for the F-statistic. Note moreover that the revisions of components related to the public sector, like government consumption, government investment, public administration and defence, are relatively well explained by their past revisions. The low compilation frequency of public sector statistics likely explains this result.

The growth rate of GDP, $\overset{\circ}{GDP}_t$, is the weighted sum of the growth rates of its underlying components: $\overset{\circ}{GDP}_t \equiv \sum_{i=1}^{l} b_i x_{it}$, where x_{it} are the growth rates of either the six expenditure components or the value added of the ten production components. Likewise, the revision of the GDP growth rate is the weighted sum of the revisions of its underlying components' growth rates. Therefore, we can apply the Mincer-Zarnowitz regression using the underlying components as regressors for both the expenditure and the production approach:

$$\overset{\circ}{GDP}{}_t^s - \overset{\circ}{GDP}{}_t^p = \alpha + \sum_{i=1}^{l} \beta_i x_{it}^p + \sum_{i=1}^{l} \gamma_i \left(x_{i,t-1}^s - x_{i,t-1}^p \right) + u_t^* \ , \tag{2}$$

where s=f for the long-term and (t+8) for the short-term revision.

The preliminary data (x_t^p) consist of the regular estimate. The short-term revision considers the revised estimate after two years (x_t^{t+8}), which equals CBS's fifth

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[4] The fifth compilation moment is called the 'further provisional year estimate' (in Dutch 'Nader voorlopige jaarraming'). The quarterly statistics of the fifth compilation are published two years after the respective year in October.

[5] The 2002q4 and the 2006q2 vintages of the data for GDP reveal that the growth rates are revised upwards in 1994 and downwards in 1995.

Table 3: **Extended Mincer-Zarnowitz Regressions for the Expenditure and Production Components**

	Short-term							Long-term						
	α	β	γ_1	ϕ_1	$\bar{R}^2$	F	BG(4)	α	β	γ_1	ϕ_1	$\bar{R}^2$	F	BG(4)
Gross investment businesses	-0.41	0.09	-0.24	0.01	0.03	0.37	0.55	-0.19	0.02	0.13	-0.05	-0.03	0.78	0.08
	(-1.64)	(1.28)	(-1.42)	(0.21)				(-0.52)	(0.20)	(0.56)	(-0.70)			
Gross investment government	-0.88	0.17	0.60	0.15	0.34	0.00	0.01	0.97	-0.02	0.52	0.02	0.23	0.00	0.32
	(-1.69)	(1.26)	(4.09)	(1.97)				(2.00)	(-0.17)	(4.10)	(0.35)			
Consumption households	0.27	-0.04	0.18	-0.04	0.06	0.00	0.96	0.42	-0.02	0.13	-0.04	-0.02	0.01	0.66
	(3.35)	(-0.49)	(1.50)	(-0.44)				(2.33)	(-0.20)	(0.78)	(-0.45)			
Consumption government	0.29	-0.47	0.47	0.40	0.26	0.00	0.33	0.36	-0.80	0.62	0.70	0.43	0.00	0.03
	(1.63)	(-1.69)	(3.81)	(1.35)				(1.56)	(-2.96)	(4.17)	(2.34)			
Imports goods and services	0.80	-0.05	0.37	0.05	0.08	0.00	0.80	0.51	-0.03	0.44	0.06	0.16	0.00	0.90
	(2.13)	(-0.85)	(3.84)	(0.77)				(1.32)	(-0.54)	(4.16)	(0.89)			
Exports of goods and services	0.81	0.14	0.22	-0.09	0.04	0.00	0.85	0.74	0.06	0.35	-0.06	0.09	0.00	0.44
	(1.93)	(1.35)	(2.24)	(-1.01)				(2.34)	(0.62)	(3.65)	(-0.82)			
Value added of Construction	-0.34	0.05	0.60	-0.04	0.32	0.00	0.26	-0.62	0.10	0.48	-0.11	0.21	0.00	0.61
	(-1.45)	(0.75)	(4.89)	(-0.60)				(-2.01)	(1.77)	(4.05)	(-2.93)			
Mining and quarrying	0.17	-0.02	-0.03	0.02	-0.05	0.97	0.34	1.10	-0.04	-0.09	0.03	-0.03	0.05	0.12
	(0.45)	(-0.36)	(-0.17)	(0.48)				(2.98)	(-0.66)	(-0.68)	(0.04)			
Electricity, gas and water	1.19	-0.43	0.18	0.13	0.10	0.07	0.08	0.07	-0.51	0.56	0.37	0.32	0.00	0.36
	(2.24)	(-2.22)	(1.66)	(0.71)				(0.07)	(-2.29)	(3.96)	(1.43)			
Financial and business services	0.15	-0.77	0.84	0.71	0.50	0.00	0.21	0.09	-0.53	0.77	0.52	0.49	0.00	0.11
	(0.62)	(-3.49)	(7.45)	(4.07)				(0.27)	(-2.26)	(6.43)	(2.73)			
Wholesale and retail trade, restaurants and hotels, repair services	0.68	0.01	0.35	-0.11	0.15	0.00	0.50	0.64	0.01	0.55	-0.04	0.26	0.00	0.13
	(2.49)	(0.10)	(2.59)	(-0.98)				(2.55)	(0.12)	(3.91)	(-0.35)			
Industry	0.18	0.03	0.54	-0.02	0.26	0.00	0.00	0.15	-0.06	0.56	0.03	0.30	0.00	0.78
	(1.28)	(0.38)	(3.09)	(-0.23)				(0.94)	(-0.40)	(6.16)	(0.22)			

Table 3 (Cont.)

	Short-term							Long-term						
	α	β	γ_1	ϕ_1	$\bar{R}^2$	F	BG(4)	α	β	γ_1	ϕ_1	$\bar{R}^2$	F	BG(4)
Agriculture, hunting, forestry and fishing	2.30 (2.43)	-0.26 (-1.22)	0.19 (1.36)	-0.23 (-1.31)	0.09	0.01	0.63	1.59 (1.70)	-0.27 (-1.24)	0.28 (2.03)	-0.20 (-1.21)	0.12	0.03	0.52
Public administration and defence	0.24 (1.97)	-0.47 (-3.89)	0.72 (7.34)	0.26 (1.79)	0.68	0.00	0.44	0.29 (1.72)	-0.56 (-5.20)	0.78 (8.70)	0.34 (2.38)	0.75	0.00	0.01
Transport, storage and communication	1.60 (4.63)	-0.35 (-2.24)	0.16 (1.39)	0.15 (0.98)	0.13	0.00	0.87	0.86 (2.15)	-0.07 (-0.48)	0.53 (4.73)	0.03 (0.17)	0.23	0.00	0.40
Social, health and related community services	-0.36 (-0.81)	-0.43 (-1.61)	0.57 (4.97)	0.53 (1.49)	0.31	0.00	0.04	0.35 (0.42)	-0.63 (-2.11)	0.49 (3.89)	0.48 (1.08)	0.19	0.00	0.63

Notes: The table presents the results of regression analysis (2) for 6 expenditure components and 10 production components. The sample starts in 1990q2 for the expenditure component regressions and in 1992q2 for the production components regressions and ends in 2003q4 for the long-term regressions and 2004q2 for the short-term regressions. Newey-West HAC consistent covariance t-values are given in parentheses. The table presents the p-values of the F-statistic to test whether the four coefficients are equal to zero. BG(4) denotes the Breusch-Godfrey test statistic for up to 4-th order autocorrelation.

compilation moment. The long-term revision considers the final estimate (x_t^f), which equals the vintage of the data published in 2006q2. The regressors x_{it} are either the six expenditure components or the ten underlying components of the production approach. So, equation (2) results if we substitute in the Mincer-Zarnowitz regression (1) the preliminary estimate βGDP_t^p with the term $\sum_{i=1}^{l} \beta_i x_{it}^p$ and substitute the lagged revision γr_{t-1}^s with the term $\sum_{i=1}^{l} \gamma_i \left(x_{i,t-1}^s - x_{i,t-1}^p \right)$. This latter term then represents the weighted sum of the revisions of the underlying components.

The results of the regression analysis (3) are presented in Table 4 for the expenditure approach and in Table 5 for the production approach. For both approaches, the short- and long-term revisions are analysed. For both approaches and both revision horizons, we also estimated (2) using only lagged revision of GDP.

The results for the expenditure approach indicate that the preliminary estimates for the growth of household consumption significantly explain the short- and long-term revisions of GDP growth rates. The main sources for the compilation of the household consumption are the household budget surveys and the retail trade statistics (see Bos and Gorter 1993). The share of household consumption in total GDP is about 50%. Table 3 shows that the preliminary estimates of the household consumption explain the household revisions, which also constitutes the bulk of the GDP data revisions.

The results for the production approach indicate that the preliminary estimates for the growth of the value added of construction significantly explain the short- and long-run revision of GDP growth rates. The production components data is compiled using producer survey results and statistics on paid working days and gross wages and salaries. A case in point is construction (see Bos and Gorter 1993, page 24). In addition to the abovementioned source data, also information is used about issued building permits, started and completed building projects and the statistics on capital formation. Although the share of the value added of construction in total GDP is only about 5%, a possible reason for its preliminary estimates to forecast GDP data revisions are the issued building permits. This variable is part of OECD's (2002) leading business cycle indicators for some countries and provides a reliable signal about economic developments.

The general conclusion is that the forecast rationality hypothesis is rejected for almost all components separately, but that almost no individual component's preliminary data release can forecast the revisions of GDP. The way to proceed is to decompose the revisions in GDP growth further into the revisions of the source data. The decomposed source data revisions can then be classified according to their origin. Possible characterisations are the arrival of newly observed data, discontinuities in the source data, changes in National Accounts concepts and changes imposed in the compilation of the national accounts to make the expenditure, production and income approach mutually consistent.

Table 4

Extended Mincer-Zarnowitz Regression Using Expenditure Components

	Short-term	Long-term	Short-term	Long-term
α	0.36*	0.53*	-0.04	0.64*
	(2.63)	(3.77)	(-0.08)	(3.55)
γ_i (lagged revision)				
GDP^1	0.40*	0.36*		
	(3.12)	(3.47)		
Gross investment businesses[1]			-0.01	-0.00
			(-0.28)	(-0.10)
Gross investment government[1]			-0.02	-0.02
			(-1.24)	(-0.97)
Consumption households[1]			-0.02	0.14
			(-0.18)	(1.28)
Consumption government[1]			0.09	0.07
			(1.90)	(1.24)
Imports goods and services[1]			-0.11	-0.09
			(-1.63)	(-1.32)
Exports of goods and services[1]			0.13*	0.09
			(2.48)	(1.20)
β_i (preliminary data)				
Gross investment businesses[2]	0.02	0.01	0.02	0.02
	(0.88)	(0.67)	(0.82)	(0.76)
Gross investment government[2]	0.00	0.02	0.01	0.02
	(0.24)	(0.93)	(0.55)	(1.10)
Consumption households[2]	-0.07*	-0.09	-0.09*	-0.13*
	(-2.12)	(-1.71)	(-2.51)	(-2.23)
Consumption government[2]	-0.01	-0.04	0.04	-0.01
	(-0.15)	(-0.76)	(0.45)	(-0.11)
Imports goods and services[2]	0.05	0.03	0.06	0.04
	(1.62)	(0.83)	(1.39)	(0.81)
Exports of goods and services[2]	-0.07	-0.04	-0.08	-0.05
	(-1.89)	(-1.25)	(-1.89)	(-0.99)
$\bar{R}^2$	0.22	0.19	0.16	0.11
BG(1)	0.57	0.43	0.05	0.05
BG(4)	0.77	0.42	0.39	0.33
Ramsey (1)	0.83	0.69	0.50	0.12
Ramsey (2)	0.36	0.58	0.78	0.30
White heteroscedasticity test	0.40	0.43	0.59	0.23
ARCH(1)	0.17	0.52	0.37	0.20
ARCH(4)	0.64	0.75	0.88	0.36

The table presents the results of regression analysis (3) using 6 expenditure components as explanatory variables. The superscript [1] denotes lagged revision of the variable. The superscript [2] denotes preliminary estimate of the variable. The sample starts in 1990q2 and ends in 2003q4 for the long-term regressions and 2004q2 for the short-term regressions. Newey-West HAC consistent covariance *t*-values are given in parentheses. We report probability values for the diagnostics. BG(h) denotes the Breusch-Godfrey test statistic for up to h-th order autocorrelation. Moreover, White's test for heteroscedasticity and Ramsey' s reset test for linearity are reported. ARCH(h) tests whether there is no ARCH up to order h in the residuals. * denotes significantly different from zero at the 5% level of significance

Table 5

Extended Mincer-Zarnowitz Regression Using Production Components

	Short-term	Long-term	Short-term	Long-term
α	0.24	0.33	-0.04	0.45
	(0.52)	(0.73)	(-0.08)	(0.97)
γ_i (lagged revision)				
GDP^I	0.39*	0.34*		
	(3.46)	(2.88)		
Construction[1]			0.02	-0.00
			(0.51)	(-0.02)
Mining and quarrying[1]			0.02	-0.04
			(0.78)	(-1.01)
Electricity, gas and water[1]			-0.00	-0.03
			(-0.16)	(-1.33)
Financial and business services[1]			0.10	-0.09
			(1.63)	(-1.43)
Wholesale and retail trade, restaurants			0.18*	0.02
and hotels, repair services[1]			(2.94)	(0.30)
Industry[1]			-0.15	0.00
			(-1.46)	(0.03)
Agriculture, hunting, forestry and fish-			0.03*	0.01
ing[1]			(2.11)	(0.42)
Public administration and defence[1]			-0.07	0.15*
			(-0.55)	(2.29)
Transport, storage and communication[1]			0.02	0.05
			(0.26)	(1.24)
Social, health and related community			0.04	0.02
services[1]			(0.31)	(0.15)
β_i (preliminary data)				
Construction[2]	0.04*	0.04*	0.04	0.06*
	(2.10)	(2.33)	(1.69)	(2.53)
Mining and quarrying[2]	0.00	-0.01	0.01	0.01
	(0.49)	(-1.11)	(0.65)	(1.04)
Electricity, gas and water[2]	0.01	0.02	-0.01	0.06
	(0.48)	(0.55)	(-0.34)	(1.39)
Financial and business services[2]	0.04	0.04	0.01	-0.02
	(0.34)	(0.37)	(0.09)	(-0.10)
Wholesale and retail trade, restaurants	0.03	0.01	0.03	-0.02
and hotels, repair services[2]	(0.40)	(0.18)	(0.39)	(-0.30)
Industry[2]	-0.03	-0.06	-0.02	-0.01
	(-0.74)	(-1.53)	(-0.51)	(-0.27)
Agriculture, hunting, forestry and fish-	-0.00	-0.00	0.01	0.01
ing[2]	(-0.26)	(-0.35)	(0.42)	(0.65)
Public administration and defence[2]	-0.04	-0.15	0.01	-0.22
	(-0.41)	(-1.47)	(0.12)	(-1.47)
Transport, storage and communication[2]	-0.09	-0.05	-0.07	-0.09
	(-1.58)	(-0.93)	(-1.23)	(-1.35)
Social, health and related community	0.07	0.11	0.17	0.25
services[2]	(0.34)	(0.61)	(0.73)	(1.22)

Table 5 (Cont.)

	Short-term	Long-term	Short-term	Long-term
$\bar{R}^2$	0.32	0.27	0.29	0.22
BG(1)	0.23	0.17	0.21	0.58
BG(4)	0.38	0.41	0.00*	0.03*
Ramsey (1)	0.80	0.63	0.95	0.38
Ramsey (2)	0.06	0.54	0.02*	0.69
White heteroscedasticity test	0.22	0.84		
ARCH(1)	0.10	0.79		
ARCH(4)	0.10	0.78		

The table presents the results of regression analysis (3) using 10 production components as explanatory variables. The superscript ^{1} denotes lagged revision of the variable. The superscript ^{2} denotes preliminary estimate of the variable. The sample starts in 1992q2 and ends in 2003q4 for the long-term regressions and 2004q2 for the short-term regressions. Newey-West HAC consistent covariance t-values are given in parentheses. We report probability values for the diagnostics. BG(h) denotes the Breusch-Godfrey test statistic for up to h-th order autocorrelation. Moreover, White's test for heteroscedasticity and Ramsey' s reset test for linearity are reported. ARCH(h) tests whether there is no ARCH up to order h in the residuals. * denotes significantly different from zero at the 5% level of significance

5. Conclusion

This paper examines whether Dutch GDP data revisions are predictable or the preliminary releases of GDP incorporate efficiently all available information. The first published figures for GDP growth rates are considered as preliminary data. We analyse the revision over three horizons; the very short-term revision after one quarter, short-term revision after two years and the long-term revision.

Results emerging from our analyses are the following. Firstly, the summary statistics show that the revisions are large for the short-term and the long-term revisions. They are positive on average implying that there is a downward bias in the preliminary estimates. So, there is a tendency for pessimism in initial Dutch GDP announcements. Secondly, we applied the Mincer-Zarnowitz regression, which is a least-squares regression of the revisions on a constant term and the preliminary estimates. We test for a bias in the revisions by checking whether the constant term and the coefficient of the preliminary estimates are significantly different from zero. The results indicate evidence for the predictability of all short- and long-term revisions of Dutch GDP data. Moreover, the revisions of the seasonally adjusted (SA) quarter-on-quarter (q-o-q) growth rates are in line with the findings of G7 countries. The evidence for predictability of the very short-term revisions is less convincing, while we find no evidence for the SA q-o-q revisions on the very short-term.

A natural extension is to explore the major causes of revisions of GDP growth rates. A real-time data set is available with year-on-year (y-o-y) NSA growth rates of GDP, six expenditure components and ten production components. For almost all components individually, we can reject the hypothesis of forecast rationality.

Moreover, we apply the extended Mincer-Zarnowitz regression using the underlying components' preliminary releases as regressors for both the expenditure and the production approach. Only the preliminary releases of household consumption and the construction sector seem to explain the GDP data revisions. The general conclusion is that the forecast rationality hypothesis is rejected for almost all components separately, but that almost no individual component's preliminary data release can forecast the revisions of GDP.

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