AN EXAMINATION OF THE IFS CORPORATION TAX FORECASTING RECORD

Suman Basu
Carl Emmerson
Christine Frayne

An Examination of the IFS Corporation Tax Forecasting Record

Suman Basu, Carl Emmerson and Christine Frayne[†]

Abstract

This paper examines the corporation tax forecasting techniques used by the Institute for Fiscal Studies. For current year forecasts a judgemental forecast is found to have performed better than relying solely on a simple model or information on the receipts available so far in the current financial year. For longer time horizons the judgemental forecast has performed slightly less well than the modelled forecast. While forecasts made later in the financial year have led to more accurate estimates of receipts in the current year no evidence is found that this has improved the accuracy of longer run forecasts. In the short term inaccuracies in the modelling process are found to be more important than errors in forecasting growth in corporate profits. However the latter is still an important component of errors and one that grows substantially in relative importance as the forecast horizon increases.

Acknowledgements

[†] Institute for Fiscal Studies, London.

Executive Summary

Improved understanding of the sources of errors can aid the development and refinement of the forecasting procedure. This paper considers the range of corporation tax forecasting techniques used by the Institute for Fiscal Studies (IFS) in its annual Green Budget publications. It compares the accuracy of the IFS judgement forecasts, with those made using the IFS forecasting model and the current receipts outturn in terms of their current and short-term predictions.

For the current year forecast the most accurate forecast is found, on average, to have been the IFS judgement forecast. This is to be expected since it is able to take into account the information provided by both the IFS model and the current receipts forecasts, as well as other information about the economy and the forecasts produced by the HM Treasury.

As the forecasting horizon extends forwards the IFS model is found to have delivered more accurate forecasts that the IFS judgement. The increased precision of the IFS judgement over and above the IFS model does therefore not persist beyond the current year.

A closer examination of the sources of errors in the forecasts produced by the IFS model shows that both the estimates of the growth in corporation profits and the accuracy of the actual model itself are less accurate the further ahead the planning period. For shorter time periods the average absolute error caused by inaccurate forecasts of corporate profits growth are found to have been smaller than those from the actual model. However the former becomes more important once the forecast horizon reaches four years ahead. This suggests that investment in better forecasting of the likely path of corporation profits and refinements to the IFS model could both improve the accuracy of the forecasts made.

The move from October to January Green Budgets, which occurred as the Government's annual budget was moved from Autumn to Spring, has been associated with an improvement in the accuracy of the current year's IFS judgement forecast. This is likely to have been caused by an increase the accuracy of the current receipts forecast, and possibly due to the availability of additional information. It has not led to a noticeable improvement in the forecasting performance further ahead.

2

The IFS Approach to Corporation Tax Forecasting

1. Introduction

The government has committed itself to meeting two fiscal rules. The 'golden rule' requires that, over the economic cycle, the government borrows only to invest and not to fund current spending. The 'sustainable investment rule', which also applies over the economic cycle, requires that the ratio of public sector debt to national income be kept at a 'stable and prudent' level. To date, both of the rules have been met.[1] In order for the government to maintain its credibility, it is important that its fiscal policy be consistent with meeting the rules in the future. To assess whether the government can expect to continue to meet the two rules under current policy it is necessary to produce forecasts of the evolution of public spending and receipts. HM Treasury publishes two sets of public finance forecasts each year – currently one in the Pre-Budget Report each Autumn and one in the Budget each Spring. In addition every month the Treasury publishes a summary of the forecasts produced by independent forecasters.[2] The Institute for Fiscal Studies (IFS) produces a set of public finance forecasts once a year in its annual Green Budget, which is published in the run up to the actual Budget. In this paper, the performance of the techniques used by the IFS to produce estimates of corporation tax receipts are evaluated.

Accurate forecasting of corporation tax revenues is particularly important for the overall accuracy of the UK public finance projections. Total public sector receipts amounted to £397.7 billion in 2002–03. Corporation tax receipts accounted for £29.2 billion (7.3%) of this total. This makes corporation tax the fourth largest source of tax revenue. Furthermore, its highly cyclical nature makes it the most difficult tax to forecast and means that it typically accounts for a substantial part of the variation in receipts from year to year. For example, the November 2002 Pre-Budget Report presented a weaker in-year forecast for receipts in 2002–03 compared with the April

---

[1] For a discussion of the UK fiscal rules see, for example, Emmerson and Frayne (2002) or Balls and O'Donnell (2002).

[2] See www.hm- treasury.gov.uk /economic_data_and_tools/forecast_for_the_uk_economy/ data_forecasts_index.cfm for more details.

2002 Budget, with half of the £7.8bn cut in revenue forecasts being due to a deterioration in expected corporation tax receipts.[3]

Corporation tax receipts, as a percentage of national income, since 1970–71 are shown in figure 1.1. The series is strongly cyclical, and exhibits several sharp swings of 1% of national income or more. The amplitude of fluctuations is particularly large in the period since the mid-1980s, with receipts in 1989–90 being double what they were in the late 1970s.

Figure 1.1. Corporation tax receipts as a share of national income, 1970–71 to 2002–03.
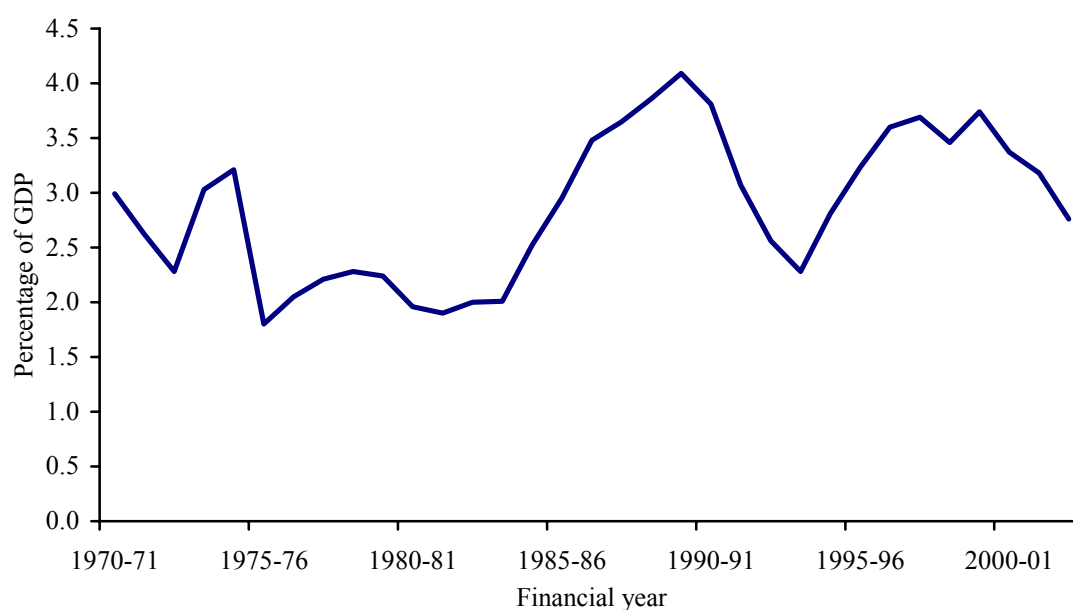
Note: Corporation tax receipts include Advance Corporation Tax (ACT) in years where this is payable.
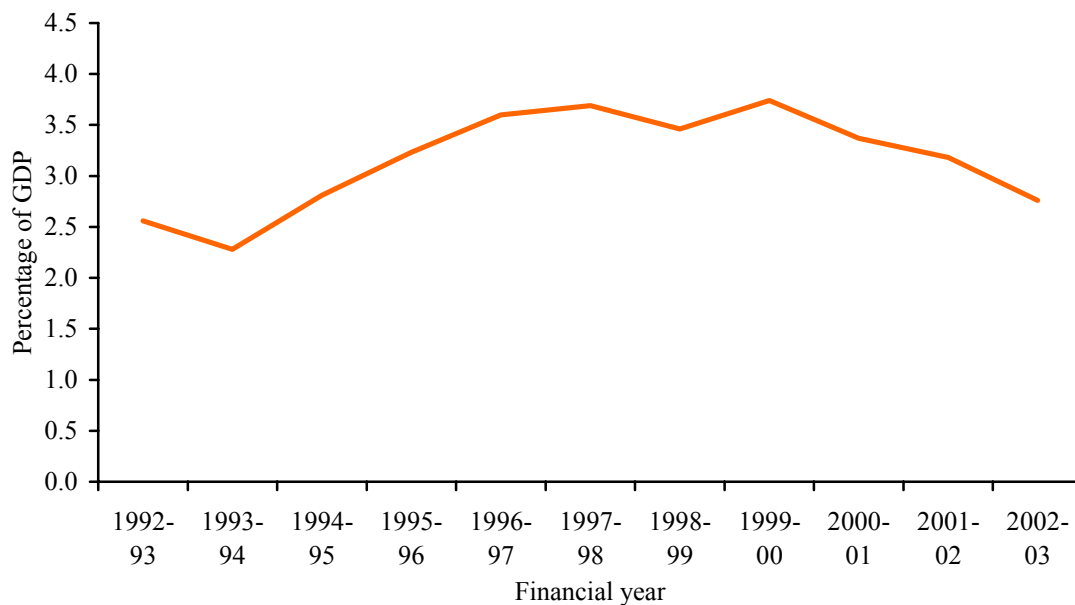*Source:* HM Treasury, *Public Finances Databank*, June 2003 and July 2003; Office for National Statistics website.

In this paper the record of IFS Green Budget forecasts for the period since October 1993 is analysed. The path of corporation tax receipts as a share of national income during this time is shown in more detail in Figure 1.2. Receipts rose continuously from 2.3% of national income in 1993–94 to 3.7% in 1997–98. In contrast between 1999–2000 and 2002–03 receipts have fallen from 3.7% to 2.8% of national income. In 2002–03 terms this fall of almost 1% of national income is equivalent to £10.3bn of

---

[3] The data in this paragraph come from: HM Treasury, *Public Finances Databank*, July 2003; HM Treasury, *Financial Statement and Budget Report*, April 2002; HM Treasury, *Pre-Budget Report*, November 2002; Office for National Statistics website.

revenue – this is equivalent to a 10 percentage point reduction in the corporation tax rate had profits remained stable.

Figure 1.2. Corporation tax receipts as a share of national income, 1992–93 to 2002–03.


Note: Corporation tax receipts include ACT in years where this is payable.
Source: HM Treasury, *Public Finances Databank*, July 2003; Office for National Statistics website.

Leaving aside discretionary changes to the corporation tax system introduced during the years being considered here, the analysis in this paper covers a period during which there has been a shift in the composition of the corporate tax base. In particular, the share of the tax base attributable to financial company profits has risen from around 20% to nearly 40% in the seven years since 1993–94.[4] Figure 1.3 shows the evolution of the tax base, broken down into contributions from financial and non-financial sectors over this period. Financial company profits have more than doubled as a share of national income from 2.4% of national income in 1993–94 to 5.8% in 2000–01. In contrast non-financial company profits are larger at around 10% of national income, but have, in comparison, remained broadly static as a share of national income over the period.

---

[4] Inland Revenue, *Inland Revenue Statistics*, various years.

Figure 1.3. Financial company and non-financial company profits chargeable to tax as a share of national income, 1993–94 to 2000–01.
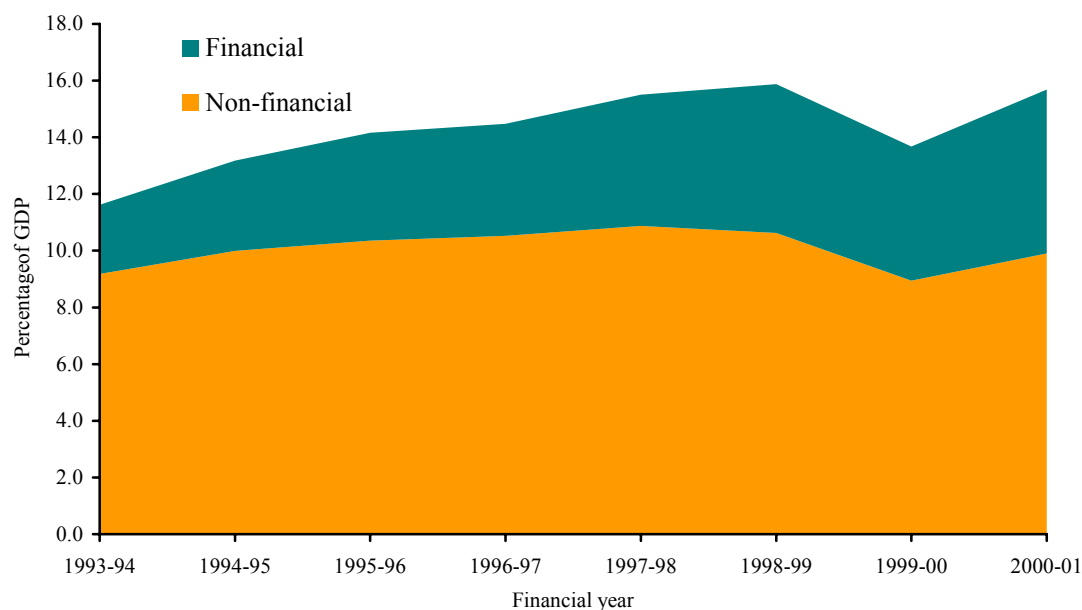
Note: Figures are for income chargeable to tax.
Source: Inland Revenue, *Inland Revenue Statistics*, various years; HM Treasury, *Public Finances Databank*, July 2003.

The increase in the relative importance of financial company profits means that the accuracy of forecasts of corporate tax revenues will now be more dependent on the accuracy with which their fortunes are forecast. Figure 1.4 shows the nominal level of corporation tax receipts from 1980–81 to 2002–03 and the FTSE All-Share Index from 1980 Q1 to 2003 Q1. It is interesting to note that corporation tax receipts over the last 10 years were more closely correlated to the level of the FTSE All-Share Index than was the case over the previous 5 years from 1988–89 to 1993–94. To the extent that the FTSE is an indicator of financial company profits, which as we have shown are now a larger component of overall corporate profits, we can expect a deterioration in the accuracy of corporation tax forecasts, as forecasting the FTSE is particularly difficult.

6

Figure 1.4. Corporation tax receipts 1980–81 to 2002–03 and FTSE All-Share Index 1980 Q1 to 2003 Q1 (both in nominal terms).
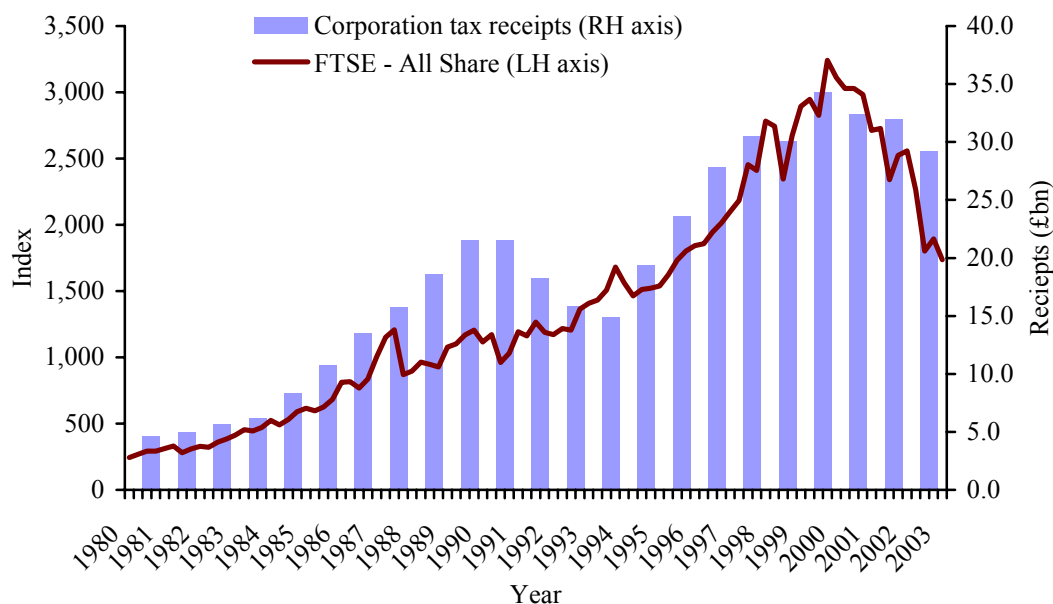
Source: HM Treasury, *Public Finances Databank*, July 2003; FTSE.

The IFS produces forecasts for corporation tax using a modelled receipts approach, a current receipts approach and using both of these and any additional information produces the IFS judgement. This paper evaluates the accuracy of the methodology used by the IFS to produce these forecasts. There are several reasons why corporation tax receipts may not follow the path suggested by IFS projections. Where possible the observed errors are decomposed into two components: those due to incorrect underlying forecasts of macroeconomic variables (in particular, estimated corporate profits growth), and those arising from incorrect modelling of revenues given the movements in the underlying economy. In order to decompose the error the eventual out-turn in corporate profits is used to estimate what the IFS modelled forecast would have been in the absence of inaccurate forecasts of macroeconomic variables. This, and the original modelled corporation tax forecast are compared with the actual out-turn of corporation tax.

In addition to the model projections, the IFS decides upon a judgemental forecast, by considering the influence of variables outside the model. The errors from modelled forecasts are compared to those from 'IFS judgement' forecasts in order to assess whether the use of judgement reduces forecast errors.

Understanding the sources of errors made in previous forecasts is important for a number of reasons. Firstly, it will help put current forecasts that use the same (or similar) modelling techniques into context. Secondly, the examination reveals changes in the response of corporation tax receipts to underlying economic developments.[5] Thirdly, the information about the causes of errors may be used to suggest where resources and effort towards improvement should be directed with highest priority.

The paper begins, in section 2, by detailing the technique used in IFS Green Budgets over the period from October 1993 to January 2003. It also considers, the adjustments that need to be made to forecast figures to produce series which may be compared to the series for actual out-turns. Section 3 presents the 'headline' analysis of the performance of the forecasts made by the IFS over the last 10 years. Forecasts made by the IFS for the outturns at the end of the current financial year (i.e. current year forecasts) are then examined in detail in section 4. Turning to the medium-term period, which is of particular importance in the context of fiscal rules that are assessed over the economic cycle, section 5 looks at errors for forecast horizons from one year to four years. Section 6 concludes.

2. The IFS Green Budget Forecasting Process

The IFS publishes its 'Green Budget' every financial year, typically six to eight weeks prior to HM Treasury's publication of its Financial Statement and Budget Report (FSBR). Each IFS Green Budget contains a set of public finance projections. A number of sources of information are used in the formulation of these forecasts. In this section the procedures employed by the IFS to forecast corporation tax receipts is described.

2.1 The IFS Modelled Receipts Approach

This approach models corporation tax receipts growth using the forecast growth in the tax base relevant to corporation tax, combined with an estimate of the elasticity of revenue with respect to this tax base. The proxy used for the tax base is corporate profits, and so the forecast growth in corporate profits is the input into the model.[6]

---

[5] This demarcation is adapted from Giles and Hall (1998).
[6] For a more detailed discussion of the actual tax base, see Adam and Kaplan (2002).

8

The forecast is then adjusted for the revenue effects of pre-announced tax changes from previous Budgets that are yet to have a full effect. This yields the formula:

$$2002\text{--}03\ forecast = 2001\text{--}02\ receipts \times (1 + Corporate\ profits\ growth\ forecast \times Elasticity) +$$
$$Pre\text{-}announced\ discretionary\ tax\ changes$$

From the standpoint of the Green Budget published in the 2002–03 financial year, the above forecast is a current year forecast. In the Green Budget, such a forecast is called a 'modelled receipts forecast for 2002–03'. The forecast for 2003–04 is here denoted as the 'one year ahead forecast'. Forecasts can be made for horizons of one year or more by using the formula iteratively. Given the tax structure implied by current announcements, and forecasts for corporate profits growth, modelled forecasts can be generated for corporation tax receipts.

2.2 The IFS Current Receipts Approach

The current receipts approach uses information on the corporation tax receipts received so far in the current financial year and compares this figure with the corresponding sum received until the same point in the previous financial year. The forecast for the current year is based upon the assumption of a uniform rate of growth of receipts over the financial year. This yields the formula:

$$2002\text{--}03\ forecast = \frac{Receipts\ received\ so\ far\ this\ year}{Receipts\ received\ to\ the\ same\ point\ last\ year} \times 2001\text{--}02\ receipts$$

The current receipts method can therefore only provide a forecast for the current financial year and, in the absence of any additional adjustment, will only accurately deal with budgetary changes that come into force at the beginning of the financial year.

2.3 The IFS Judgement

The IFS judgement forecast is the main estimate the IFS produces after taking the latest HM Treasury forecast, the modelled receipts forecast and the current receipts forecast into account. The forecast is also based on information about special factors that are not automatically incorporated into either the modelled or the current receipts forecasts. In practice, there is a close relationship between the methodology of the IFS modelled and judgement forecasts. For the current year, a modelled receipts forecast is produced. This forecast is revised for judgemental reasons. The revised figure is

used as the base for the calculation of the following year's judgement forecast (using the methodology of the modelling procedure described in section 2.1). This figure is again revised in the light of extra-model information. This process is then continued for subsequent years, although the extent to which additional information is used to revise the forecasts will naturally tend to decline the further ahead the forecast is for.

2.4 Decomposition of Forecast Errors

The IFS modelled receipts approach uses a well-defined formula in order to calculate forecasts for different horizons. Such a model can be used not only to generate the modelled receipts forecast from the relevant Green Budget, but also what would have been forecast had different corporate profits growth forecasts been used. This means it is possible to eliminate all the forecast error that is caused by an inaccurate estimate of growth in corporate profits, by using the growth in corporate profits that actually occurred.

The IFS current receipts and judgement forecasts cannot be adjusted in the same way. As regards the former, underlying macroeconomic variables are not an input into the model. As regards the latter, it is difficult to predict what the IFS judgement would have been had the modelled receipts forecast been different. There is little reason to expect the revision made to the modelled forecast (to produce the judgement forecast) to remain of the same direction or magnitude. Consequently, the current receipts and judgement forecast errors cannot be decomposed in the way that the modelled forecast errors are.

2.5 Timetable of Green Budgets

The dates of IFS Green Budgets from October 1993 to January 2003 are given in table 2.1. The relevant subsequent HM Treasury Budget is also indicated. From 1993 to 1996 when the Government held its Budget in November, IFS published its Green Budget in the preceding October. The election of new Labour in 1997 led to a special Budget in July 1997, which was preceded by a Green Budget in May 1997. Since then the Government has held its Budget in March or April and the IFS has launched its Green Budget at the end of the previous January. Each IFS Green Budget contains detailed forecasts of corporation tax for the current year and the next year.[7]

---

[7] With the exception of the May 1997 Green Budget which only contains a detailed forecast for 1997–98 and not 1998–99.

Furthermore, since 1992, the IFS has also published medium term public finance projections in order to evaluate the fiscal position over the economic cycle.

Table 2.1. IFS Green Budget & HM Treasury Budget dates from October 1993 to January 2003.

IFS Green Budget Publication Date	HM Treasury Budget	Previous year's out-turn from
October 1993	November 1993	March 1993 Financial Statement and Budget Report
October 1994	November 1994	June 1994 Summer Economic Forecast
October 1995	November 1995	June 1995 Summer Economic Forecast
October 1996	November 1996	July 1996 Summer Economic Forecast
May 1997	July 1997	April 1997 Public Finance First Release
January 1998	March 1998	November 1997 Pre-Budget Report
January 1999	March 1999	November 1998 Pre-Budget Report
January 2000	March 2000	November 1999 Pre-Budget Report
January 2001	March 2001	November 2000 Pre-Budget Report
January 2002	April 2002	November 2001 Pre-Budget Report
January 2003	April 2003	November 2002 Pre-Budget Report

2.6 Elasticities used in the IFS Modelled Receipts Approach

In the forecasting model described in section 2.1, the elasticity is designed to capture the responsiveness of corporation tax receipts to changes in the levels of corporate profits. In practice, there will be substantial variability in true value of this elasticity over time as there is reason to expect that the relationship between corporation tax and profits exhibits cyclical variation. In an economic upturn following a recession, corporation tax receipts should rise less slowly than implied by profits growth, because companies offset their tax liability against accrued losses from previous years. Upon the exhaustion of such tax reliefs, receipts rise more quickly. The use of a single value for the elasticity does not capture this cyclical variation in the relationship. Nevertheless in assessing the public finances over the medium term this issue will be less important as the economy will be expected to return to trend. In addition, the relationship between corporation tax and corporate profits is unlikely to remain static over time (even controlling for the effect of the economic cycle) due to the impact of policy changes.

During the period up to and including 1998–99, corporation tax receipts were assumed to be related to the previous year's corporate profits growth. Details of the estimation of the elasticity can be found in Devereux (1986). Prior to May 1997 an elasticity of 1.2 was used in the Green Budget forecasts; the current elasticity being

used is 1.0. The rationale behind reducing the value of the elasticity is that corporation tax allowances have become less generous and corporate tax rates have fallen. The reduction in allowances will mean that a one percent increase in the corporate tax base will lead to a smaller percentage increase in corporation tax receipts than would otherwise have been the case.

The abolition of advance corporation tax (ACT) from April 1999 and the implementation of a quarterly payment system for corporation tax has altered the relationship between tax receipts and profits. In particular, the new system reduces the lag between the realisation of profits and the payment of the tax upon the profit. Hence corporation tax revenue follows the cycle in profits more closely. The change in this lag relationship has been modelled in IFS Green Budgets as a change in elasticities. The elasticities change gradually over the transition period between the payment systems (this period starts in 1999–2000 and ends in 2003–04).

During and after the transition, corporation tax receipts are related not only to corporate profits in the previous year, but also in the current year. The elasticities used in Green Budgets since January 1999 are shown in Table 2.2, for the financial years from 1998–99 to 2003–04. The elasticities do not sum to one during the transition period because the method of introduction of quarterly instalments in the UK brought forward tax payments.[8] The 2003–04 elasticities are used for future years.

Table 2.2. Corporation tax elasticities used in Green Budgets since January 1999.

Elasticity with respect to	1998–99	1999–2000	2000–01	2001–02	2002–03	2003–04
Current year	0.00	0.49	0.48	0.45	0.40	0.34
Previous year	1.00	0.66	0.60	0.65	0.68	0.66
Sum of elasticities	*1.00*	*1.15*	*1.08*	*1.10*	*1.08*	*1.00*

Note: Elasticities are with respect to growth in corporate profits in relevant years.

2.7 Construction of Adjusted Series for IFS Green Budget Forecasts

Even if the IFS Green Budget forecasts were accurate, it would not necessarily be the case that the forecast projections would coincide with the actual subsequent path of corporation tax receipts. This is because after the forecasts were made, there may have been new discretionary tax changes to the corporation tax system. To measure

---

[8] The transition raised additional revenue of £1-2 billion per year over a four year period (HM Treasury, *Financial Statement and Budget Report*, March 1998). For more detail regarding the transition between the two tax systems, see section 6.2 of the IFS Green Budget, January 2001.

the accuracy of the forecasts it is necessary to adjust for these unanticipated budgetary changes before comparing to the eventual out-turns. Estimates of the impact of budgetary changes at the time of the Green Budget are produced using the latest published HM Treasury figures. For the current year forecasts (the forecast made for the financial year in which the Green Budget is published), there is typically no unanticipated budgetary change, because all tax changes which have revenue effects for the current year have already been announced.[9] For longer horizon forecasts, this is not true, and in the analysis that follows adjustments are made for subsequent, unanticipated, budgetary changes.[10]

3. The performance of the IFS Judgement forecast

This section presents our first look at the performance of the IFS Green Budget forecasts. The dark line in figure 3.1 shows the path of corporation tax receipts from 1992–93 to 2002–03 in nominal terms. This increased continuously between 1992–93 and 1997–98, with a point of inflexion in 1996–97 (i.e. the growth in nominal receipts increased prior to this and slowed afterwards). Receipts then subsequently peaked in 1999–2000 and have declined continuously since. The lighter lines show the projected path of corporation tax receipts from IFS Green Budgets from October 1993 to January 2003 (as set out in table 2.1).

The starting point for each forecast path is the outturn from the previous financial year, with the next value being the judgement forecast made within that financial. Thus, the first forecast path representing the October 1993 forecasts starts with the 1992–93 outturn and the provides the current year forecast for 1993–94 and subsequently 1994–95. The growth in nominal corporation tax receipts that occurred between 1992–93 and 1999–2000 follows the IFS Green Budget forecast relatively closely. However the subsequent medium term decline in revenues was not anticipated. Furthermore the last three Green Budget forecasts have each substantially reduced the level of corporation tax receipts expected in the medium term. This is in

---

[9] Over the period from November 1996 to January 2003 the only exception to this is the 'special' Budget in May 1997 which had an impact on corporation tax revenues in 1997–98
[10] While the change in lag structure during the transition between old and new corporation tax systems is modelled as a change in elasticities for the modelled forecasts (see section 2.5), it is not possible to adjust the judgement forecasts in the same way. The adjustment procedure followed here is to use the

contrast to the recent forecasts made by the HM Treasury where substantial downwards revisions to the short term forecast for corporation tax receipts have not led to downwards revisions of the level of receipts expected in the medium term.

Figure 3.1. Out-turns and (adjusted) IFS judgement forecasts over time.
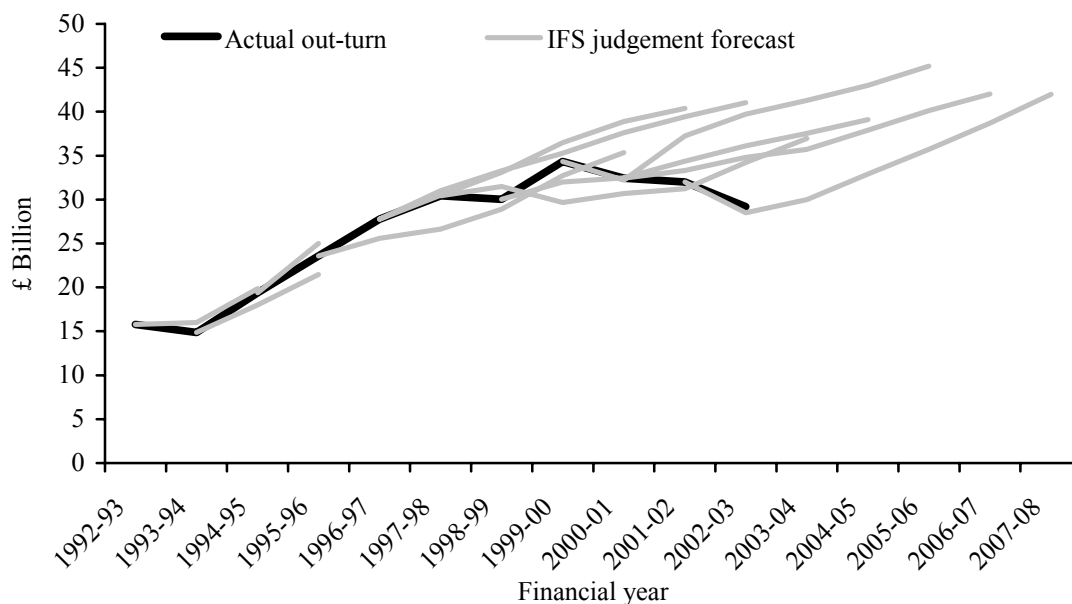
Note: Corporation tax receipts include ACT in years where this is payable.
Source: Office for National Statistics website; IFS Green Budget, various years; authors' calculations.

It is more difficult to see from figure 3.1 the relative accuracy of the short and medium term forecasts compared to those made for years further ahead. Sections 4 and 5 examine these in more detail, alongside an examination into the extent to which the IFS judgement forecast is more accurate than the predictions made by the IFS model. The extent to which errors made by the IFS forecasting model are the result of inaccurate forecast growth in corporate profits is also examined.

4. Detailed analysis of Current Year Forecasts

This section examines the accuracy of forecasts made within the financial year for the corporation tax out-turn figure which will be realised by the end of that financial year. Where possible, a visual impression of the divergences between forecast paths and the realised out-turns is provided. The section begins with a detailed examination of the

Inland Revenue's own estimates of the revenue effects of those aspects of the transition that the IFS

forecasts made by the IFS forecasting model. It then turns to the current receipts forecast and then the IFS judgemental forecast that was presented in figure 3.1.

4.1 The IFS Modelled Forecast Error

The adjusted IFS modelled forecasts and the actual path of out-turns are depicted in Figure 4.1. As before the dark line shows the path of corporation tax receipts from 1992–93 to 2002–03. The lighter lines show the projected path of corporation tax receipts made by the IFS model from IFS Green Budgets from October 1993 to January 2003 (as set out in table 2.1).[11] The starting point for each forecast path is the outturn from the previous financial year, with the next value being the judgement forecast made within that financial.

At first examination the pattern is not dissimilar to that of the IFS judgement. This is not particularly surprising as it simply indicates the extent to which the IFS forecasting model feeds into the final IFS judgement forecast. Some of the forecasts follow the eventual path in revenues fairly closely – for example the forecasts made in October 1993, October 1994 and January 1999. Others were less accurate. In particular the forecast made in October 1996 underestimated in revenues in 1996–97 and 1997–98, while that made in January 2001 substantially overestimated revenues over the period 2000–01 to 2002–03.

---

models as a change in elasticities.

[11] Corporate profits growth forecasts are not available for the October 1995 Green Budget, because this publication used an alternative modelling technique. Consequently no modelled forecasts are shown for this Green Budget.

Figure 4.1. Out-turns and (adjusted) IFS modelled forecasts over time.
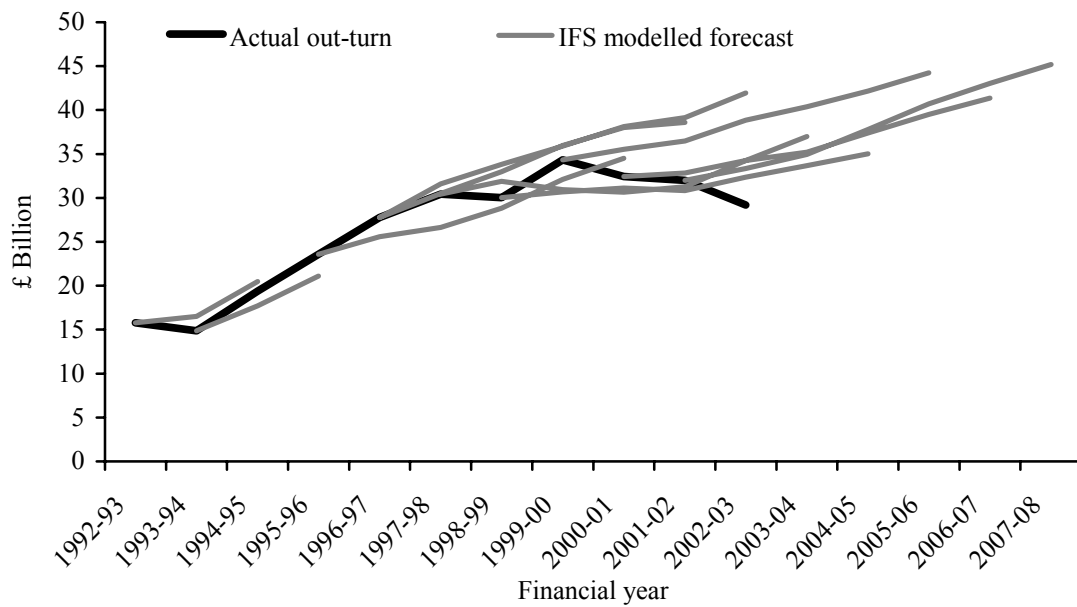
Note: Forecasts shown are calculated using the modelled receipts method. Corporation tax receipts include ACT in years where this is payable.
Source: Office for National Statistics website; IFS Green Budgets, various years; authors' calculations.

So precisely how accurate was the IFS model in predicting current year receipts? Table 4.1 provides the forecast errors of each Green Budget, both in billions of pounds and as a percentage of actual corporation tax receipts from October 1993 through to January 2003. Negative values indicate that forecasts were too low; positive values indicate that the modelled approach overestimated corporation tax receipts. The raw average was +£0.5bn, or 2.0% of corporation tax receipts. The positive sign indicates that on average over this period the IFS model slightly overestimated current financial year corporation tax receipts. The average absolute error of the forecasts made over this period was £2.0bn, or in percentage terms 7.5% of the level of corporation tax receipts. This is a substantial error.

Table 4.1. Current year forecast errors for the IFS modelled receipts approach, in £ billion and as a percentage of corporation tax receipts.

IFS Green Budget	Current year error	
	(£bn)	**(% of receipts)**
October 1993	1.6	10.8
October 1994	−1.7	−8.7
October 1995	n/a	n/a
October 1996	−2.2	−7.9
May 1997	0.1	0.3
January 1998	1.2	3.8
January 1999	1.9	6.2
January 2000	−3.6	−10.6
January 2001	3.1	9.7
January 2002	0.8	2.6
January 2003	4.1	14.2
Average error	0.5	2.0
Average absolute error	2.0	7.5

Note: Forecasts have been adjusted for unanticipated budgetary changes. Consequently they may differ from those published in the original IFS Green Budgets.
Source: Office for National Statistics website; IFS Green Budget, various years; authors' calculations.

It is also of interest to see whether the change in the timing has been associated with a different level of forecasting accuracy. From 1993–94 to 1996–97, the Green Budget was published in the October, whereas since the start of 1998, it has been published in January. The later publication data should mean that more information is available when forecasting corporate profits growth, which in turn might lead to a reduction in the magnitude of forecast errors made by the IFS modelled approach. There is some evidence that suggests this might be the case: the average absolute error of the October Green Budgets was 9.1% of corporate tax receipts, compared to 7.9% of the January Green Budgets. However, it is also the case that the largest percentage forecast error was made in the January 2003 Green Budget. In addition evidence from the decomposition of errors over time, which is presented in section 4.2, suggests that in fact there has not been a reduction in the IFS model forecast errors arising from the later publication date.

There is also a pattern in the direction of the average error overtime. There is a slight tendency for the model to under-predict corporation tax receipts towards the start of the period – this arises from the underestimates of revenues made in the October 1994 and October 1996 forecasts. In contrast out of the seven Green Budgets from May 1997 to January 2003 only once (in January 2000) has the model been too pessimistic.

This is in contrast to the direction we would expect the errors to take given the way the elasticities in the IFS model operate, as discussed in section 2.6.

4.2 The IFS Corrected Profits Forecasts

There are three inputs into the IFS model that could lead it to incorrectly forecast the path of corporation tax receipts.

1. Incorrect estimate of the previous years out-turn.

2. Incorrect assessment of the impact of discretionary budgetary changes.

3. Inaccurate forecast for growth in corporate profits.

If all of these are correctly assessed then any remaining forecasting error will be solely due to inaccuracies in the way the IFS model estimates corporation tax receipts.

Examination of differences in the eventual out-turn for corporation tax receipts and the estimated out-turn at the time of the Green Budget reveals that this is only a very small source of error (for more details see section A.1 of appendix A). Budgetary changes are accounted for using the Treasury's *ex ante* estimates of the impact of discretionary budgetary changes and a comparison of these estimates and their eventual costs is beyond the scope of this paper. It is possible to assess the extent to which forecasting errors have been caused by inaccurate forecasts for the growth in corporate profits by retrospectively replacing corporate profits growth forecasts with actual corporate profits growth as the input for the IFS model.

Forecasts representing what the IFS model would have predicted had the future growth in corporation tax receipts been perfectly forecast are presented in figure 4.2.[12] (Unlike figures 3.1 and 4.1 it is not possible to extend the forecasts beyond 2002–03 since the actual growth in corporation tax receipts is not yet known). As expected the projections made using the correct growth in corporation profits follows the path in corporation tax receipts more closely than the IFS model forecasts made using projections of corporate profits growth. This can be seen by comparing figure 4.2 with figure 4.1. Moreover the IFS model using the correct path of corporation profits growth is also, on average, more accurate than the IFS judgemental forecast. This can be seen by comparing figure 4.2 with figure 3.1. The corrected profits forecast in

---

[12] Again these forecasts have been adjusted for subsequent discretionary policy changes. For more details see section 2.7.

18

figure 4.2 is not, however, always more accurate than the judgemental forecast. This can be shown most obviously by looking at 2002–03 where corporation tax receipts fell in nominal terms despite the growth in corporate profits suggesting that this would not be the case.

Figure 4.2. Out-turns and (adjusted) IFS corrected profits forecasts over time.
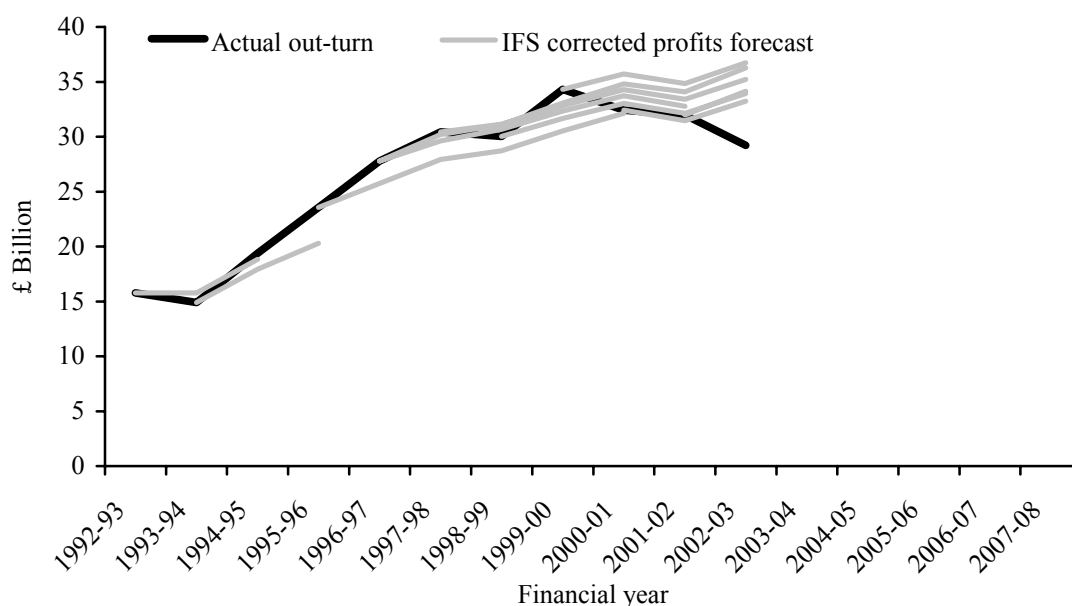
Note: Forecasts shown are based upon actual values of corporate profits growth. Corporate profits is proxied by total gross operating surplus of corporations from the National Accounts. Corporation tax receipts include ACT in years where this is payable.
Source: Office for National Statistics website; authors' calculations.

So how much of the IFS model forecast error is due to incorrectly forecasting the growth in corporate profits? Table 4.2 again shows the errors in the IFS model forecasts for the current year that were presented in table 4.1. In addition it presents a decomposition of the errors to show the extent to which these were caused by inaccurate estimates of corporation profits growth. So, for example, the October 1996 Green Budget IFS model forecast for corporate tax revenues in 1996–97 was £1.6bn too high. Of this £0.7bn was the result of using a too optimistic forecast for growth in corporate profits, leaving an error of £0.9bn that would have remained had the true growth in corporate profits been used as in input in the model. This is an example of when the two errors compound. Often this has not been the case. For example in 2002–03 the IFS modelled forecast overestimated revenues by £4.1bn. However using the eventual growth in receipts would have increased the forecast leaving it £5.0bn higher than the eventual outturn.

The average absolute error made over the period as a whole would have been 6.4% of corporation tax revenues had growth in corporate profits been forecast correctly. This is lower than the actual 7.5% average absolute error that occurred.

Table 4.2. Decomposition of current year forecast errors, in £ billion and as a percentage of corporation tax receipts.

IFS Green Budget	IFS modelled forecast error		Corporate profits input error		Modelling error	
	(£bn)	(%)	(£bn)	(%)	(£bn)	(%)
October 1993	1.6	10.8	0.7	4.9	0.9	5.9
October 1994	−1.7	−8.7	−0.2	−1.2	−1.5	−7.6
October 1995	n/a	n/a	n/a	n/a	n/a	n/a
October 1996	−2.2	−7.9	−0.1	−0.5	−2.1	−7.4
May 1997	0.1	0.3	0.9	3.0	−0.8	−2.7
January 1998	1.2	3.8	1.4	4.6	−0.2	−0.7
January 1999	1.9	6.2	0.8	2.5	1.1	3.7
January 2000	−3.6	−10.6	−1.0	−2.8	−2.7	−7.8
January 2001	3.1	9.7	−0.2	−0.5	3.3	10.1
January 2002	0.8	2.6	1.4	4.2	−0.5	−1.6
January 2003	4.1	14.2	−0.8	−2.8	5.0	17.0
Average error	0.5	2.0	0.3	1.1	0.2	0.9
Average absolute error	2.0	7.5	0.7	2.7	1.8	6.4

Ratio R = Average absolute input error/Average absolute modelling error = 0.42

Note: Forecasts have been adjusted for unanticipated budgetary changes. Consequently they may differ from those published in the original IFS Green Budgets.
Source: Office for National Statistics website; authors' calculations.

As the two errors sometimes offset it would be inappropriate to consider the percentage of the overall modelled error explained by incorrect corporate profits forecast. This can be demonstrated by the errors in May 1997. The overall IFS model error was just £0.1bn. However this is the result of a modelled error of −£0.8bn being more than offset by £0.9bn error arising from using a too optimistic forecast for corporate profits growth.

One measure of the extent to which errors can be explained by an incorrect forecast for the growth in corporate profits is the ratio of the average absolute errors. This is presented in table 4.3 as the ratio R. The figure of 0.42 indicates that the average absolute value of the input error is 42% of the modelling error. For the current year horizon, the contribution of modelling error is significantly larger than the input error on average. This is intuitively plausible, as corporate profits forecasts have been relatively more accurate at such a short horizon.

The decomposition enables us to better understand the problems that arise with the IFS modelling technique. Surprisingly the average absolute input error is found to be *higher* in the January than in the October Green Budgets (2.9% as opposed to 2.2%). There is no reason to suspect that the average absolute modelling error has changed and indeed analysis shows that it has been almost the same in the two classes of Green Budgets (6.8% and 7.0% respectively). The reduction in the average absolute error accompanying the move from October to January Green Budgets that was discussed in section 4.1 is therefore not due to improvement in forecasting corporate profits growth. Rather, it has arisen from one type of error now having a greater tendency to offset the other. In fact, as shown in table 4.2, during the October Green Budgets, input and modelling errors were always in the same direction (both positive in 1993 and both negative in 1994 and 1996). Since January 1998, four out of the six years have seen errors in opposite directions, and therefore to some extent have cancelled each other out.

Section 4.1 noted a tendency for the IFS model to under-predict corporation tax receipts during the start of the sample period, and to over-predict towards the end. Decomposition of the errors casts light upon this problem. The average error due to incorrect corporate profits growth forecasts is 1.1% during the period to October 1996, and 1.2% thereafter. This suggests that while on average there has been a tendency for the corporate profits forecasts to have been too optimistic, this tendency is similar both before and after 1996. The average error due to incorrect modelling has risen from –3.0% of receipts in the period to October 1996 to 2.6% of total receipts afterwards. This might be indicative of a change in the relationship between corporation tax receipts and the underlying economy. One scenario is that corporate profits growth is a reasonable sole input into the IFS model, but that the elasticity used at the start of the period should have been greater than 1.2 and that used more recently should be lower than 1.0. If this is the case it is difficult to know whether this is a permanent change, or simply suggesting that the model does not fully account for the cyclicality of corporation tax receipts. In addition it might be that other inputs – such as the performance of equity markets – should also have been taken into account. This could be particularly true given the increasing importance of the performance of financial company profits highlighted in section 1.

4.4 The IFS Current Receipts Forecast Error

The forecasts made in the current year using the current receipts method are now examined. As described in section 2.2 this uses information on receipts from the financial year so far and will be accurate if the growth in corporate tax receipts tends to be constant within the financial year. Forecasts calculated using the current receipts method from IFS Green Budgets in October 1993 to January 2003 are contrasted with the eventual out-turns in figure 4.3.[13] The figure suggests that with a couple of exceptions (for example the October 1994 forecast for 1994–95 and the January 2002 forecast for 2001–02) the current receipts forecast performs relatively well.

Figure 4.3. Out-turns and IFS current receipts forecasts over time.
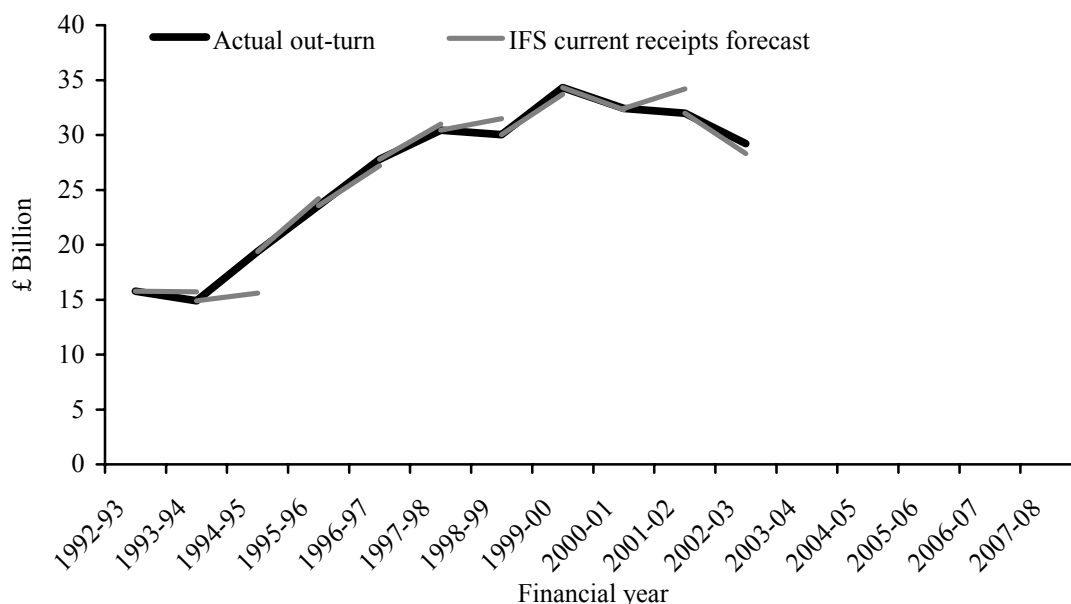
Note: Corporation tax receipts include ACT in years where this is payable.
Source: Office for National Statistics website; IFS Green Budget, various years.

So how well has the current receipts forecast performed? The forecast errors for each Green Budget from October 1993 to January 2003 are presented in table 4.3. The average absolute error is 4.9%. This is substantially less than the 7.5% of the IFS modelled receipts approach.

Table 4.3. Current year forecast errors for the IFS current receipts approach, in £ billion and as a percentage of corporation tax receipts.

IFS Green Budget	Current year error	
	(£bn)	(% of receipts)
October 1993	0.8	5.5
October 1994	–3.8	–19.5
October 1995	0.6	2.7
October 1996	–0.6	–2.1
May 1997	n/a	n/a
January 1998	0.6	1.8
January 1999	1.5	4.9
January 2000	–0.6	–1.8
January 2001	–0.1	–0.4
January 2002	2.2	6.9
January 2003	–0.9	–3.1
Average error	0.0	–0.5
Average absolute error	1.2	4.9

Source: Office for National Statistics website; IFS Green Budget, various years; authors' calculations.

The move from October to January Green Budgets should, all other factors unchanged, have reduced the absolute forecast error. This is because more of the receipts figures are available in the latter case.[14] Of course, the move from October to January Green Budgets coincided with the transition to quarterly corporation tax payments, which impacted on the timing of corporation tax receipts. Although this has served to work against the expected reduction in the forecast error due to more information being available, this the move to a later publication date has indeed brought a reduction in the average absolute error in the current receipts method from 7.5% to 3.2% of overall corporation tax receipts. If the outlier in October 1994 is ignored (when the current receipts method underestimated receipts by nearly 20%) then the average absolute error for the October Green Budgets is reduced to 3.4%. This is still greater, albeit only slightly, than the average absolute error seen in January Green Budgets from 1998. The average forecast error is negative before the point of inflexion in corporation tax revenues of 1996–97 (discussed in section 3) and positive thereafter. This is unsurprising since the current receipts method will be expected to underestimate receipts when growth in receipts is increasing and to overestimate receipts when the growth in receipts is falling. Now that the transition to

---

[13] It was not possible to produce a current receipts forecast at the time of the May 1997 Green Budget.
[14] For example in 1996–97, 24% of the corporation tax receipts for the whole financial year were available by October and 64% by January.

the new system is over, we can expect, other things being equal, to see the current receipts forecast perform better than in recent years.

4.5 The IFS Judgement Forecast Error

The final current year forecast to examine is the IFS judgement forecast. This was presented graphically in section 3, figure 3.1. Table 4.4 displays the current year forecast error in detail. It would only be desirable to make a judgemental revision to the IFS modelled receipts or the current receipts forecasts if this improved the forecast in some sense. For the current year, it appears that, in terms of average absolute error, the IFS judgement is indeed beneficial. The average absolute error of 4.5% of corporation tax receipts is lower than that recorded for the IFS modelled or the current receipts approaches (7.5% and 4.9% respectively). In addition on average the IFS judgement, unlike the IFS model or the current receipts forecasts, has been unbiased as shown by an average error of 0.0% of corporation tax receipts.

Table 4.4. Current year forecast errors for the IFS judgement forecasts, in £ billion and as a percentage of corporation tax receipts.

IFS Green Budget	Current year error	
	(£bn)	(% of receipts)
October 1993	1.1	7.5
October 1994	−1.4	−7.2
October 1995	1.4	6.1
October 1996	−2.2	−7.9
May 1997	0.1	0.3
January 1998	0.6	1.8
January 1999	1.5	4.9
January 2000	−2.3	−6.8
January 2001	−0.2	−0.7
January 2002	1.3	4.1
January 2003	−0.7	−2.4
Average error	−0.1	0.0
Average absolute error	1.2	4.5

Note: Forecasts have been adjusted for unanticipated budgetary changes. Consequently they may differ from those published in the original IFS Green Budgets.
Source: Office for National Statistics website; IFS Green Budget, various years; authors' calculations.

The move from October to January Green Budgets has also led to increased accuracy in the IFS judgement forecast. The average absolute error has been 3.5% of corporation tax receipts in January Green Budgets compared to 7.2% in October Green Budgets. Section 4.2 showed that there was no evidence that corporate profits

growth had been forecast more accurately in January Green Budgets. This suggests that the improved performance of the IFS judgement is likely to be a result of the improved accuracy of the information from the current results methodology, although it is possible that other sources of relevant information were also more accurate by the time of the later publication date.

As far as the cyclical performance of IFS judgement is concerned, the average bias in the first four years shown in table 4.4 was –0.4% of corporate tax receipts, compared to 0.2% across the last seven years. Therefore it appears that there is some evidence for a tendency to under-predict revenues at the start of the sample and to over-predict towards the end (although such differences are unlikely to be statistically significantly different). In any case the magnitude of such systematic errors is substantially smaller than that for the IFS modelled receipts series.

5. Detailed analysis of Medium-Term Forecasts

It is plausible that the performance of the forecasts varies markedly with the horizon in question. In particular, there could be changes in the direction and the magnitude of forecast errors, and also in the relative contribution of different types of errors. This section examines how the errors in forecasts made for the following financial year and beyond.

5.1 IFS Modelled Forecast Error

The medium-term accuracy of the IFS forecasting model that was shown in figure 4.1 is described in more detail in table 5.1. These figures are all shown as a percentage of corporation tax receipts. The figures in billions of pounds (nominal) figures can be found in section A.2 of the appendix. For the current year forecasts table 4.1 showed that the average absolute error was 7.5% of corporation tax receipts. The errors are larger for forecasts further ahead, although surprisingly the model does not appear to have been particularly less accurate in predicting revenues 1, 2 or 3 years in advance. The average absolute errors across these horizons has been 10.7%, 9.3% and 10.9% of corporation tax revenues respectively. The average absolute error 4 years hence is found to have been larger at 16.7% of corporation tax receipts.

Also unsurprisingly table 5.1 shows that the direction of forecast errors tends to persist. So, for example, a positive error on the forecast on any one year tends to lead

to a positive error in the next year too. In both May 1997 and January 1998 all the errors were positive, and if current forecasts are correct this will also have occurred in January 2001.

The bottom panel in table 5.1 shows the average error and average absolute errors by each forecast horizon for a consistent set of forecasts – namely those made from October 1996 to January 1999 inclusive. The average error is zero or close to zero for the forecasts made for both one and two years out. The average absolute error is smaller on average looking two years out than either the 1 year forecast or those made for 3 or 4 years ahead.

Table 5.1. Medium-term IFS modelled forecast errors (all in percentage terms).

IFS Green Budget	1 year ahead	2 years ahead	3 years ahead	4 years ahead
October 1993	5.6	n/a	n/a	n/a
October 1994	−10.5	n/a	n/a	n/a
October 1995	n/a	n/a	n/a	n/a
October 1996	−12.5	−4.1	−6.4	6.4
May 1997	9.9	4.8	17.2	20.7
January 1998	12.7	4.6	17.5	22.3
January 1999	−9.9	−5.5	−2.3	17.3
January 2000	−4.0	−3.7	10.9	n/a
January 2001	14.0	33.0	n/a	n/a
January 2002	17.4	n/a	n/a	n/a
Average error	2.5	4.9	7.4	16.7
Average absolute error	10.7	9.3	10.9	16.7
Average errors over Oct 1996 to Jan 1999				
Average error	0.0	−0.1	6.5	16.7
Average absolute error	11.2	4.7	10.9	16.7

Note: Forecasts have been adjusted for unanticipated budgetary changes.
Source: Office for National Statistics website; authors' calculations.

Sections 4.1 and 4.2, found that the change in the timing of the Green Budget in the financial year (from October to January) had coincided with a reduced average absolute forecast error, but that this was associated with the input and model errors tending to offset rather than an actual reduction in the individual error components. The average absolute error of the IFS model is actually *higher* for the 1 year and 2 year ahead forecast when the Green Budget was published later in the financial year. For one year ahead, the average absolute error has risen from 9.5% to 11.6% as the

Green Budget comes later in the financial year. For the two-year forecast horizon, the average absolute error rises much more, but these figures are very sensitive to the inclusion of the outlier forecast error from January 2001.

The positive average error found for the current year modelled receipts forecasts persists and increases with the forecast horizon. This was 2.0% of corporation tax receipts for the current year and increases to 2.5%, 4.9%, 7.4% and 16.7% of corporation tax receipts 1, 2, 3 and 4 years ahead respectively.

The decomposition of modelled forecast errors for forecast horizons from one to four years ahead is presented in table 5.2. Again, the modelled forecast errors are decomposed into two components: the error arising from incorrect forecasts of corporate profits growth and the error arising from incorrect modelling of revenues given the underlying economy. They are denoted input and model errors respectively in the table. All the figures are expressed as a percentage of the overall level of corporation tax receipts. (Again the nominal values of the forecast errors, in billions of pounds, may be found in section A.2 of the appendix).

Moving to a longer forecast horizon increases both the average absolute error arising from inaccurate forecast of corporate profits growth and the average error from modelling errors. The table also shows that the contribution of corporate profits growth forecasting errors relative to modelling error rises. This is shown by the ratio R, which took the value 0.42 for the current year forecasts (in table 4.1). This increases to 0.89, 0.91, 0.93 and 1.47 as the forecast period increases to 1, 2, 3 and 4 years ahead respectively. The value of 1.47 shows that when forecasting four years ahead the error due to incorrect corporate profits growth forecasts contributes more to the overall error than the error due to inaccurate modelling.

Again the bottom panel of the table shows the average error and average absolute errors by each forecast horizon a consistent set of forecasts. This shows that both the average error and the average absolute errors in both input and model errors both increase steadily as the forecast horizon is extended further forwards.

Table 5.2. Decomposition of IFS modelled forecast errors (all in percentage terms).

IFS Green Budget	1 year ahead			2 years ahead			3 years ahead			4 years ahead		
	Overall	Input	Model	Overall	Input	Model	Overall	Input	Model	Overall	Input	Model
October 1993	5.6	8.4	−2.8	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
October 1994	−10.5	3.5	−13.9	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
October 1995	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
October 1996	−12.5	−4.3	−8.2	−4.1	0.3	−4.4	−6.4	4.7	−11.1	6.4	7.3	−0.9
May 1997	9.9	7.7	2.1	4.8	10.6	−5.8	17.2	13.2	4.0	20.7	18.2	2.4
January 1998	12.7	9.1	3.6	4.6	8.3	−3.7	17.5	10.1	7.4	22.3	15.8	6.5
January 1999	−9.9	−5.5	−4.3	−5.5	−11.3	5.8	−2.3	−6.7	4.4	17.3	−3.3	20.6
January 2000	−4.0	−5.9	1.9	−3.7	−4.1	0.4	10.9	−5.3	16.2	n/a	n/a	n/a
January 2001	14.0	5.2	8.9	33.0	7.2	25.8	n/a	n/a	n/a	n/a	n/a	n/a
January 2002	17.4	3.6	13.8	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Average error	2.5	2.4	0.1	4.9	1.8	3.0	7.4	3.2	4.2	16.7	9.5	7.2
Average absolute error	10.7	5.9	6.6	9.3	6.9	7.7	10.9	8.0	8.6	16.7	11.2	7.6
Average errors over Oct 1996 to Jan 1999												
Average error	0.0	1.8	−1.7	−0.1	2.0	−2.0	6.5	5.3	1.2	16.7	9.5	7.2
Average absolute error	11.2	6.6	4.6	4.7	7.6	4.9	10.9	8.7	6.7	16.7	11.2	7.6
R		0.89			0.91			0.93			1.47	

Note: Forecasts have been adjusted for unanticipated budgetary changes. R is defined as in Table 4.2, i.e. R = Average absolute input error/Average absolute modelling error.
Source: Office for National Statistics website; authors' calculations.

5.2 The IFS Judgement Forecast Error

The medium-term performance of the IFS judgement (as shown in figure 3.1) is described in more detail in table 5.3. Again these figures are all shown as a percentage of corporation tax receipt, the corresponding figures in billions of pounds (nominal) figures can be found in section A.2 of the appendix. For the current year forecasts table 4.4 showed that the average absolute error was 4.5% of corporation tax receipts. As was the case with the IFS modelled forecasts the errors tends to increase as the forecast horizon extends. The average absolute errors has been 10.5%, 10.3%, 13.3% and 18.9% of corporation tax revenues for the forecasts made 1, 2, 3 and 4 years ahead. Looking just over the consistent forecast period from October 1996 to January 1999 (as shown in the bottom panel of the table) shows that, as with the IFS model projections, the average absolute error is lowest for forecasts made 2 years ahead. As far as the move from October to January Green Budgets is concerned, the improvement in the accuracy of the current year judgement forecasts (as shown in section 4.5) does not carry over to longer forecast horizons.

Table 5.3. Forecast errors for the IFS judgement forecasts (all in percentage terms).

IFS Green Budget	1 year ahead	2 years ahead	3 years ahead	4 years ahead
October 1993	2.4	n/a	n/a	n/a
October 1994	–9.0	n/a	n/a	n/a
October 1995	n/a	n/a	n/a	n/a
October 1996	–12.5	–3.7	–4.6	9.0
May 1997	10.2	6.2	20.0	26.3
January 1998	10.8	2.7	16.0	23.3
January 1999	–13.6	–5.3	–2.4	17.2
January 2000	0.1	7.5	23.7	n/a
January 2001	16.5	36.0	n/a	n/a
January 2002	19.2	n/a	n/a	n/a
Average error	2.7	7.2	10.5	18.9
Average absolute error	10.5	10.3	13.3	18.9
Average errors over Oct 1996 to Jan 1999				
Average error	–1.3	0.0	7.3	18.9
Average absolute error	11.8	4.5	10.8	18.9

Note: Forecasts have been adjusted for unanticipated budgetary changes.
Source: Office for National Statistics website; IFS Green Budget, various years; authors' calculations.

Section 4.5 found that for the current year the IFS judgement forecast was superior in terms of average absolute error that the IFS modelled forecast. This not the case for the forecasts made further ahead with the average absolute error 2, 3 and 4 years out being lower in the IFS modelled forecast than the IFS judgement forecast. The average error is also closer to zero in the IFS model for the entire medium term horizon.

Looking at whether revisions made to the IFS modelled forecast have improved or worsened forecasts in subsequent years highlights this. In five out of the nine years for which there is comparable data, the revision to the pure modelled forecast leads to a less accurate forecast in the following year. What is more, it has occurred in four out of the five Green Budgets since January 1998 for which data exists (the one year ahead forecast error from the January 2003 Green Budget is not yet available). This suggests that, over the period considered here, while revisions have led to improved current year forecasting performance, they have not improved the accuracy of the longer-term forecasts.

6. Conclusions

Improved understanding of the sources of errors can aid the development and refinement of the forecasting procedure. This paper has considered the range of corporation tax forecasting techniques used by the IFS in its Green Budgets. These include the modelled receipts and current receipts approaches, and the formulation of the IFS judgement. The errors of the modelled receipts approach have been decomposed into those arising from incorrect macroeconomic forecasts and those arising from incorrect modelling of revenues given the underlying economy. Some of the key findings of this paper are summarised in Table 6.1, which presents the average error and the average absolute error of different forecasts over different horizons.

For the current horizon forecast, the 'best' forecast is the IFS judgement. It is unbiased for the years examined, and its average absolute error is the smallest of all the forecast techniques, at 4.5% of the level of corporation tax receipts. This is reassuring. It is also clear that the current receipts forecast is preferable to the IFS model for the current year. This is despite the fact that the accuracy of the current receipts forecast should have been worsened over the period of this study as a result of the transition to the new quarterly payments system.

Table 6.1. Forecast errors of alternative forecasting techniques (average errors shown as a percentage of corporation tax receipts).

	Current year	1 year ahead	2 years ahead	3 years ahead	4 years ahead
Average error:					
IFS modelled	2.0	2.5	4.9	7.4	16.7
IFS corrected profits	0.9	0.1	3.0	4.2	7.2
IFS current receipts	–0.5	n/a	n/a	n/a	n/a
IFS judgement	0.0	2.7	7.2	10.5	18.9
Average absolute error:					
IFS modelled	7.5	10.7	9.3	10.9	16.7
IFS corrected profits	6.4	6.6	7.7	8.6	7.6
IFS current receipts	4.9	N/a	N/a	n/a	n/a
IFS judgement	4.5	10.5	10.3	13.3	18.9

Source: Authors' calculations.

The IFS Green Budget forecasts, both modelled and judgement, appear to be systematically biased since there is evidence of under-prediction followed by over-prediction. It is difficult to discriminate between permanent and cyclical changes in a sample stretching over just 10 years. However it does appear that the IFS model is unable to fully predict the cyclicality of corporation tax receipts since it tended to under predict revenues prior to the point of inflexion in 1996–97 and has tended to over predict them since. The IFS judgement is found to reduce the modelling errors substantially for the current year horizon, and also substantially reduces the apparent cyclical problem with the IFS model identified above.

The IFS model has delivered a very similar level of forecasting accuracy to the IFS judgement when looking at the period one year ahead (an average absolute error of 10.7% compared to 10.5%). Looking further ahead the IFS model has performed slightly better than the IFS judgemental forecast.

Average errors of the IFS model are reduced when the actual rather than forecast growth in corporation profits is included. For example the average absolute error looking 3 years ahead is 9.3% of corporation tax receipts using the forecast growth in corporate profits. This falls to 7.7% when actual growth in corporate profits is used. This indicates that investment in more accurately forecasting corporate profits growth

might help improve the performance of the forecasting model. This is increasingly true for longer horizon forecasts. The fact that there are still substantial errors with the corrected receipts series indicates that modifications to the model structure itself may also be beneficial.

In addition the decomposition of errors has helped to discriminate between competing hypotheses for explaining the forecast errors observed over the past decade. In terms of the current year forecasts the move from October to January Green Budgets appears to have been accompanied by some decrease in the IFS modelled forecast error, but this has little to do with improved forecasts of corporate profits growth. Instead it has been due to 'input' and 'model' errors in recent years tending to offset rather than compound. In contrast the move to January Green Budgets has led to the IFS judgement forecast errors for the current year falling substantially. This is likely to have been caused by the improved accuracy of the information available from the current receipts methodology. The change in timing of the Green Budgets appears not to have discernibly improved longer horizon forecasting.

References

Adam, S. and Kaplan, G. (2002), *A Survey of the UK Tax System*, Briefing Note No. 9, London: Institute for Fiscal Studies (www.ifs.org.uk/taxsystem/taxsurvey.pdf).

Balls, E. and O'Donnell, G. (eds.) (2002), *Reforming Britain's Economic and Financial Policy*, Basingstoke: Palgrave.

Dilnot, A., Emmerson, C. and Simpson, H. (eds.) (2001), *The IFS Green Budget: January 2001*, Commentary No. 83, London: Institute for Fiscal Studies (www.ifs.org.uk/gbfiles/gb2001.shtml).

Devereux, M. (1986), 'The IFS Model of the UK corporation tax', Working Paper No. 86, London: Institute for Fiscal Studies.

Emmerson, C. and Frayne, C. (2002), *The Government's Fiscal Rules*, Briefing Note No. 16, London: Institute for Fiscal Studies (www.ifs.org.uk/public/bn16.pdf).

Giles, C. and Hall, J. (1998), 'Forecasting the PSBR outside government: the IFS perspective', *Fiscal Studies*, vol. 19, No. 1, pp 83–100 (www.ifs.org.uk/publications/fiscalstudies/fscj.pdf).

A. Appendix

A.1 Errors due to inaccurate out-turns

In addition to the sources of error emphasised in the paper, the current year forecasts from the IFS modelled receipts approach may be incorrect because of errors in the inputs other than the corporate profits growth forecasts. One example is error arising from the use of inaccurate out-turn estimates for the previous year's corporation tax receipts. Table A.1 records information on the modelled forecast errors before and after correcting for inaccuracies in the previous year's out-turn figure. The correction does not affect the average error or the average absolute error of the modelled forecast error to one decimal place, and has only a small effect upon individual forecast errors. Therefore of the 3 sources of 'input' error identified in section 4.2 it seems reasonable to ignore the error in the previous years outturn.

Table A.1. Current year forecast errors before and after correcting for inaccurate estimates of the previous year's out-turn, in £ billion and as a percentage of corporation tax receipts.

IFS Green Budget	Overall error		Out-turn corrected error	
	(£bn)	(%)	(£bn)	(%)
October 1993	1.6	10.8	1.7	11.5
October 1994	−1.7	−8.7	−1.8	−9.4
October 1995	n/a	n/a	n/a	n/a
October 1996	−2.2	−7.9	−2.2	−8.0
May 1997	0.1	0.3	0.2	0.6
January 1998	1.2	3.8	1.1	3.8
January 1999	1.9	6.2	1.9	6.2
January 2000	−3.6	−10.6	−3.6	−10.5
January 2001	3.1	9.7	3.3	10.0
January 2002	0.8	2.6	0.9	2.7
January 2003	4.1	14.2	3.8	12.9
Average error	0.5	2.0	0.5	2.0
Average absolute error	2.0	7.5	2.0	7.5

Note: Forecasts have been adjusted for unanticipated budgetary changes.
Source: Office for National Statistics website; IFS Green Budget, various years; authors' calculations.

A.2 Nominal values for forecast errors

The nominal forecast errors (in billions of pounds) corresponding to the forecast errors recorded in Table 5.1 are presented in Table A.2.

Table A.2. Decomposition of IFS modelled forecast errors (all in £bn).

IFS Green Budget	1 year ahead			2 years ahead			3 years ahead			4 years ahead		
	Overall	Input	Model	Overall	Input	Model	Overall	Input	Model	Overall	Input	Model
October 1993	1.1	1.6	–0.5	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
October 1994	–2.5	0.8	–3.3	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
October 1995	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
October 1996	–3.8	–1.3	–2.5	–1.2	0.1	–1.3	–2.2	1.6	–3.8	2.1	2.4	–0.3
May 1997	3.0	2.3	0.6	1.6	3.6	–2.0	5.6	4.3	1.3	6.6	5.8	0.8
January 1998	3.8	2.7	1.1	1.6	2.8	–1.3	5.7	3.3	2.4	7.1	5.1	2.1
January 1999	–3.4	–1.9	–1.5	–1.8	–3.7	1.9	–0.7	–2.1	1.4	5.0	–1.0	6.0
January 2000	–1.3	–1.9	0.6	–1.2	–1.3	0.1	3.2	–1.6	4.7	n/a	n/a	n/a
January 2001	4.5	1.7	2.8	9.6	2.1	7.5	n/a	n/a	n/a	n/a	n/a	n/a
January 2002	5.1	1.0	4.0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Average error	0.7	0.6	0.2	1.4	0.6	0.8	2.3	1.1	1.2	5.2	3.1	2.1
Average absolute error	3.2	1.7	1.9	2.8	2.3	2.4	3.5	2.6	2.7	5.2	3.6	2.3
Average errors over Oct 1996 to Jan 1999												
Average error	–0.1	0.5	–0.6	0.1	0.7	–0.7	2.1	1.8	0.3	5.2	3.1	2.1
Average absolute error	3.5	2.1	1.4	1.6	2.6	1.6	3.5	2.8	2.2	5.2	3.6	2.3

Note: Forecasts have been adjusted for unanticipated budgetary changes.
Source: Office for National Statistics website; authors' calculations.

Table A.3 records the nominal values (in billions of pounds) of the IFS judgement forecast errors for forecast horizons from one to five years ahead. The table corresponds to Table 5.2 in the main text of the paper.

Table A.3. Forecast errors for the IFS judgement forecasts (all in £bn).

IFS Green Budget	1 year ahead	2 years ahead	3 years ahead	4 years ahead
October 1993	0.5	n/a	n/a	n/a
October 1994	–2.1	n/a	n/a	n/a
October 1995	n/a	n/a	n/a	n/a
October 1996	–3.8	–1.1	–1.6	2.9
May 1997	3.1	2.1	6.5	8.4
January 1998	3.3	0.9	5.2	7.4
January 1999	–4.7	–1.7	–0.8	5.0
January 2000	0.0	2.4	6.9	n/a
January 2001	5.3	10.5	n/a	n/a
January 2002	5.6	n/a	n/a	n/a
Average error	0.8	2.2	3.2	5.9
Average absolute error	3.1	3.1	4.2	5.9
Average errors over Oct 1996 to Jan 1999				
Average error	–0.5	0.1	2.3	5.9
Average absolute error	3.7	1.5	3.5	5.9

Note: Forecasts have been adjusted for unanticipated budgetary changes.
Source: Office for National Statistics website; IFS Green Budget, various years; authors' calculations.