CPB Netherlands Bureau for Economic Policy Analysis

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The effects of CBS revisions on CPB forecasts

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1 Introduction

"When my information changes, I alter my conclusions. What do you do, sir?" J.M. Keynes

For any given quarter, Statistics Netherlands (CBS) publishes 5 different versions of the national accounts, of which the first is the flash estimate. As CBS processes more and more of the underlying data they produce updated estimates of the national accounts until they arrive at a definitive set of national accounts 3 years later. When CPB makes a forecast we don't wait 3 years until we have definitive data. Our forecasts are, therefore, based on preliminary estimates for the recent past, which are the most up-to-date information available when the forecast is made. Such revisions to national accounts estimates are a fact of life for forecasters and our forecasts will always be based on data that may differ from what's really happening in the economy. Consequently, we often would like to know how the uncertainty in the provisional estimates translates into uncertainty in our forecasts and how different our forecast would have been based on more updated estimates. This document addresses these issues by examining how sensitive CPB forecasts are to the revisions in the CBS data. Specifically, we examine the effects on our forecasts for GDP and its components of adding a typical revision to the data upon which the forecasts are based.

The main finding of this study is that between 2004 and 2014 a typical revision to GDP is about 0.2%-points between the first and second published estimates[1]. Had we known about a revision of that size when making our March forecast (CEP) that forecast for yearly GDP growth in the current year would differ by 0.23%-points. Analysis of the quarterly profile of the forecasts shows that the difference is largely due to a level shift in the predicted level of GDP caused directly by the revision rather than through some endogenous mechanism. A tentative calculation of the contribution of data uncertainty to the accuracy of our published forecasts suggests about 30% of our forecast uncertainty between 2004 and 2014 can be attributed to data uncertainty. However, that number should be placed in context: in the period between 2004 and 2014 CPB's published forecast errors were substantially lower than in other comparable periods, which inflates the apparent importance of data uncertainty for our forecast accuracy. In addition to our GDP forecasts, revisions also have a significant effect on investment forecasts, a finding similar to that reported by Lanser and Kranendonk (2008).

This documents proceeds as follows. Section 2 takes a more detailed look at the revisions process and the size of the revisions. Section 3 introduces our method of defining a typical revision to the individual components of the national accounts and presents typical revisions for the Netherlands. Section 4 takes these typical revisions and examines the effect they would have in forecasts produced using our workhorse macro model SAFFIER. Section 5 compares the effects of data revisions to the accuracy of our published forecasts, before Section 6 offers some conclusions.

[1] Between the first and the final the root mean square revision is 0.35%-points.

2 How large are CBS revisions?

The revisions timetable

In line with EU standards, CBS publishes a series of preliminary estimates of the national accounts before the definitive set of national accounts are released. Table 2.1 shows the various estimates published by CBS. The first estimate is the *flash* estimate, which is released 45 days after the end of the quarter concerned. A further 45 days later, the *regular* estimate is released. The publication lag for these first two estimates is relative to the quarter in question. The next estimate to be released is the *provisional* estimate, which is published six months after the end of the reporting year (i.e. in July 2014 CBS provided provisional estimates for all quarters of 2013). In a similar vein, the *revised provisional* and *final* estimates are published 1.5 and 2.5 years after the end of the reporting year (Van Steeg, 2006).

Table 2.1 Publication lag of the different data revisions

	Publication lag	Data frequency
Flash	45 days after an end of the quarter	Quarterly
Regular	90 days after the end of the quarter	Quarterly
Provisional	½ year after the end of the year	Quarterly, yearly
Revised provisional	1 ½ year after the end of the year	Quarterly, yearly

In addition to the revision cycle shown in Table 2.1, the definitions of the various quantities in the national accounts are updated at regular intervals, such as the recent change from ESA1995 to ESA2010 revisions. These changes update the definitions so that they more accurately reflect economic activity and can cause substantial changes to our measures of GDP and its components. For example, the recent change to ESA2010 definitions moved R&D from current costs to investment, substantially increasing measured investment and GDP. The current document is not concerned with these regular changes in definitions; we concern ourselves only with revised estimates of the same definition.

For the purposes of this document, we refer to a revision as any change relative to the original flash estimate. We do this because the last available observation when CPB makes its forecast is a flash estimate, hence any new information in a particular data vintage that was unavailable when CPB made its forecast is new relative to the flash estimate. For terminology we define a regular revision as the difference between the regular estimate (published 90 days after the end of the quarter) and the original flash estimate (published 45 days after the end of the quarter). In a similar vein a provisional revision is the difference between the subsequent provisional estimate that is published in the following year and the original flash estimate[2]. We have data on revisions to the quarter-on-quarter growth rates of the eight most important macroeconomic series in the national accounts: GDP, household consumption, government consumption, investment, exports and imports, inventories and the statistical discrepancy.

[2] More formal treatment is reserved for the section 3.1 on methodology.

How large are the revisions?

Over the period 2004Q1 to 2014Q2, GDP was typically revised upwards. As a result the average of each of the revisions (regular, provisional, revised provisional and final) of GDP and its components is positive. Subsequent data vintages are closer to the final value than the flash estimate. This should not be surprising as each subsequent vintage uses more of the data sources upon which the final estimate is made. The improvement can easily be seen by looking at the correlation coefficient between the intermediate GDP growth estimates and the final estimate. For flash estimates the correlation is 0.88, for regular 0.90 and it equals 0.94 and 0.96 for provisional and revised provisional estimates, respectively. Table 2.2 shows the mean absolute revision and the root mean squared revision for the various revisions to the GDP estimate. On average, revisions between flash and regular vintages equal 0.06%-points, with a standard deviation of 0.20%-points.

Table 2.2 Size of GDP revisions by data vintage

GDP	Regular	Provisional	Revised provisional	Final
Mean revision	0.061	0.050	0.080	0.118
Mean absolute revision	0.145	0.231	0.307	0.323
Root mean square revision	0.200	0.284	0.366	0.354

The size of the revisions is potentially economically meaningful. Based on the root mean square revision (RMSR), a typical flash-to-regular revision is 0.20%-points, which rises to 0.28%-points for provisional and to 0.35%-points for the final vintage. For comparison, CPB evaluates our forecast errors by comparing our published forecasts to the final national accounts. For the current year GDP growth forecasts made in March our root mean square forecast error (RMSFE) over the period from 2004 to 2014 is 0.65%-points[3]. The uncertainty embodied in the flash estimate is quite large compared to our forecast errors. We conduct a more detailed comparison in Section 5.

The components of GDP are more volatile than GDP itself. Table 2.3 shows the root mean square revisions for the components of GDP. Household consumption, which accounts for the largest share of GDP, shows the smallest fluctuations between the vintages. For imports, exports, public consumption and investment, root mean square revisions vary between 0.75-1.16 for regular revisions and between 0.91-1.54 for final revisions.

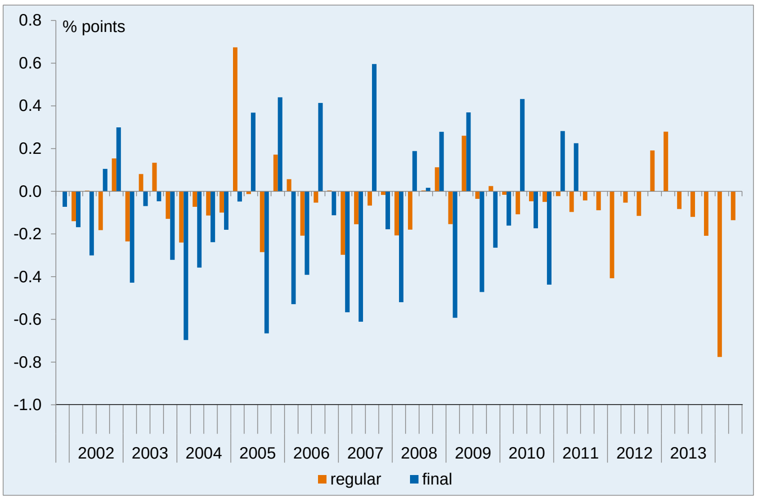
[3] The RMSFE is quite sensitive to the period chosen. For example, over the period 2001 to 2013, De Wind et al. (2015) report that the RMSFE for Centraal Economisch Plan (CEP) forecasts for the current year is 0.88 %-points, which is one-third higher than over our sample period even though the sample periods largely overlap.

Table 2.3 RMSR of the components of GDP

	Regular	Final
GDP	0.200	0.354
Household consumption	0.281	0.450
Public consumption	0.751	0.912
Investment	1.061	1.539
Exports	0.987	1.081
Imports	1.161	1.324

Revisions to GDP are smaller than revisions to the underlying components. Since the revisions to the underlying components are not perfectly correlated the revisions cancel out to some degree when aggregated to GDP. When the bulk of revisions to each variable occurs depends on the type and timing of the information upon which the estimates are based. For example, the majority of the revisions to imports and exports takes place by the regular revision since most of the information upon which these estimates are based are available quickly (CBS, 2015). In contrast, the RMSRs of the regular revisions to GDP and consumption are less than two-thirds the RMSRs of the final revisions.

Figure 2.1 GDP revisions over time: comparison to flash value



The time pattern of revisions

Figure 2.1 presents flash-to-regular and flash-to-final revisions between 2001Q4 and 2014Q2. There is no clear time pattern that would suggest predictability of revisions contingent on the state of the economy. This is at odds with the well documented observation that GDP revisions are countercyclical in most countries - that is, statistical agencies are overly optimistic during recessions and excessively pessimistic during expansions (Swanson and van Dijk, 2001). Such a countercyclical pattern is more evident in year-on-year rather than quarter-on-quarter growth rates. Additionally, the revisions in Figure 2.1 display no obvious seasonal pattern to the revisions[4].

[4] A simple regression of the revisions on seasonal dummies backs this conclusion.

International comparison

As we have seen, the national accounts produced by CBS are subject to revision, some of which can be large. However, the Netherlands is not an outlier in either direction or size of revisions[5]. The size of the revisions is comparable with the other OECD and G7 countries (McKenzie, 2006; Roodenburg and Reijer, 2006, Aruoba, 2008, Sinclair and Stekler, 2013). Neither are the observations detailed above a new phenomenon for the Netherlands. Previous analysis conducted for the Netherlands (Roodenburg, 2004; Roodenburg and Reijer, 2006) has detailed similar findings for previous time periods. There is some evidence that revisions have become smaller in recent years (see also Zwijnenburg, 2015), although, as Figure 2.1 shows, the revision in 2014Q1 was the largest in our sample period.

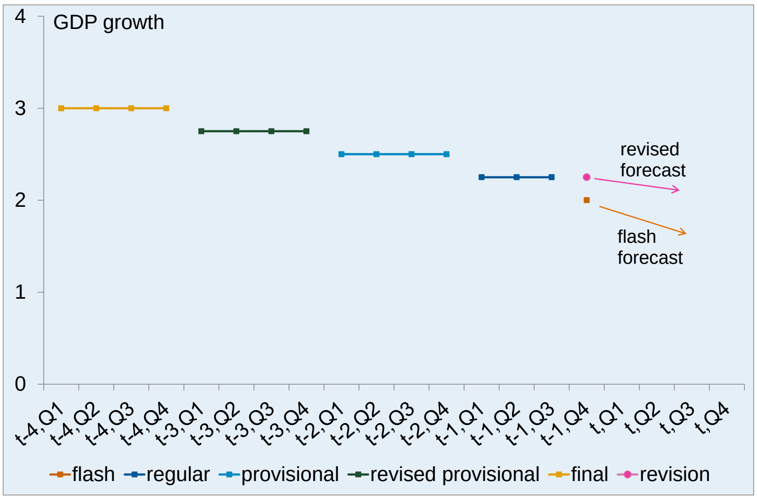
3 Defining a typical revision

In general, revisions are correlated both across variables (for example, when GDP is revised consumption is too) and across time (when GDP in the 4th quarter is revised, the 3rd quarter will likely change too). For the current document we abstract from the latter dimension by focusing on a revision where only the correlation across variables plays a role. This is very similar to the situation we face when we make our forecasts in March. In that case, the last observation (for the 4th quarter of the previous year) is a flash estimate of the national accounts, which was published in mid-February. As shown in table 2.1, a couple of weeks after our forecast is published, the last observation is revised from a flash to a regular estimate. Data preceding the 4th quarter of the previous year is not revised. Our approach here is effectively to look at how different our forecasts would have been if they had been based on the data that becomes available a couple of weeks after our official forecast is published instead of the data which was actually used. Specifically, we add a typical flash-to-regular revision to the last observed data point only. All subsequent revisions that also entail that the preceding data is also revised are ignored. Although this represents a fairly limited definition of a typical revision, it does greatly simplify the analysis.

A stylised representation is shown in Figure 3.1 wherein the true GDP growth is an annualised 3% per year. When CPB makes a forecast in the first quarter of year t only data from t-4 is a final definitive measure of GDP growth – the data for years t-3 to t-1 are preliminary and subject to revision. The fourth quarter of t-1 is a flash estimate. In this study we compare the 'flash forecast' that CPB would make with a 'revised forecast' where we add a typical revision to the flash estimate for the fourth quarter of t-1 only.

[5] Also, it is important to notice that smaller revisions do not automatically imply a better functioning statistical office. It may be the case that the countries with small revisions simply do not revise their national accounts thoroughly, i.e. some components remain estimated rather than calculated.

Figure 3.1 A stylised representation of our approach



This section starts by explaining how we ensure that the accounting identity for GDP is satisfied before detailing our method for defining a typical revision to each variable and how that relates to revisions in the other variables. Finally this section applies our definition of a typical revision to the data for flash-to-regular revisions introduced in section 2.

3.1 Ensuring revisions obey accounting identities

One of the strengths of forecasting with a large macro model is that it ensures all accounting identities are satisfied. For the current analysis that imposes some constraints on the shocks we can give the model, since they must also satisfy the accounting identities. We have data on revisions to GDP and the seven components of GDP[6], which must add up to GDP. Normally estimates (as represented by X) are expressed as a quarter-on-quarter growth rates, following the standard formula:

$$X_t = \frac{Y_t - Y_{t-1}}{Y_{t-1}} * 100\%.$$

However, using these growth rates only satisfies the accounting identities approximately. Hence, for our analysis we use standardised quarter-on-quarter growth rates for the components of GDP. The calculation of GDP growth rates remain unchanged, but the components are computed as:

$$X_t = \frac{Y_t - Y_{t-1}}{GDP_{t-1}} * 100\%.$$

Effectively, the resulting number is the contribution of variable Y to GDP. This calculation ensures that the accounting identity for GDP is satisfied.

[6] The seven components are private consumption, public consumption, investment, exports, imports, inventories and the statistical discrepancy.

3.2 Defining a typical revision

We use a generalised impulse, which is widely used in vector autoregressions (see Hashem Pesaran and Shin, 1998, for example). Intuitively a generalised impulse is a vector of impulses for each variable where each impulse is the expected deviation conditional on a one standard deviation impulse for the variable of interest. For example, if you see GDP revised upward by one standard deviation, on average you see consumption revised upwards by *x*%. For our eight variables we end up with a vector containing the standard deviation of the revision for that variable and the cross-correlation typically observed for the other variables. In what remains of this document we will refer to such vectors of impulses conditional on a one standard deviation revision to variable *X* as a *typical revision* to variable *X*.

In detail, a generalised impulse applied to our revisions data is implemented as follows. Let r_t be a vector containing the revisions to each variable for period *t*. The typical cross correlation between the revisions can be described by a simple covariance matrix, Σ, which we show here for a system with three variables, r_1, r_2 and r_3.

$$\Sigma_1 = E(r_t r_t') = E\begin{pmatrix} r_1 \\ r_2 \\ r_3 \end{pmatrix}\begin{pmatrix} r_1 & r_2 & r_3 \end{pmatrix} = \begin{pmatrix} \sigma_1^2 & \sigma_{21} & \sigma_{31} \\ \sigma_{21} & \sigma_2^2 & \sigma_{32} \\ \sigma_{31} & \sigma_{32} & \sigma_3^2 \end{pmatrix}$$

We define a typical revision to the first variable and the corresponding revisions to the other variables as the first column of the Cholesky decomposition of Σ_1. That is, the typical shock to the first variable is

$$Shock_1 = \begin{pmatrix} \sigma_1 \\ \frac{\sigma_{21}}{\sigma_1} \\ \frac{\sigma_{31}}{\sigma_1} \end{pmatrix}.$$

In words, when the first variable is revised up by one standard deviation then, on average, the second variable is revised by $\frac{\sigma_{21}}{\sigma_1}$ and the third variable by $\frac{\sigma_{31}}{\sigma_1}$. That is how much variables 2 and 3 typically vary when variable 1 varies by one standard deviation.

For the second and third variables we simply reorder the variables with the variable of interest ordered first. For example with the second variable:

$$\Sigma_2 = \begin{pmatrix} \sigma_2^2 & \sigma_{12} & \sigma_{32} \\ \sigma_{12} & \sigma_1^2 & \sigma_{31} \\ \sigma_{32} & \sigma_{31} & \sigma_3^2 \end{pmatrix}$$

so

$$Shock_2 = \begin{pmatrix} \sigma_2 \\ \frac{\sigma_{12}}{\sigma_2} \\ \frac{\sigma_{32}}{\sigma_2} \end{pmatrix}.$$

3.3 Generalised shocks based on national accounts revisions

As described in section 2 we have data on revisions to eight variables. Applying the generalised impulse method to those revisions gives us the eight stylised shocks shown in table 3.1. These shocks are computed based on the flash-to-regular revisions of the quarterly growth rates. The leading diagonal contains the RMSRs for the eight variables, which is our measure of the magnitude of a typical revision to each of the variables. The remainder of each column contains the revisions to the other components that would be expected given the shock to the main variable.

Table 3.1 Generalized revisions

	Shock to GDP	Shock to Private consumption	Shock to Public consumption	Shock to Investment	Shock to Exports	Shock to Imports	Shock to inventories	Shock to statistical discrepancy
GDP	0.201	0.078	0.070	0.032	0.070	0.079	0.064	0.019
Private consumption	0.053	0.138	0.047	-0.027	0.040	0.055	0.005	0.011
Public consumption	0.062	0.062	0.180	-0.052	-0.043	-0.024	0.033	-0.044
Investment	0.034	-0.042	-0.060	0.211	-0.016	0.013	0.008	0.000
Exports	0.271	0.223	-0.182	-0.058	0.774	0.667	0.062	0.027
Imports	0.325	0.333	-0.108	0.051	0.714	0.827	0.326	0.285
Inventories	0.079	0.009	0.045	0.009	0.020	0.098	0.248	0.030
Statistical discrepancy	0.027	0.022	-0.069	0.000	0.010	0.097	0.034	0.280

The cross-correlation between the standardised growth rate revisions shown in table 3.1 partly reflects economics and partly reflects the information gathering process at CBS. For example, for typical revisions to most variables both imports and exports show similar revisions. This is driven by the large role played by re-exports through Rotterdam and also because they are subject to similar problems with data collection methods.

Looking at the one standard deviation revision to GDP, this is associated with large revisions to exports and imports, mainly due to their large share in GDP. Relative to their share of GDP revisions to public consumption and investment when GDP is revised are large. Revisions to these components are substantial because they are derived largely from annual survey data - hence, there are few short term indicators for these components and information is not available when the flash forecast is being constructed. Furthermore, investment is a volatile time series and subject to significant revisions, reflecting the one-off nature of investment projects (Zwijnenburg, 2015).

In general, the correlation between GDP and household consumption revisions is low, especially given the large share of GDP accounted for by household consumption. Preliminary estimates of household consumption are based largely on monthly series for retail sales, but this lacks information on a number of important components of consumption, such as sports, culture and recreation. In turn, GDP statistics are based on monthly manufacturing and trade data, but the flash estimate is not based on hard data for the production side of the economy. For example, hard data for healthcare, government and banking sectors are not included in the flash estimate. Given the low correlation between GDP revisions and consumption revisions it seems that the information contained in the sources omitted from the flash estimate are largely independent.

For the revision to private consumption there are also large movements in exports and imports, especially the latter. The large movements, once again, reflect the size and volatility of exports and imports. Imports vary more with consumption than exports simply because a significant share of consumption is imported, whilst exports depend on foreign consumption and investment. A very similar explanation holds for the correlation between an RMSR investment revision and revisions to imports, since around two-thirds of investment goods are imported.

The revisions of the final major components of GDP, exports and imports, are highly correlated with each other, but not with the other components. Again, this is simply mirroring the role played by re-exports that we detailed above when explaining the GDP revisions.

4 The effect of revisions in SAFFIER

Now that we have defined a typical revision, we turn our attention to the effects of such a revision in SAFFIER, the workhorse model of CPB. To do so, we compare a baseline CEP forecast[7] with an alternative forecast where the flash estimate for the last observation is replaced by the flash estimate adjusted for a typical revision. This is a similar situation to that faced by CPB when presenting our forecasts, since users of our forecasts typically want to know why one forecast differs from the previous forecast. One such difference is the revision of the flash estimate to a regular estimate. In the main text we will focus on a typical GDP revision, results for typical revisions to the components of GDP are presented in appendix A. Before discussing the outcome of the simulation we first detail conditions under which the simulations were carried out.

The rules of the game

- The quarterly version of the SAFFIER model is used. Whilst our published forecasts are yearly forecasts, SAFFIER actually produces a quarterly path for each forecast. In this study we report the effect on both yearly and quarterly forecasts.
- The last observation in the data set is shocked with a typical revision, as defined in the previous section. Given our CEP framework, that corresponds to giving a shock to the 4th quarter of the previous year. None of the data before the 4th quarter are altered[8].

[7] SAFFIER is, in large part, a linear model. That implies that the choice of baseline forecast is of little importance for analyzing the effect of a revision since the same revision would alter the forecasts similarly regardless of what the actual baseline is. The most important non-linearity in the model is in the labour market block: periods with high unemployment behave differently to periods with low unemployment, although the degree of non-linearity is not large.
[8] In reality, when Statistics Netherlands updates their 4th quarter flash estimates the seasonal adjustment is recalculated, which changes all of the previous quarters for that year too. Such changes are typically small compared to the size of the revisions so the current analysis ignores those changes.

- The add factors arising from expert opinion[9] used to produce the baseline forecast are kept unchanged for the alternative forecast. This assumption may lead to an overestimate of the effect of revisions on our forecasts in the sense different data would lead to different expert opinion.
- In contrast to the baseline forecast where some fiscal variables, specifically revenue variables, are forecast by other dedicated models[10], the alternative forecast treats these variables endogenously, relying on the built-in "rules-of-thumb" in SAFFIER (See CPB, 2010). This is in line with the way CPB uses the model for scenario analysis.

The effect of revisions on SAFFIER forecasts

Table 4.1 displays the effects on a yearly CEP forecast of a one standard deviation revision to GDP and corresponding revisions to the other variables typically observed when GDP is revised. It shows the difference in annual growth rates between the baseline forecast and the alternative forecast for selected macroeconomic variables. The first two columns contain the shocks, whilst the final two columns contain the responses to the shocks. The growth rates given in these tables are standard growth rates with respect to each variable's own past value. We focus first on the annual forecasts since these are the key forecasts that CPB makes and any changes from forecast round to forecast round receive considerable attention.

The quarterly shock itself is shown in the column for Q4, t-1, since the shock is applied to the fourth quarter of the previous year. Due to carry-over effects, when looking at the effects on annual forecasts, about 25% of the revision is visible in year t-1 and about 75% in year t. This can be easily seen in the table because the column for year t-1 is ¼ of the quarterly change in the preceding column. In addition to the variables shocked, other variables such as labour productivity which are, at least partly, deterministic functions of GDP, also change. This accounts for the small observed changes in the non-shocked variables.

The main results are displayed in the columns for t and t+1. If GDP growth in the last period of year t-1 would have been higher by a typical revision, then our forecast for GDP growth in year t would have been 0.23 %-points higher. Furthermore, all of the components of GDP would have been higher too, with the 0.46 %-points increase in investment the largest change[11]. In year t+1, GDP growth is only marginally above the baseline growth forecast. The persistent increase in the GDP growth forecast is driven by a persistent response of consumption, which is the only component of GDP that is not already returning to the baseline path.

The intuition behind this pattern of responses is that such a revision would be typical for more demand at the end of t-1 compared to the baseline. Since demand is normally correlated across time periods, the extra demand in t-1 also shows up in period t for all

[9] As with most large macro econometric models, SAFFIER is normally used in conjunction with expert knowledge. This expert knowledge allows the forecaster to take account of other sources of information not formally incorporated into the main model, such as consumer confidence.

[10] When making an official forecast fiscal policy variables (such as tax revenues) come from a detailed fiscal policy model TAXUS (Verkade, 2015). SAFFIER treats these variables as exogenous. The final forecast is an iterative process between the two models: SAFFIER produces economic forecasts treating the tax variables as exogenous and the other model produces projections for the fiscal policy variables conditional on the economic forecast from SAFFIER.

[11] Of course, investment is a relatively small share of GDP so such large growth is compensated by consumption, which is the largest component of GDP, growing slightly less than GDP.

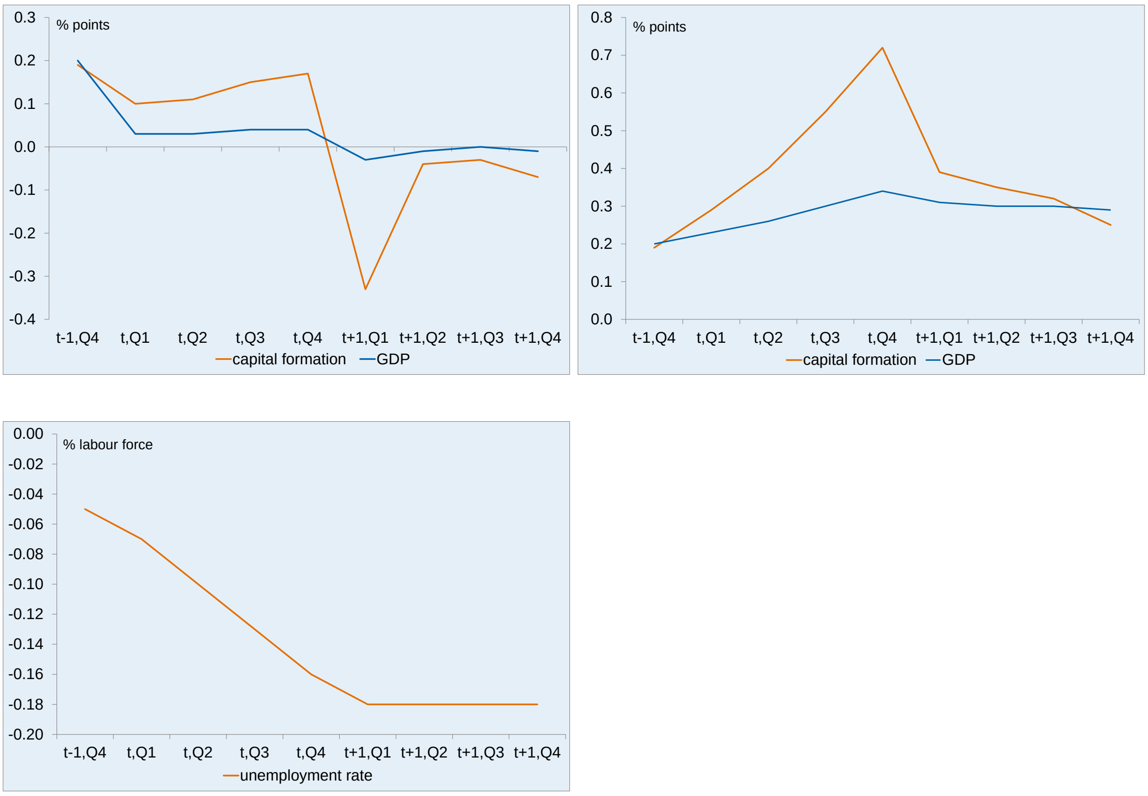
expenditure categories. The effect is especially noticeable in investment, which we would expect firms to undertake to help meet the extra demand. Furthermore, the investment response is larger because a large increase in investment is needed to provide a small increase in capital. The large effect on investment is also in line with the finding of Lanser and Kranendonk (2008), who found investment forecasts were highly susceptible to uncertainty in provisional data publications. We would also expect such increased demand to show up eventually in increased employment, although employment normally lags output and capacity utilisation since it takes time to find and hire good new workers. Once the extra capital is installed, less new investment is needed in year t+1 compared to year t, so the growth reverses as the forecasts tend towards the baseline forecast path.

Yearly growth forecasts can sometimes be difficult to interpret – by changing the level of a series in the baseline year the forecast for the growth rate in the following year is also changed due to the carry-over effect. As a consequence it is not surprising to find differences between the baseline and alternative forecasts for t. A better understanding of the differences displayed in table 1 can be obtained by looking at the differences in the quarter-on-quarter profile of the forecasts. Figure 4.1 shows quarterly responses to the revision. For the growth rate of GDP it is clear that the initial shock is the dominant feature, with subsequent growth rates similar to the baseline path. That means that the effect of the revision is a level shift in the forecast for the level of GDP, which is not surprising given that GDP is an integrated process. The temporary boost to investment needed to produce the extra GDP is clearly visible in the figure showing the level responses of GDP and investment. Figure 4.1 also shows the unemployment response, which slowly falls due to the lag involved in finding and hiring new workers.

Table 4.1 Differences between baseline and alternative forecast (annual differences)

	Shock		Responses	
	Q4, t-1	t-1	t	t+1
GDP and demand (volume)				
Gross domestic product (GDP, economic growth, %)	0.20	0.05	0.23	0.02
Consumption households (%)	0.12	0.03	0.14	0.12
Consumption general government (%)	0.22	0.05	0.16	-0.08
Capital formation (%)	0.19	0.05	0.46	-0.17
Exports of goods and services (%)	0.31	0.08	0.23	-0.02
Imports of goods and services (%)	0.42	0.10	0.28	-0.10
Labour market				
Labour force (%)	0.00	0.00	0.01	0.02
Active labour force (%)	0.06	0.01	0.12	0.09
Unemployment (in thousands of persons)	-4.76	-1.19	-10.49	-16.11
Unemployment rate (% of the labour force)	-0.06	-0.01	-0.13	-0.20

Figure 4.1 **Effects of GDP revisions on the quarterly profile of forecasts: growth rates (left) levels (right) and the unemployment rate (below)**



5 Relating the effect of data revisions to CPB's forecast errors

The results in the previous section tell us that a one standard deviation revision in the fourth quarter of the previous year changes our annual forecast made in March for the current year by 0.23%-points. In other words, the standard deviation of the forecast error caused by forecasting based on uncertain flash data is 0.23%-points. How does this relate to the overall error of our published forecasts? How accurate would our forecasts be if they were based on fully accurate data?

To answer this let X represent the forecast error caused by preliminary data and Y the forecast error caused by all other sources of forecast error, then the uncertainty in the final forecast is given by

$$Var(X+Y) = Var(X) + Var(Y) + 2Cov(X,Y).$$

As reported in section 2, the RMSFE for current year GDP growth of our published CEP forecasts is 0.65%-points - so our mean squared forecast error $0.65^2 = 0.42\%\text{-points}^2$.

Suppose we take the uncertainty caused by flash-to-regular revisions as representative of the uncertainty caused by all of the preliminary data, then the variance caused by uncertain flash data is $0.23^2 = 0.05$%-points^2. Suppose further that X and Y are uncorrelated, that is the data uncertainty is uncorrelated with the other sources of forecast error, then Cov(X,Y) = 0. Consequently we can use the equation above to back out the root mean squared forecast error caused by all other sources of uncertainty: $(0.42\text{-}0.05)^{½} = 0.61$%-points. That is what our published forecast error would be if we received perfectly accurate data from CBS. Based on these assumptions the accuracy to be gained from more accurate preliminary national accounts is limited.[12]

However, the effects of flash-to-regular revisions is not a true reflection of the uncertainty inherent in using preliminary data. In this document we look at flash-to-regular revisions for the most recent quarter only, whilst our published forecast errors are calculated relative to the final definitive data. Therefore, to compare how much more accurate our forecasts would be with perfect data we would need to look at the effects of flash-to-final revisions rather than flash-to-regular. As reported in section 2, the RMSR for GDP from flash-to-final is 0.35%-points – since SAFFIER is approximately linear a rough calculation of what that would mean for the change in forecast would be about 0.40%-points. Following the calculation above once again would imply that removing the whole flash-to-final revision would lower our RMSFE from 0.65%-points to 0.51%-points.

Furthermore, to accurately reflect the contribution of data uncertainty to our forecast errors would require us to take account of the effects of revisions in all periods subject to revision, not just the last observation. That, however, is beyond the scope of this paper. Nonetheless, a few general observations should give us a ball park idea of the magnitude of the effect. In general, whether adding an extra source of uncertainty increases the overall uncertainty depends on the covariance between the sources of uncertainty[13]. Taking into account that the previous data is also uncertain doesn't necessarily increase the overall uncertainty of our forecasts. For the current analysis it is sufficient to assume that the increased uncertainty caused by uncertainty about the preceding data does increase the overall level of forecast uncertainty, but not by a lot. Taking all of these effects into account, if we had based our forecasts for the period 2004 to 2014 on fully accurate data we could have reduced the mean square forecast error by about one-third.

[12] The proportion of our forecast error attributable to uncertain data reported here is probably an overestimate of the true importance of uncertain data. Between 2004 and 2014 the forecast error of our published CEP forecasts is lower than for other periods, which may simply reflect the small number of observations. A higher published forecast error would automatically imply a smaller role for the effects of uncertain data. One reason we think our sample period had an unusually low forecast error is that, if we calculate Cov(X,Y) from our sample period it is significantly negative: in fact |2*Cov(X,Y)| > |Var(X)|. That implies that our published forecast error in the period 2004 to 2014 would have been higher if we had based our forecasts on definitive data rather than the provisional data we actually had available. In the calculations reported here we assume Cov(X,Y) = 0 because we believe it is reasonable to assume that uncertain data is uncorrelated with other sources of forecast error, such as shocks occurring after the forecast is made.

[13] In our case, the size of the effect on our forecast depends principally on two factors: 1) the correlation between flash-to-final revisions and the revisions for previous periods and 2) the correlations embodied in the lag structures in SAFFIER. To illustrate this, suppose that when the level of GDP in the most recent period is revised upwards, the levels in the previous periods are also revised by the same amount. In the short-run, the error correction terms in SAFFIER play only a small role, meaning that the short-run forecast is largely driven by the preceding growth rates. Since all of the preceding levels are shifted upwards equally, the growth rates would stay the same and have very little effect on the forecast from SAFFIER, except for the relatively small effect of the error correction term.

At first glance this appears to suggest that uncertain data is more important than was found previously by Lanser and Kranendonk (2008), who looked at a similar issue using stochastic simulations. They took typical provisional-to-final and revised-provisional-to-final revisions for all quarters subject to revision and report that the uncertainty in provisional data contributes about 15% of the total uncertainty in our published forecasts. However, two points must be noted: 1) this 15% is for a sample period with a significantly higher RMSFE than our sample and 2) focusing on provisional-to-final and revised-provisional-to-final underestimates the uncertainty in the most recent periods. Specifically, the forecast standard error induced by the provisional-to-final and revised provision-to-final in Lanser and Kranendonk (2008) was about 0.5%-points. The RMSR of provisional-to-final is 0.25%-points as opposed to the RMSR of flash-to-final, which is 0.35%-points. Adding in the extra uncertainty embodied in the flash-to-final and regular-to-final revisions and the analysis of Lanser and Kranendonk represents a higher induced standard error than we report in the current study. That's intuitive because the revisions themselves appear to be getting smaller (Zwijnenburg, 2015), thus the uncertainty they cause in our published forecasts is getting smaller.

All-in-all, the key conclusion of Lanser and Kranendonk (2008) still holds – most of our published forecast error is attributable to factors other than the uncertainty in provisional national accounts data. Our current analysis suggests that it increases the mean square forecast error by about 0.15%-points[2]. What proportion this is of our overall forecast error depends crucially on the magnitude of the other sources of forecast error.

6 Concluding comments

There is an inherent trade-off between the speed of publication of preliminary estimates of the national accounts and their accuracy. It takes considerable time to compile all of the relevant underlying data into a definitive set of national accounts. In contrast, when forecasting it is important to have the latest available information. That implies that CPB's forecasts are, and will continue to be made on the basis of incomplete, preliminary estimates of the national accounts. As the quote at the start of the document makes clear, different information would likely have led us to make different forecasts. This document has attempted to put the size of those changes into perspective.

This document has shown that, although the majority of our forecast error is caused by other sources of uncertainty, errors in provisional data can be an important part of the overall forecast error for our published forecasts. There are alternatives to using preliminary data, but these also have significant drawbacks. One alternative is to make forecasts without any estimate of the latest data, which is unlikely to be an improvement. Another would be for CPB to base its forecasts on its own prediction of what the final, definitive data will be rather than solely on the latest official data[14]. That, however would not only move our forecasts

[14] This is related to the problem of nowcasting - see Bańbura et al. (2013) for a comprehensive review.

away from being directly based on the official national accounts[15], it would also be technically challenging to produce a consistent set of accounts for both prices and quantities.

7 Appendix A

7.1 Private consumption

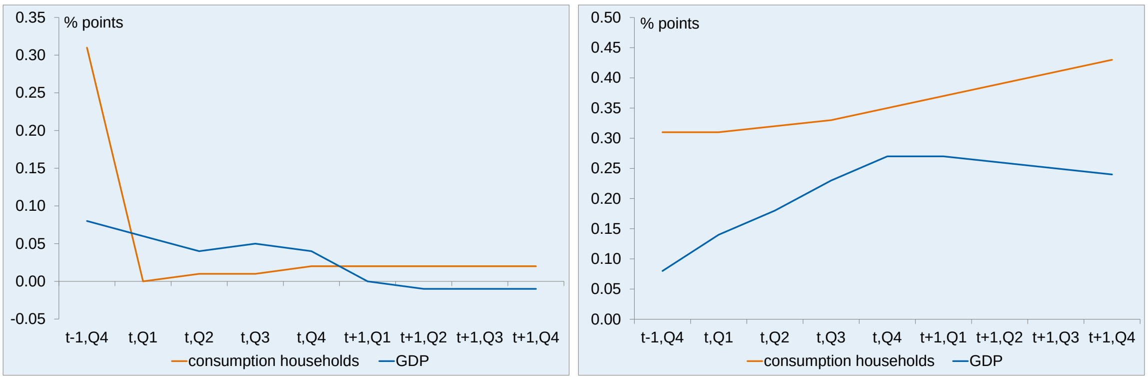
As with the table in the main text, the first column shows the shock applied to the 4th quarter of the previous year, whilst the remaining three columns show the effects of the revision on the annual growth forecasts of the listed variables. Whilst a typical consumption revision does alter the annual growth rate forecasts, this is largely driven by the carry-over effect. As can be seen in Figure 7.1, a typical consumption revision only has an effect on the growth rate of consumption in the period of the shock itself. The difference between the baseline and the alternative forecast is almost zero in the forecast period. That translates into a level shift for the level of consumption. The effect on GDP growth is more persistent than for consumption growth, although the level effect is smaller. The persistent effect on the growth rate of GDP is mainly driven by the increased investment that is stimulated by the extra demand inherent in the shock. A similar mechanism was described in the main text of section 4.

Table 7.1 Differences between baseline and alternative forecast (annual differences)

	Shock	Responses		
	Q4, t-1	t-1	t	t+1
GDP and demand (volume)				
Gross domestic product (GDP, economic growth, %)	0.08	0.02	0.18	0.06
Consumption households (%)	0.31	0.07	0.24	0.06
Consumption general government (%)	0.22	0.05	0.16	-0.08
Capital formation (%)	-0.24	-0.06	0.21	0.14
Exports of goods and services (%)	0.26	0.07	0.19	-0.02
Imports of goods and services (%)	0.43	0.11	0.30	-0.10
Labour market				
Labour force (%)	0.00	0.00	0.01	0.02
Active labour force (%)	0.06	0.01	0.08	0.09
Unemployment (in thousands of persons)	-4.83	-1.21	-7.34	-13.1
Unemployment rate (% of the labour force)	-0.06	-0.02	-0.09	-0.16

[15] Currently, only under some limited circumstance does CPB deviate from provisional national accounts data. Specifically, when the latest information from the ministry of Finance for quarterly government consumption and healthcare expenditures has not been updated in the official quarterly national accounts, CPB follows the ministry of Finance information. CPB never deviates from the annual national accounts data.

Figure 7.1 Effect on growth rate (left) and level (right) forecasts of a typical private consumption revision



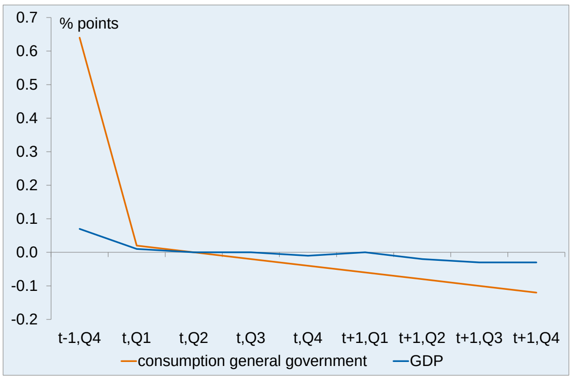
7.2 Public consumption

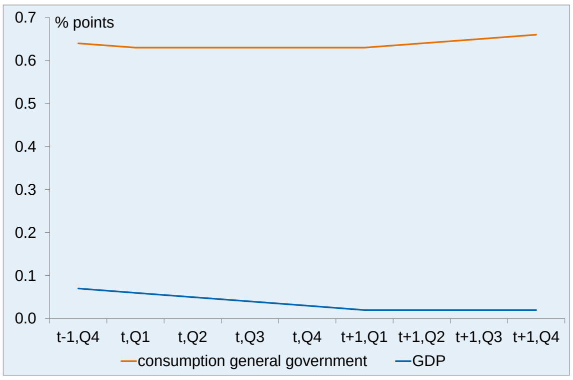
The effects of a typical revision in government consumption are rather small, both on the annual growth rates and on the quarterly profiles of the forecasts. Only in the quarter of the shock is the growth rate higher than the baseline forecast and the effect on the level is limited too, with the GDP level forecast back to baseline by the end of the second year. Due to the small effects on demand, the differences between the labour market outcomes of the baseline and the alternative forecast are also small.

Table 7.2 Differences between baseline and alternative forecast (annual differences)

	Shock	Responses		
	Q4, t-1	t-1	t	t+1
GDP and demand (volume)				
Gross domestic product (GDP, economic growth, %)	0.07	0.02	0.03	-0.02
Consumption households (%)	0.11	0.03	0.04	-0.03
Consumption general government (%)	0.64	0.16	0.47	0.02
Capital formation (%)	-0.35	-0.08	-0.30	-0.09
Exports of goods and services (%)	-0.21	-0.05	-0.15	0.02
Imports of goods and services (%)	-0.14	-0.03	-0.08	0.01
Labour market				
Labour force (%)	0.00	0.00	0.01	0.00
Active labour force (%)	0.05	0.01	0.04	-0.01
Unemployment (in thousands of persons)	-4.28	-1.07	-3.97	-3.05
Unemployment rate (% of the labour force)	-0.05	-0.01	-0.05	-0.04

Figure 7.2 Effect on growth rate (left) and level (right) forecasts of a typical public consumption revision





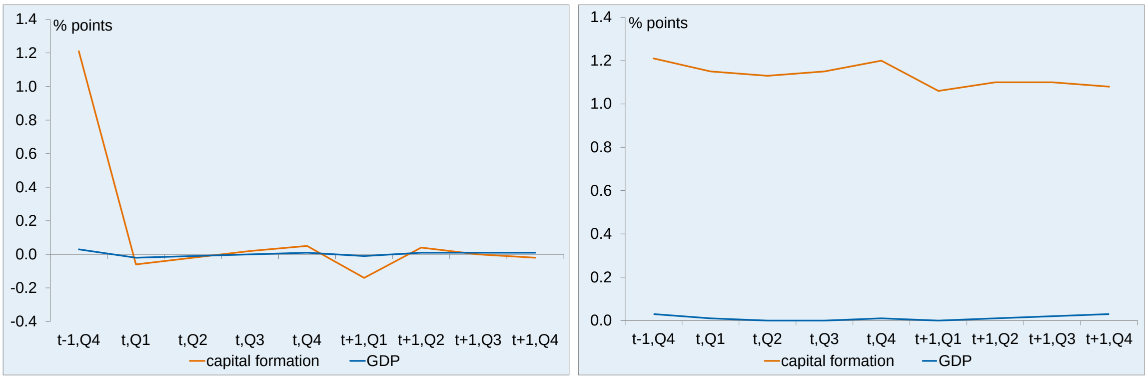
7.3 Investment

As Figure 7.3 make clear, the effects of a typical revision to investment is almost entirely felt in the quarter of the shock itself. The seemingly large effect on the current year annual growth forecast for investment is almost entirely a carry-over effect. Given such small effects on the growth rates of GDP and investment it is not surprising that the differences between the labour market outcomes of the baseline and the alternative forecast are also small.

Table 7.3 Differences between baseline and alternative forecast (annual differences)

	Shock	Responses		
	Q4, t-1	t-1	t	t+1
GDP and demand (volume)				
Gross domestic product (GDP, economic growth, %)	0.03	0.01	0.00	0.01
Consumption households (%)	-0.06	-0.01	-0.05	0.01
Consumption general government (%)	-0.18	-0.05	-0.14	0.07
Capital formation (%)	1.21	0.29	0.82	-0.08
Exports of goods and services (%)	-0.07	-0.02	-0.05	0.01
Imports of goods and services (%)	0.07	0.02	0.05	-0.01
Labour market				
Labour force (%)	0.00	0.00	-0.01	0.00
Active labour force (%)	-0.05	-0.01	-0.02	0.02
Unemployment (in thousands of persons)	4.06	1.01	2.08	0.26
Unemployment rate (% of the labour force)	0.05	0.01	0.03	0.00

Figure 7.3 Effect on growth rate (left) and level (right) forecasts of a typical investment revision



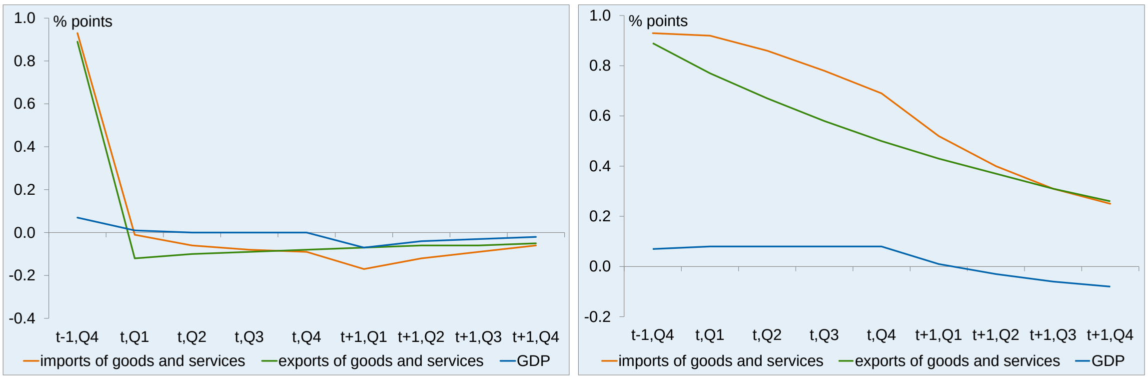
7.4 Imports

When imports are revised, exports are also revised by a similar, albeit slightly smaller amount. This follows directly from the importance of re-exports for the Netherlands. As Figure 7.4 shows, imports are slightly more persistent than exports as both levels tend back toward the baseline forecast. This difference between imports and exports ends up in inventories (not shown). The slow return to the baseline level forecast is driven by the link between both imports and exports and world trade, which is exogenous and fixed in this exercise (it is also exogenous for our short-term forecasts, CEP and MEV). The exogenous world trade acts as an anchor for both the import and exports forecasts. Once again, for the other variables the main change in the growth rate forecasts comes from carry-over effects, since the quarterly growth forecasts return to the baseline immediately.

Table 7.4 Differences between baseline and alternative forecast (annual differences)

	Shock	Responses		
	Q4, t-1	t-1	t	t+1
GDP and demand (volume)				
Gross domestic product (GDP, economic growth, %)	0.07	0.02	0.06	-0.12
Consumption households (%)	0.09	0.02	0.06	0.00
Consumption general government (%)	-0.15	-0.04	-0.11	0.05
Capital formation (%)	-0.09	-0.02	0.01	-0.54
Exports of goods and services (%)	0.89	0.23	0.41	-0.30
Imports of goods and services (%)	0.93	0.23	0.59	-0.45
Labour market				
Labour force (%)	0.00	0.00	0.00	0.01
Active labour force (%)	-0.04	-0.01	0.02	0.01
Unemployment (in thousands of persons)	3.40	0.85	-0.86	-1.33
Unemployment rate (% of the labour force)	0.04	0.01	-0.01	-0.02

Figure 7.4 Effect on growth rate (left) and level (right) forecasts of a typical imports revision



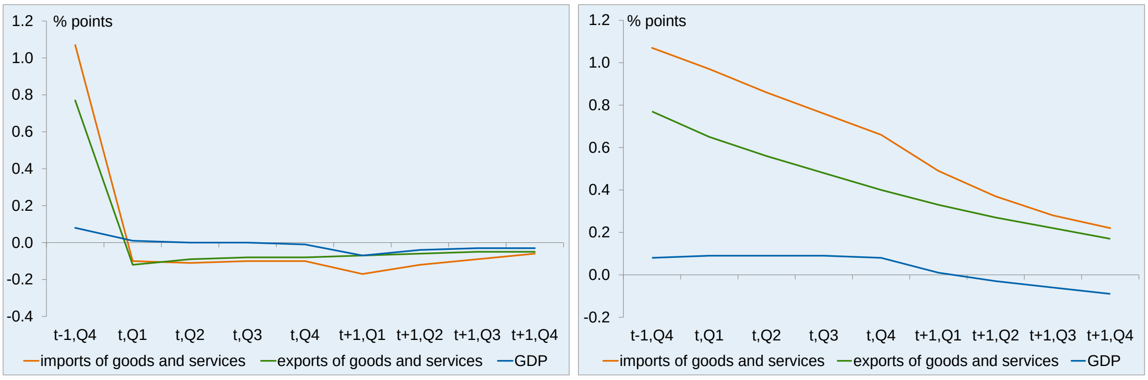
7.5 Exports

Exports display a very similar response to the imports revision because the same mechanisms are at work.

Table 7.5 Differences between baseline and alternative forecast (annual differences)

	Shock	Responses		
	Q4, t-1	t-1	t	t+1
GDP and demand (volume)				
Gross domestic product (GDP, economic growth, %)	0.08	0.02	0.06	-0.12
Consumption households (%)	0.12	0.03	0.09	0.00
Consumption general government (%)	-0.08	-0.02	-0.06	0.03
Capital formation (%)	0.07	0.02	0.11	-0.53
Exports of goods and services (%)	0.77	0.20	0.34	-0.28
Imports of goods and services (%)	1.07	0.27	0.55	-0.48
Labour market				
Labour force (%)	0.00	0.00	0.00	0.01
Active labour force (%)	-0.02	-0.01	0.02	0.00
Unemployment (in thousands of persons)	1.91	0.48	-1.68	-1.13
Unemployment rate (% of the labour force)	0.02	0.01	-0.02	-0.02

Figure 7.5 Effect on growth rate (left) and level (right) forecasts of a typical exports revision



References

Aruoba, S., 2008, Data Revisions Are Not Well Behaved, *Journal of Money, Credit and Banking,* vol. 40: 319-340.

Bańbura, M., D. Giannone, M. Modugno and L. Reichlin, 2013, Now-casting and the real-time data flow, European Central Bank Working Paper .1564.

CBS, 2015, Overzicht van bijstellingen op de ramingen van de economische groei in 2015, http://www.cbs.nl/nl-NL/menu/themas/macro-economie/methoden/bijstellingen/economische-groei/default.htm.

CPB, 2010, SAFFIER II, 1 model voor de Nederlandse economie, in 2 hoedanigheden, voor 3 toepassingen, CPB Document 217.

Hashem Pesaran, M., Shin, Y., 1998, Generalized impulse response analysis in linear multivariate models, Economics Letters, vol. 58(1)*:* 17-29.

Lanser, D. and H. Kranendonk, 2008, Investigating uncertainty in macroeconomic forecasts by stochastic simulation, CPB Discussion Paper 112.

McKenzie, R., 2006, Undertaking Revisions and Real-Time Data Analysis using the OECD Main Economic Indicators Original Release Data and Revisions Database, OECD Statistics Working Papers 2006/02.

Roodenburg, O., 2004, On the predictability of GDP data revisions in the Netherlands, DNB Working Paper 4.

Roodenburg, O. and A. Reijer, 2006, Dutch GDP Data Revisions: Are They Predictable and Where Do They Come From?, *Applied Economics Quarterly,* vol. 52: 337-356.

Sinclair, T. and H. Stekler, 2013, Examining the quality of early GDP component estimates, *International Journal of Forecasting,* vol. 29*:* 736-750.

Swanson, N. and D. van Dijk, 2001, Are statistical reporting agencies getting it right? Data rationality and business cycle asymmetry, Econometric Institute Research Report 2001-28/A.

Steeg, G-J. van, 2006,. Bijstellingen ramingen economische groei, De Nederlandse Conjunctuur Centraal Bureau voor de Statistiek, pp. 30-35.

Verkade, E., 2015, Het belastingramingsmodel TAXUS, CPB Achtergronddocument.

Wind, J. de, K. Grabska and D. Lanser, 2015, Onzekerheid rondom CPB-ramingen, in kaart gebracht met fan charts, CPB Achtergronddocument.

Zwijnenburg, J., 2015,. Revisions of quarterly GDP in selected OECD countries, OECD Statistics Brief 22.

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