

Office for
**Budget
Responsibility**

Briefing paper No.7

Evaluating forecast accuracy

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1 Introduction

Why evaluate past forecasts?

- 1.1 The Office for Budget Responsibility (OBR) was created in 2010 to provide independent and authoritative analysis of the UK's public finances. To that end we produce two 5-year-ahead forecasts for the economy and the public finances each year. Parliament also requires us to evaluate our past forecast accuracy at least once a year, which we do in our *Forecast evaluation report (FER)* each October.
- 1.2 Forecasts provide an essential basis for setting policy and we use them to assess the Government's progress against the fiscal objectives it has set itself. But since the future can never be known with anything approaching precision, forecasts are surrounded by significant uncertainty and will inevitably prove to be wrong in many respects. All users of forecasts need to be aware of that. We stress these uncertainties in every *Economic and fiscal outlook (EFO)* by presenting fan charts around our main forecasts¹ and analysing sensitivity to key assumptions and the fiscal implications of different economic scenarios.
- 1.3 Since we forecast twice a year, and cover five years in each forecast, over time we produce ten forecasts for each year (and more if we produce more than two forecasts in a year – e.g. when a new Government adds a post-election Budget to the normal timetable). For example, we produced eleven forecasts for the 2015-16 fiscal year between June 2010 and March 2015 (plus three 'in-year estimates' in July 2015, November 2015 and March 2016 as 2015-16 was in-progress).
- 1.4 In each *FER* we select a small number of these earlier forecasts to compare against the latest official estimates of outturn data for the economy and public finances published by the Office for National Statistics (ONS). We then explore the reasons for the inevitable differences. These differences are often described as 'forecast errors', although strictly speaking few of them could be avoided on the basis of information available at the time. We therefore refer to them as 'forecast differences'. We disclose where differences have resulted from true errors – which inevitably occur from time-to-time given the large number of forecast models we use and the rapid turnaround of forecast rounds in the run-up to a Budget or other fiscal statement.
- 1.5 Our forecast evaluation process is important for a number of reasons:
 - **Transparency and accountability:** reporting on the reasons for differences between forecast and outturn should help to reassure people that our forecasts reflect dispassionate professional judgement rather than politically motivated wishful thinking

¹ More detail can be found in Briefing paper No.4 'How we present uncertainty' on our website.

– the main rationale for contracting out the official fiscal forecast to an independent body in the UK.

- **Learning lessons for future forecasts:** analysing how outturns have evolved relative to our previous forecasts helps us to build our understanding about the underlying drivers of the economy and public finances, and thereby improve our forecast judgements and the modelling infrastructure that we use.
- **Assessing the performance of forecast models:** generating a consistent time-series of forecast differences and their sources gives us a systematic way of measuring the performance of our assumptions and models, helping us to refine and develop them.²
- **Providing information that the Government can use when formulating policy:** understanding the underlying cause of a forecast difference allows policymakers to target that cause if they wish to address it. For example, determining whether unexpectedly high inflation was caused by an external or domestic surprise, or whether unexpectedly high borrowing is due to structural or cyclical factors, is a vital piece of analysis for policymakers to consider before deciding how policy should respond.³

1.6 The aim of this briefing paper is to describe how we approach the forecast evaluation process, including the roles of other departments and the ONS, and how we analyse differences forecast and outturns. As with all our work, we seek maximum possible transparency about the process and methodologies used, as well as the results of our analysis. This is the seventh in a series of briefing papers explaining how we work, all of which can be found on our website.

General principles of forecast evaluation at the OBR

1.7 There are far more forecasts and issues that could potentially be evaluated than we and our forecasting stakeholders could process in the time and with the resources we have available, so we need to focus each *FER* on specific years, forecasts and issues:

- **Which years?** We usually choose to evaluate forecasts against outturns for a single year – the most recent for which ONS outturn estimates are available. The rationale is that lessons learnt from analysing the most recent year of outturn are more likely to be relevant for informing our next forecast.
- **Which forecasts?** We have typically pursued two objectives in when choosing which forecasts to evaluate. First, we have always evaluated our two most recent March forecasts, for which the most recent year of outturn will represent one- and two-year-ahead forecasts. This allows us to build up a consistent time series of forecast differences, from which we draw the accuracy metric that feeds into our assessment of fiscal forecast models. We have also picked a significant forecast to revisit in each *FER*

² See for example the review of fiscal forecast models discussed in Chapter 4 of our 2017 *Forecast evaluation report*.

³ For more on the role of forecasts in the context of uncertainty, see *In Defence of Forecasting: Its Importance in the Budget Process*, IMF PFM blog, 23 June 2014.

so that over time we build up a complete analysis of all years of that forecast. In each *FER* from 2011 to 2016 we revisited our first forecast from June 2010, which was produced alongside the newly formed Coalition Government's post-election Budget that set out its multi-year deficit reduction plan.

- **Which issues?** In most cases, the issues that we cover are driven by the analysis we undertake, with exploration of forecast differences revealing themes that become the key 'forecast issues' as we prepare our next forecast. In some cases we identify issues before beginning the evaluation process. For example, we have returned to the issues of productivity growth and fiscal multipliers in most *FERs*, and we have set up an annual process to evaluate the effect of anti-avoidance tax policy measures where policy costings are typically subject to a high degree of uncertainty.

1.8 For our fiscal forecasts, we use a consistent approach to breaking down forecast differences into components that are due to:

- **ONS classification or methodological changes:** if outturns are prepared on a different basis to the one that we used when preparing the forecast, a simple comparison of the two would not compare like with like. We make adjustments to correct for this.
- **Subsequent policy changes:** Parliament requires us to base our forecasts on the Government's stated policy at the time, so one source of difference between forecast and outturn comes when the Government subsequently changes policy. This is clearly something we cannot factor into our forecasts, so we separate out these effects.
- **Economy forecast differences:** our fiscal forecasts use 'determinants' that are drawn from our economy forecast, so any differences between economic forecast and outturn there will generate differences between our actual fiscal forecast and what it would have been had those determinants matched estimated outturns.
- **The residual 'fiscal forecasting difference':** any difference that is not accounted for in the previous three categories is categorised as a fiscal forecasting difference, in the sense that it must stem from other assumptions and judgements that we make and how those are combined in the models we use to construct the fiscal forecast. We investigate these differences to understand their underlying drivers and to learn lessons that can be applied in subsequent forecasts.

1.9 These categories help us to draw appropriate lessons from the forecast evaluation. As well as having the logical rationale set out above, they also match the process by which we prepare the forecast – where different teams of OBR staff are responsible for the economy forecast, the fiscal forecast and the policy costings process. This also allows us to allocate follow-up analysis to the relevant teams as we move to our next forecast process.

2 Evaluating our economy forecasts

Our economy forecast

- 2.1 Our economy forecast is produced as an input into our fiscal forecast. This requires us to produce a detailed forecast that covers the many different tax bases and drivers of public spending. It follows the National Accounts framework used by the ONS when preparing its quarterly and annual outturn estimates. We use a large-scale macroeconomic model as the main tool for ensuring our judgements are internally consistent and that the whole forecast is consistent with the National Accounts. It contains over 500 variables.¹ The approaches we take to different variables – including the key determinants of our fiscal forecast – are described in a guide to the economy forecast on our website.
- 2.2 All forecasts are surrounded by uncertainty. In each *Economic and fiscal outlook (EFO)*, we illustrate this uncertainty around our central economy forecast in various ways. We produce fan charts that illustrate the likelihood of a range of possible outcomes if previous forecast differences were a good guide to the future. We also carry out scenario analyses that show the wider economic implications of specific changes in our macroeconomic forecast, usually based on an issue that is topical at the time of the forecast. We use these analyses to provide context when we evaluate these forecasts against outturn in the *FER* – for example, where in the fan chart for a given forecast do the latest estimated outturns lie?

Data revisions

- 2.3 The first step in evaluating our economy forecasts is to understand and account for revisions and other changes to the ONS outturn data. It is not possible to know with certainty what happened in the economy at any point in time – that reflects the thousands of transactions carried out each year by millions of people. The ONS ‘outturns’ will always be an estimate of this true underlying activity. They are revised over time as new information and new methodologies are used. For example, in many of our *FERs*, we have looked at how revisions have affected the path of the 1990s recession and recovery. This means the conclusions we draw from evaluating our previous forecasts are likely to evolve too.
- 2.4 Early revisions to data tend to be driven by new information. Some data are received with a lag, while households and firms are surveyed periodically and may not return their information on time. So it can take time for a full picture of economic activity in a period to form. For GDP data published by the ONS, a particularly important stage of the revision process is ‘supply-use balancing’, an annual exercise carried out for each Blue Book, which aims to reconcile information from the three measures of GDP (income, expenditure and

¹ An explanation of the model and the full model code are available on our website.

output). For outturns estimates for any given year, revisions due to new data and the supply-use balancing process generally occur up to the first or second Blue Book after the year in question. Revisions thereafter almost entirely reflect methodological changes.²

2.5 One common type of methodological revision is to change the classification of a specific type of spending so that it adds to GDP rather than being treated as an intermediate cost. These typically lead to the level of nominal GDP being revised up, but have less impact on its growth rate. Recent examples include those related to the 2010 European System of Accounts (ESA10), which changed the treatment of research and development spending from an intermediate cost to a form of investment that adds to GDP. It is important to understand these changes, because they affect ratios of public finances metrics relative to GDP. But they are unlikely to have implications for our interpretation of them.

Decomposing economy forecast differences

2.6 After understanding developments in the data, we evaluate the performance of our economy forecasts against outturns by breaking the overall forecast into components. It is impossible to understand all the causal links when evaluating our economy forecasts, given the complexity of the underlying activity. Understanding developments by component helps us to build up a picture of the overall story and to identify any common themes. This also helps us to understand the economic drivers of the results of our fiscal forecast evaluation.

2.7 The components we tend to evaluate are:

- **Conditioning assumptions:** these include interest rates (short- and longer-term), equity prices, the oil price and the exchange rate. In general, we used market-derived assumptions to generate our forecasts. We aim to understand the differences between assumptions and outturns by looking at the drivers of different financial markets, including economic and policy developments.
- **Income and expenditure components of GDP growth:** public discussion of economic forecasts tends to focus on real GDP – the volume of goods and services produced in the economy. But the nominal or cash value is more important for the behaviour of the public finances. So it is important for us to understand developments in both real GDP and whole-economy prices to build a picture of the drivers of nominal GDP growth.
- **GDP by institutional sector** (household, corporate, government and overseas): some components of GDP are taxed more highly than others and so it is important to understand developments in the economy by institutional sector.³ For the household sector, we look at developments in income and consumption (and the impact they have on the saving ratio), in CPI and RPI inflation and in the residential property market. For the corporate sector, we look at developments in profits and business investment. Business investment can be volatile on a quarterly basis, and has often

² ONS, *Revisions to GDP and components*, January 2014.

³ See, for example, Chart 3.8 and associated discussion in Chapter 3 of our 2017 *Fiscal risks report*.

been subject to substantial revisions, reflecting changes to methodology or data sources.⁴ For the government sector, we look at developments in general government consumption and investment. For the overseas sector, we look at developments in net trade and the current account balance.

- **The labour market:** we investigate the drivers of employment growth and the contributions from population growth, participation rates and average hours worked. We also look at developments in average earnings and productivity growth. Productivity growth is a key element of our economic and fiscal forecast and judgements about the outlook are subject to significant uncertainty, particularly in light of the disappointing performance of productivity since the late 2000s recession.
- **The effect of fiscal policy on the economy:** we review the overall effect of fiscal policy changes on the economy by considering whether the ‘fiscal multipliers’ that we apply to estimates of the size of fiscal policy changes accord with the pattern and composition of outturn GDP data.⁵ As fiscal multipliers – the sensitivity of GDP growth to a change in fiscal policy – cannot be observed, we can never compare our judgements with an actual value, so these estimates will always remain subject to uncertainty. This is an area where different interpretations of the outturn data can support significantly different views about the size of fiscal multipliers at any point in time. We occasionally review external estimates and debate about fiscal multipliers.⁶
- **Cyclical versus structural factors:** we seek to understand whether developments in GDP growth are related to cyclical/temporary or structural/persistent factors. Since potential output is unobserved, there is no outturn against which we can compare our forecasts and the answer to this question will remain uncertain even in the fullness of time. We therefore analyse how our latest forecast judgements compare with previous forecasts and what has driven the changes between them. Governments have often set themselves fiscal targets that focus on a cyclically adjusted measure of the deficit – i.e. correcting for the effects of cyclical/temporary fluctuations in economic activity. This analysis of our economy forecast judgements therefore contributes to understanding how and why our estimates of cyclically adjusted borrowing have evolved.

⁴ See Box 2.1 of our March 2017 *Economic and fiscal outlook* for a discussion of business investment data revisions.

⁵ For further discussion of our approach to fiscal multipliers see, for example, *Briefing Paper No.6: Policy costings and our forecast*, March 2014; and Box 3.2 from our July 2015 *Economic and fiscal outlook*.

⁶ See Box 2.2 of our 2017 *FER*, Box 3.2 of our July 2015 *EFO*, Box 2.3 of our 2013 *FER* and Box 2.4 of our 2012 *FER*.

3 Evaluating our fiscal forecasts

Our fiscal forecast

- 3.1 Our fiscal forecast is a detailed bottom-up compilation of individual forecasts for each line of the public finances, covering receipts, expenditure and financial transactions to generate forecasts for public sector net borrowing ('the deficit') and public sector net debt. More than 350 forecast models are used in this process, with analysts from various government departments and agencies involved in running those models on the basis of our forecast assumptions and judgements. This means there are an enormous number of potential sources of difference between forecast and outturn, which we prioritise and explore during the preparation of each *FER* and in the run-up to each *EFO*.
- 3.2 All forecasts are surrounded by uncertainty. We illustrate the uncertainty around our central fiscal forecasts by using fan charts that are calibrated on the accuracy of past forecasts, sensitivity analysis that tests key assumptions one at a time, and scenario analysis that considers the effect of varying a range of judgements in a consistent manner. We publish 'ready reckoners' on our website that show how the public finances could be affected by changes in selected economic determinants of our fiscal forecasts. We also publish a database of past official forecasts – both our own and the Treasury's that preceded them – to help show how they have evolved over time.

Decomposing fiscal forecast differences

- 3.3 Due to the disaggregated 'bottom-up' approach of our fiscal forecast, we have much more material with which to decompose forecast differences into specific factors. Indeed, there are almost as many fiscal forecast models in use as there are variables in our macroeconomic model. We also maintain a database of the estimated effects of policy changes announced at Budgets or other fiscal statements that contains over 1,000 policy measures announced since 2010. This allows us to aggregate the estimated effects of these changes on the public finances.
- 3.4 We decompose differences between forecasts and outturn into the four categories outlined in Chapter 1:
- **classification and accounting treatment changes** made by the ONS or the Treasury;
 - subsequent Government **policy changes**;
 - **economy forecast** differences; and

- a residual '**fiscal forecasting difference**'.

3.5 This rest of this chapter details these four steps. In Annex A we present a worked example based on the analysis of our March 2015 forecast for onshore corporation tax receipts, where each of these steps is important to understanding the source of a significant difference between forecast and the latest estimated outturn.

Classification and accounting treatment changes

Changes affecting the public finances data

3.6 This first step ensures we are comparing like with like when we look at forecast differences. There have been several recent examples of significant classification and accounting treatment changes to the measurement of the public finances:

- many related to aligning the public finances data with **the 2010 European System of Accounts (ESA10)**, which involved the reclassification of Network Rail into the public sector and the treatment of a number of spending lines as capital rather than current spending (e.g. spending on research and development);
- a Government policy change announced in July 2015 prompted the ONS to review the classification of **housing associations** and to decide that they should be considered public rather than private corporations from a statistical perspective because of the degree of control exerted by Government; and
- more recently, the ONS moved to recording **corporation tax receipts** on a time-shifted basis to proxy for when the underlying profits and tax liability were generated, having previously recorded them when the cash payments were received by HMRC.

We keep a record of the impact of these changes on our forecasts in the 'Forecast revisions database' on our website.

3.7 To ensure we compare like with like when evaluating our forecasts against outturns, we account for the effect of classification and accounting treatment changes by adjusting forecasts or outturns. For major changes, including those related to ESA10 and housing associations, we restate our original forecasts to be on a consistent basis. For more minor changes, we show the effect as an 'other' component in the decomposition of forecast differences. The choice between the two approaches is a pragmatic one designed to ensure we can present our evaluation results as clearly as possible.

3.8 We make the necessary adjustments in two ways:

- **For new receipts and spending streams** that did not feature in the forecast that we are evaluating, we simply assume that past forecasts for these items would have been in line with the latest forecasts and outturns. For example, our pre-ESA10 forecasts did not include the receipts and spending lines associated with Network Rail, so we adjust those forecasts by adding in the latest outturns and forecast. This approach is not used

because we think we would have got these forecasts right, but rather that there would be no value in us spending time thinking about how we might have got them wrong.

- **For classification changes to pre-existing receipts and spending streams** that did feature in the forecast that we are evaluating, we adjust the original forecast so that it is stated on the new basis. For example, one ESA10 change was to treat all tax credits as expenditure, where previously some had been treated as ‘negative tax’. When evaluating our pre-ESA10 forecasts, we remove the negative tax element of the original forecast and add it to spending to be consistent with the latest treatment in the ONS outturn data.

3.9 As well as ONS changes, we need to consider those made by the Treasury in relation to public spending. The Treasury manages spending within two ‘control totals’ of about equal size. Departmental expenditure limits (DELs) are items that can be planned over extended periods and cover spending on public services, administration and investment. Annually managed expenditure (AME) are items of spending that are less amenable to multi-year planning, such as social security spending and debt interest.

3.10 These are administrative rather than statistical concepts, so the Treasury is free to switch items between them as it sees fit. As these reflect changes in how the Treasury chooses to control spending, rather than it being a statistical requirement, we treat them as policy changes in our decomposition of forecast differences. This is in contrast to classification decisions made by the ONS or changes to our forecasts to ensure that they are consistent with National Accounts definitions, which are treated as classification changes. In our *FER* analysis, we account for them by adjusting our original forecasts to be on a consistent basis – for example, switching research and development from current to capital spending.

Changes affecting the GDP denominator

3.11 It is often useful to consider how receipts and spending move in relation to GDP, especially when looking at trends over a number of years. This helps us to understand how spending – and the receipts and borrowing that finance it – move in relation to the value of underlying economic activity that can be taxed. So we often present our forecasts of receipts, spending and the deficit as a percentage of GDP. As set out in Chapter 2, economic data are often revised – reflecting both data and methodological updates. In general, revisions to the level of nominal GDP (as opposed to its growth) would not materially affect our understanding of movements in the public finances. It can therefore be helpful to adjust for these level effects when analysing forecast differences for the public finances relative to GDP.

3.12 The four panels of Chart 3.1 show our historical forecasts for spending and receipts as a share of GDP. The left-hand panels make no adjustment for revisions to the level of nominal GDP or to the level of receipts or spending at the start of the forecast period. In the right-hand panels we adjust for both types of revision, with the adjusted forecast line produced by applying the rate of change in the relevant ratio that was assumed in each forecast. This provides a more useful illustration of the extent to which each forecast was optimistic or pessimistic relative to the latest outturns.

Chart 3.1: Receipts as a share of GDP

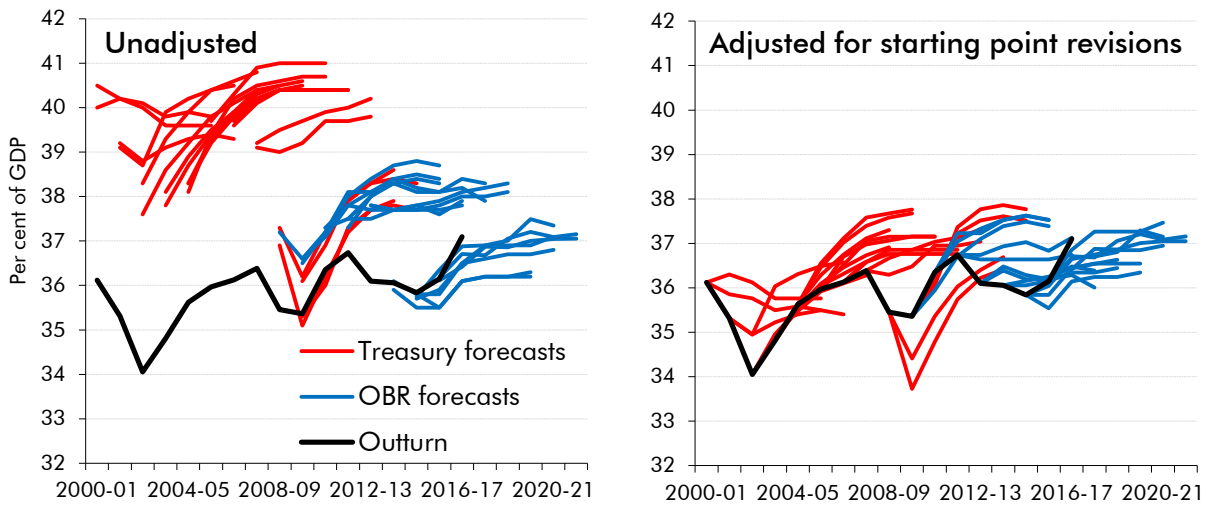
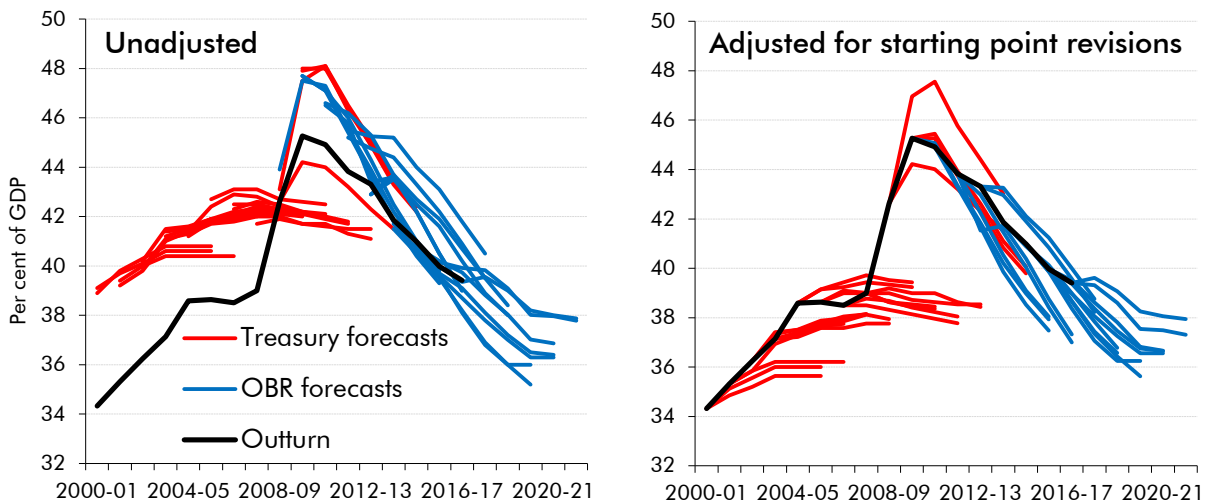


Chart 3.2: Spending as a share of GDP



Policy changes

3.13 Having established a like-for-like basis for our comparison, we next account for the estimated effect of policy changes announced after a given forecast was published. Given the requirement placed on us to base our forecasts on current policy as it stands at the time, these effects could not be anticipated.

3.14 Policy changes can have a large impact on the public finances, so it is important to capture their impact when evaluating our previous forecasts. The effects included in our *FER* analysis, include:

- **Receipts and annually managed expenditure (AME) policies** that are shown on the Government's 'scorecard' at each fiscal event. These are collated from scorecard

costings published in each *EFO*, which can be found in the ‘policy measures database’ available on our website.

- **Other changes to receipts and spending** that we identified as policy changes in an *EFO* despite the Treasury choosing not to present them on the scorecard. These are also sourced from the database available on our website.
- **Changes to departmental expenditure limits (DELs)** that do not reflect our own judgements about underspending against plans or neutral switches between DEL and AME within total managed expenditure (TME).

3.15 We account for most policy effects using the original estimate produced at the time of each forecast, rather than making any adjustments for later estimates of the policy’s effect. This means that we treat differences between forecast and outturn on policy costings consistently with other elements of our forecast. For example, if a tax policy change yielded less than we originally expected, the shortfall would be treated as a fiscal forecasting difference.

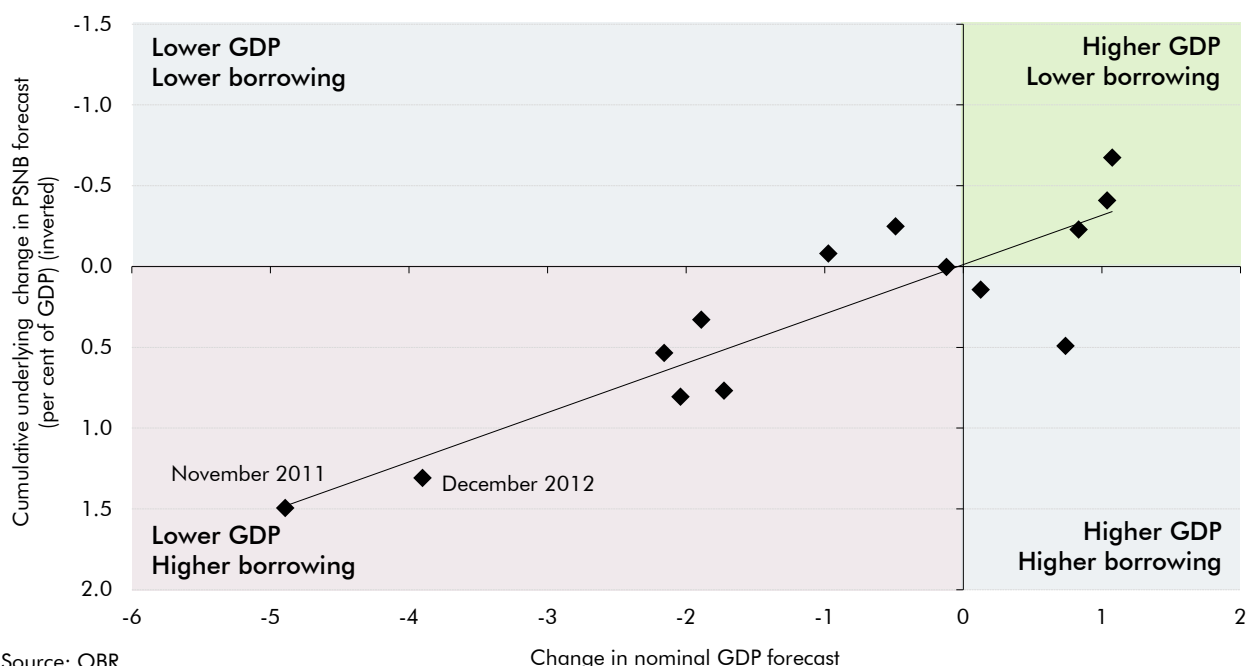
3.16 These original costings are subject to considerable uncertainty themselves, which we illustrate by presenting subjective uncertainty rankings in each *EFO*. A database of these rankings is available on our website. We also carry out case-by-case evaluations of policy costings, in particular where they are large, or where they were assigned a ‘high’ or ‘very high’ uncertainty rating at the time. For example, we run an annual evaluation process for the large number of relatively uncertain anti-avoidance tax policy costings from recent years. We use these to help understand fiscal forecasting differences.

Differences in our economy forecast

3.17 Having adjusted for classification and policy effects, we are left with forecast differences that stem from our own judgements and assumptions. The next category that we consider are those differences related to our economy forecast, a key source of inputs to most of our fiscal forecasting models. This is not a comprehensive category covering all factors related in any way to the economy; rather it is a practical distinction between assumptions and judgements processed through our economy forecast and those that are added subsequently to fiscal forecast models and forecasts. It tells us where we need to focus our resources if large or persistent forecast differences are identified.

3.18 Developments in the economy explain much of the movement in the public finances from year to year, particularly for tax receipts and demand-led expenditure such as welfare and debt interest spending. When we reviewed the sources of our fiscal forecast revisions in Annex B of our March 2016 *EFO*, we found that in statistical terms around 80 per cent of the variation in the revisions to our borrowing forecasts since June 2010 were explained by revisions to our nominal GDP growth forecast. The composition of GDP growth is also important to explore, as some components are taxed more highly than others. So too are some non-GDP factors, such as asset prices. The close relationship between revisions to our nominal GDP growth and borrowing forecasts can be seen in Chart 3.1.

Chart 3.3: Underlying changes in borrowing and nominal GDP revisions



Source: OBR

- 3.19 To understand how developments in the economy forecast have affected the public finances relative to the forecast we are evaluating, we run the latest outturn economy data through the tax and spending models we used at the time. This answers the question of what our fiscal forecast would have looked like if all the economy forecast determinants had been ‘correct’ – in the sense of matching latest ONS estimates. This, of course, is not the same as ‘correct’ in the sense of reflecting true developments in the economy, since ONS estimates are themselves subject to significant uncertainty and to revision over time.
- 3.20 It is also important to recognise that the models we use to forecast tax and spending are only representations of underlying activity and will rarely give an entirely accurate reflection of the real-world impact of changes in the economy. This is a particular problem for models where the economic determinants that we use to forecast the true tax base are a relatively crude proxy – for example, we use growth in equity prices to proxy the capital gains tax base, but we know that listed share prices are not an ideal proxy for capital gains on unlisted company equity; they are, however, the best source currently available.
- 3.21 As time passes and forecast models are revised or replaced, it can become impractical to carry out this process of running the latest outturns through the vintage of the model used in a particular forecast. This is particularly true where a complex former model has been replaced and the resource cost of resurrecting it for an evaluation process would far outweigh the benefit of anything we could learn about its performance (since we have already decided that it needed replacing). With that in mind, we sometimes take a simpler top-down approach when evaluating forecasts that were published many years previously. For example, in our 2015 and 2016 FERs, we looked at overall growth in tax bases and effective tax rates rather than running outturn determinants through the original models in order to evaluate the final years of our June 2010 forecast period.

Fiscal forecasting differences

3.22 The residual difference that cannot be explained by subsequent classification or policy changes, or differences between our economy forecast and latest outturns, is termed the fiscal forecasting difference. This component can be made up of a wide range of factors and it is important to find out the underlying causes in order to draw meaningful conclusions. The process of interrogating these differences, drilling down ever further into the models and data and exploring different hypotheses, is one that we undertake with considerable assistance from the departments that run the fiscal forecast models on our behalf. The process may highlight an error in a model, an assumption that needs to be changed, a policy costing that diverged from its original estimate or an external issue (such as a one-off event) that we did not expect.

3.23 There are a number of factors that often explain at least part of each fiscal forecast difference, so we have a list of questions that we ask when investigating them. These include:

- Were there any **events** that could explain the difference? For example, were there forestalling effects around a tax policy change? Changes in the rate of non-compliance in tax or welfare systems? A judgement in a legal case that had knock-on consequences for receipts or spending?
- Which **components of the tax or spending stream** caused the difference? For example, when looking at onshore corporation tax receipts, was the difference concentrated among financial or non-financial sector companies or was it related to the profits that generate tax liabilities or the deductions that reduce them? When looking at debt interest spending, was the difference mainly in the cost of conventional or index-linked gilts or was it associated with the Asset Purchase Facility?
- Which **parts of the model** caused the difference? For example, in exploring a VAT forecast difference, was the standard-rated share assumption a source of difference, and if so, which component of that assumption was wrong? If we have identified deductions as a source of the corporation tax forecast difference, was it related to capital allowances, group relief or something else?
- Were there any **key judgements or assumptions** that contributed to the difference? For example, assumptions about the speed with which a new benefit is rolled out across the eligible population? Or the extent to which local authorities will draw down from their stock of reserves to maintain higher levels of spending than their available resources would otherwise allow?
- Is there anything **consistent** about this fiscal forecasting difference, given previous *FER* analyses? Does it highlight any changes that need to be made to the model or to the assumptions that are put into it?

- Are there any **other stories** we can tell about the difference? For example, are there 'economic' factors that are not being fully captured by the determinants that we draw from our economy forecast, such as changes in the distribution of earnings or other compositional effects?

3.24 Armed with these questions and the support of our forecasting partners, we pursue many possible hypotheses in order to quantify the effect of particular factors and narrow down the unexplained element of each fiscal forecast difference as much as possible. Since our forecast models are only representations of the true interactions between tax bases and the tax system, we will rarely be able to explain the entire fiscal forecast difference. Sometimes this will be because we simply do not know what explains the residual, but more often we will have a hypothesis that cannot be tested and quantified given the level of detail in the model, the information available about the true tax base, or the breakdown of the tax or expenditure data.

3.25 For example, we are able to quantify most of the differences between our stamp duty land tax forecast and outturns because the tax data and microsimulation model underpinning the forecast can be compared at a highly disaggregated level. This is not possible when looking at self-assessment tax receipts because there is little information available on self-employment incomes and our forecast model is therefore a cruder representation of reality. But we can surmise from other sources that some of the 'unexplained' negative fiscal forecast difference seen in recent years has reflected a less tax-rich self-employment earnings distribution than was implicit in the assumptions underpinning our past forecasts.

A A worked example

- A.1 One of the most significant sources of forecast difference explored in our 2017 *FER* was that between our March 2015 forecast for onshore corporation tax in 2016-17 and the latest outturn estimate. The evaluation of that forecast provides good examples of all the steps that we take when analysing forecast differences.
- A.2 Our March 2015 was for £42.9 billion of onshore corporation tax receipts in 2016-17; the latest outturn estimate is much higher at £53.5 billion. A positive difference of £10.6 billion (24.7 per cent) is very large by historical standards, especially during a period when the economy was not booming. This annex details how that forecast difference can be disaggregated into the components described in the main body of this briefing paper.

Classification and accounting treatment changes

- A.3 The largest single source of difference between forecast and outturn is that the two figures are not on a like-for-like basis, with the accounting treatment for corporation tax receipts in the official statistics having changed since our March 2015 forecast was prepared. In 2016, the ONS announced that the measurement of corporation tax receipts would move from a simple cash basis (i.e. when payments reach HMRC) to a time-shifted cash basis as a proxy for the true accruals basis (i.e. when the underlying taxable profits generated the tax liability). This methodology involves shifting monthly cash receipts back into earlier months via a number of payment timing assumptions.
- A.4 This adjustment did not feature in our March 2015 forecast, so in order to compare like with like, we used the latest outturn estimate of the cash-to-accruals timing adjustment to quantify this accounting treatment change. In effect, this means we evaluated outturn cash receipts against the original cash forecast. This effect explains £4.3 billion (around two-fifths) of the overall difference, leaving a £6.3 billion (14.6 per cent) like-for-like forecast difference to explain. The cash-to-accruals adjustment estimate is itself subject to uncertainty, as a diminishing proportion of the 2016-17 estimate will continue to be based on forecasts until cash receipts in December 2018 have been received.

The effect of subsequent policy changes

- A.5 There were four fiscal events containing policy measures affecting 2016-17 onshore corporation tax receipts that took place after our March 2015 forecast. These were the July 2015 post-election Budget, the November 2015 Autumn Statement and Spending Review, the March 2016 Budget and the November 2016 Autumn Statement. Table A.1 lists the relevant measures, with the sum of their estimated effect in 2016-17 being £0.8 billion in

A worked example

2016-17. That explains around 12 per cent of the like-for-like forecast difference, but still leaves £5.5 billion to explain.

Table A.1: Impact of policy measures announced since March 2015 budget

	£ billion					
	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21
July 2015 post-election Budget	0.1	0.1	3.5	1.0	-1.9	-2.4
<i>of which:</i>						
Corporation Tax: reduce to 19% from 2017-18, and 18% from 2020-21	0.0	0.0	-0.6	-1.6	-1.8	-2.4
Annual Investment Allowance: set at new permanent level of £200,000	0.0	-0.1	-0.5	-0.6	-0.6	-0.5
Corporation Tax: bringing forward payments for large groups	0.0	0.0	4.2	2.8	0.1	0.0
Dividends tax: abolish credit, introduce allowance, and increase effective rates	0.0	-0.2	-0.5	-0.7	-0.9	-1.0
Tax Motivated Incorporation: reduction due to dividend tax reform	0.0	0.2	0.4	0.4	0.5	0.6
Other measures	0.1	0.3	0.5	0.6	0.8	0.9
November 2015 Autumn Statement and Spending Review	0.3	0.1	0.2	0.1	0.1	0.1
<i>of which:</i>						
Corporation Tax: special rate on restitution payments	0.3	0.1	0.1	0.1	0.1	0.1
Other measures	0.0	0.1	0.1	0.1	0.0	0.0
March 2016 Budget	0.0	0.5	-3.1	-0.5	8.3	4.8
<i>of which:</i>						
Corporation Tax: reduce to 17% in April 2020	0.0	0.0	0.0	0.0	-0.1	-0.9
Corporation Tax: restrict relief for interest	0.0	0.0	0.9	1.2	1.0	0.9
Corporation Tax: extend scope of hybrid mismatch rules	0.0	0.0	0.3	0.3	0.2	0.2
Corporation Tax: reform loss relief	0.0	0.0	0.4	0.4	0.3	0.3
Corporation Tax: further restrict use of banks' pre-2015 losses	0.0	0.3	0.5	0.5	0.4	0.3
Corporation Tax: defer bringing forward payment for large groups for 2 years	0.0	0.0	-5.7	-3.5	5.6	3.3
Offshore Property Developers: tackle avoidance and evasion	0.0	0.1	0.4	0.5	0.6	0.5
Other measures	0.0	0.0	0.1	0.2	0.2	0.3
November 2016 Autumn Statement	0.0	0.0	0.0	0.0	0.0	0.0
Total impact of measures announced since March 2015 Budget	0.4	0.8	0.6	0.7	6.6	2.5

Note: these costings reflect the 'ex-ante' cash estimates made at the time of each fiscal event.

Economy-related forecast differences

- A.6 Our onshore corporation tax models use a large number of determinants drawn from our economy forecast, the most important being non-oil company profits and business investment. The forecast is prepared in four parts, with two relating to non-financial companies, where larger and smaller companies are treated separately depending on whether they pay tax in quarterly instalment payments (QIPs) or not, and two relating to financial companies, split between life assurance and other financial companies.
- A.7 Table A.2 shows the effect of running the latest ONS outturns through our original March 2015 models. The main economy forecast elements explaining each were:
- **QIPs-paying non-financial companies:** Receipts were boosted by higher-than-expected industrial and commercial profits. Business investment was lower-than-expected, reducing the overall value of capital allowances that can be used to offset tax liabilities. Combined with other smaller effects, these determinants would have increased the forecast by £0.4 billion.
 - **Non-QIPs-paying non-financial companies:** Similarly, receipts from smaller non-financial companies were boosted by weaker stronger profits and business investment. This would have increased the forecast by £0.7 billion.
 - **Financial companies (excluding life assurance):** Outturn determinants would have had a number of largely offsetting impacts on the forecast. In particular, lower-than-expected interest rates would have reduced the investment income of financial companies. HMRC data on outturn financial company profits are only available with a long time lag (the 2016-17 data will only be available in late 2018) and so the results of this evaluation are likely to change over time.
 - **Life assurance companies:** Lower-than-expected equity prices reduced the investment returns of life assurance companies. Combined with other smaller factors, the outturn determinants would have reduced the forecast by £0.3 billion.
- A.8 Overall, the forecast would have been £0.9 billion higher, explaining just 15 per cent of the like-for-like forecast difference and leaving a £4.7 billion residual fiscal forecasting difference to investigate.

Table A.2: Onshore corporation tax: Economy-related forecast differences

	£ billion		
	March 2015 forecast	March 2015 models with latest outturn determinants	Economy-related forecast difference
HIC sector (QIPs-payers)	16.1	16.5	0.4
HIC sector (other payers)	15.8	16.5	0.7
Financial sector (excluding life assurance)	6.7	6.7	0.0
Life assurance sector	1.3	1.0	-0.3
Other receipts	3.1	3.1	0.0
Total onshore CT	42.9	43.8	0.9

Fiscal forecasting differences

A.9 The £4.7 billion residual difference is equivalent to 10.9 per cent of our original forecast. This is large by comparison with most forecasts, so we devoted a greater amount of resource to investigating this difference. We pursued a number of issues, with those that we were able to quantify set out in Table A.3. They were:

- 2014-15 starting point:** at the time of the March 2015 forecast, we had access to ONS outturn data for April 2014 to January 2015, and some preliminary data on tax receipts in February 2015. By the time of our July 2015 forecast, receipts in 2014-15 were already £0.5 billion higher than we expected. On the latest estimates, cash onshore CT in 2014-15 was £0.7 billion higher than we expected at the time. Adjusting for that higher starting point would have boosted our forecast for 2016-17 receipts by around £0.7 billion.
- Payment timing assumptions:** the speed at which companies pay off their liabilities for a particular year is an important forecast assumption. Companies appear to have paid a higher proportion of their liability in instalment payments before the end of 2016-17 than we expected, boosting receipts by £1.2 billion relative to our forecast.
- Life assurance sector:** receipts from the life assurance sector were £0.4 billion higher than our March 2015 forecast – around a 30 per cent fiscal forecasting difference for this sector. These differences suggest there is a problem with the way our model factors in the effect of bond price movements on life assurance companies' tax liabilities. We are reviewing this with HMRC analysts.
- The special 45 per cent corporation tax rate on 'restitution payments':** the original costing for this measure expected this to raise £55 million in 2016-17 (as recorded in Table A.1), but the latest analysis from HMRC suggests that it actually raised £0.6 billion. Interim litigation payouts made by HMRC in 2016-17 were substantially higher than expected.
- An unexplained residual:** even after exploring many avenues, an unexplained difference of £1.8 billion remained (around 30 per cent of the like-for-like forecast

difference). With more time to interrogate the 2016-17 corporation tax data (released in late 2018) it may be possible to narrow this down further – for example, we were not able to quantify the effect of trends in group relief deductions in time for our 2017 FER, but this may be another source of higher receipts. These will remain important forecast issues that we will return to when preparing our forecasts for each EFO.

Table A.3: Onshore CT: Fiscal forecasting difference decomposition

	£ billion
	2016-17
Onshore CT fiscal forecasting difference	4.7
<i>of which:</i>	
Revisions to the 2014-15 cash starting point	0.7
Payment timing assumptions	1.2
Life assurance fiscal forecasting difference	0.4
Higher-than-expected CT on restitution payments	0.5
Unexplained residual	1.8

Summary

A.10 Table A.4 brings together the results of this evaluation. It is important to note that the results of this analysis are likely to evolve over time. We can expect both the outturn receipts data and the economy determinants that underpin the forecast to be revised over time, which may change the conclusions we draw from this evaluation. Such changes would be reflected in future forecasts and explained in the relevant EFO.

Table A.4: 2016-17 onshore corporation tax forecast differences

	£ billion						
	Forecast (on a cash basis)	Outturn (time-shifted accruals)	Difference	<i>of which:</i>			
				Accounting treatment change	Policy changes	Economic factors	Fiscal forecasting difference
March 2015 forecast	42.9	53.5	10.6	4.3	0.8	0.9	4.7

