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## TAX FORECASTING BY THE UNITED KINGDOM GOVERNMENT

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Tax forecasting has a long history in the UK. Some estimates of government receipts for the year ahead have been published in annual Budget Red Books since the nineteenth century. More systematic forecasts of the UK economy and public finances have been published since 1968 and the Industry Act of 1975 required the Treasury to publish two forecasts a year. To start with these forecasts only looked two years ahead, but from 1980 medium term projections have been published each year.

The current publication requirements are set in *The Code for Fiscal Stability*, published in 1998. The Code stipulates that there should be at least two economic and fiscal projections published each year, that these projections should include projections of all the main fiscal aggregates, including total government revenues, and have a projection horizon of not less than two full financial years from the date of publication. It also says that where possible the projections should include a breakdown of revenue by sector and by economic and functional category.

Economic and fiscal projections are now included in each year's Pre Budget Report (normally in November or December) and in the Budget itself (March or April). In practice the projection horizon for tax revenues extends further than the minimum set out in the Code. The Budget 2006 projections published in March 2006 looked forward for five full years to 2010-2011. A limited breakdown, showing receipts of larger taxes as a percentage of GDP, is published for the full period but more detailed breakdowns by type of tax and economy category are given for one year ahead.

The public finance projections in general and tax forecasts in particular are of critical importance to the Government and attract a lot of public attention, largely because of the Government's strict fiscal rules. These are:

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- the golden rule: over the economic cycle the Government will borrow only to invest and not to finance current spending; and
- the sustainable investment rule: public sector net debt will be held at a stable and prudent level. Other things being equal, net debt will be maintained below 40 per cent of GDP over the economic cycle.

Section 2 sets out the main features of the tax forecasting process and how it is organised, section 3 briefly describes some of the methods used and section 4 looks at aspects of the monitoring process.

## 1 THE TAX FORECASTING PROCESS

Tax forecasting is a joint exercise involving the Treasury and HM Revenue & Customs (HMRC), which is responsible for almost all of the tax revenue collected by central government. A small team of analysts in the Tax forecasting section of the Public Sector Finances (PSF) team in Treasury are responsible for putting the overall tax forecasts together and work very closely with their colleagues in HMRC and with Treasury colleagues responsible for the economic projections.

The Treasury produces economic forecasts using a macroeconomic model, usually known as the Treasury model. This can also produce estimates of tax receipts using published outturn data and a set of econometric equations, and this approach could be used to produce the medium term tax projections. However there were problems with this method, and since the 1970s the tax projections have been produced on a tax by tax basis, using tax specific models. The Treasury model tax equations are still maintained for policy simulations and related purposes.

The individual tax forecasting models used by HMRC all rely to some extent on economic determinants (e.g. forecasts of wage and salary growth, profits, consumer spending etc) supplied by Treasury. A lot of care is taken to ensure consistency between the economic and tax projections. As required by the *Code for Fiscal Stability* the major assumptions underlying the public finance projections are set out in the Budget and Pre Budget Report, and some of these assumptions are audited by the independent National Audit Office (see Box 1). The economic projections are presented in terms of ranges, with annual GDP growth varying by  $\frac{1}{4}$  of a percentage point either side of the neutral view. However the lower end of this range is assumed for the public finance projections in order to incorporate caution into the forecast. All the GDP components and other economic determinants associated with this assumption are taken from the Treasury model and supplied to analysts in HMRC who then feed the data into their models.

The HMRC analysts producing the tax forecasts are experts on their particular taxes and work closely with their operational and technical colleagues in HMRC to gather up to date intelligence on the impact of special factors or new legislation on tax receipts. They will also have access to the latest receipts and tax assessment data, including where necessary access to data on individual taxpayers.<sup>1</sup> The information content of receipts outturns will vary from tax to tax. Sometimes, for example in corporation tax where large companies start making instalment payments part way through the year and need to base these payments on their estimated liability for the whole year, this will be a much better indication of future receipts than outturns of economic determinants. Hence short term forecasts for the current year for taxes will often be based primarily on recent outturns and HMRC judgements.

#### BOX 1

#### National Audit Office (NAO) Audited Assumptions

- In 1997, the Government invited the NAO to perform the first ever audit of the key assumptions and conventions underpinning the fiscal projections. Their role has developed since 1997 and the NAO currently audit 11 key assumptions. Since 2000, the NAO have been invited to conduct a rolling review to ensure those it audited three years previously remain reasonable and cautious. This cautious approach to fiscal policy builds a 'safety margin' into the public finance projections to guard against unexpected events. The main assumptions which have an impact on the tax forecasts are:
- Trend growth: Assuming 2½ per cent growth up to 2006 and 2¼ per cent in subsequent years, ¼ percentage points below the Government's neutral view.
- Composition of GDP: Shares of labour income and profits in National Income are broadly constant in the medium term.
- Equity prices: Rise from their current starting point in line with money GDP.
- Oil prices: Based on the average of independent forecasts for one year ahead.
- VAT: The VAT gap will rise by 0.5% points a year from a level that is at least as high as the estimated outturn for the current year.
- Tobacco: In projections, the underlying market share of smuggled cigarettes will be set at least at the latest published outturn.

Prepared by the authors.

The HMRC analysts return their forecasts to the Public Sector Finances (PSF) in Treasury and also provide a lot of diagnostic material on changes relative to previous forecasts and from year to year. PSF, who are responsible for putting these forecasts together and for presenting, explaining, and justifying the resulting projections for receipts, and for the main fiscal aggregates, to Ministers and senior officials, critically examine the HMRC work.

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1. Under UK legislation nobody in Treasury is allowed access to tax data on identifiable taxpayers.

Any unexpected changes will be discussed in detail with HMRC, and PSF will also look at top down comparisons, ensuring for example that there is a sensible, and comprehensible, pattern for the overall tax to GDP ratio.

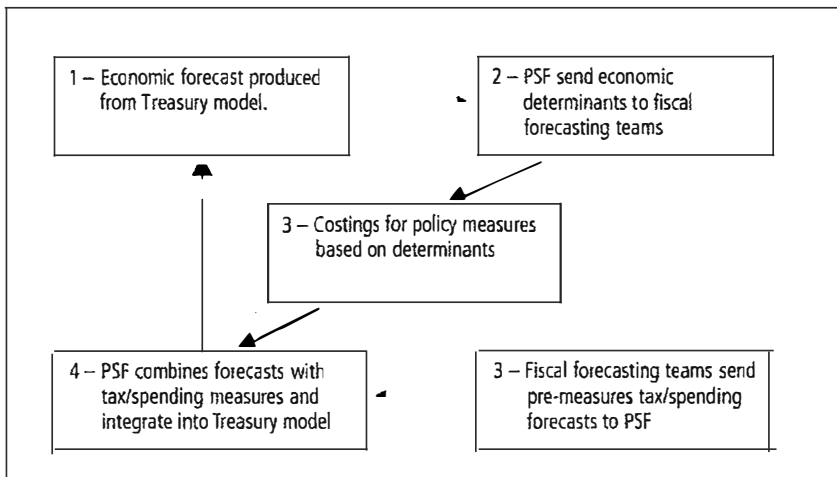
Each Budget or Pre Budget Report forecasting exercise will stretch over several weeks and involve a series of forecasting rounds. This is partly because some of the economic determinants do depend on tax projections so a degree of iteration is required, and partly because more outturn data will become available during the exercise.

As set out in the *Code for Fiscal Stability*, the projections also have to take into account government decisions on changes to the tax regime. The importance of the fiscal rules is such that the Government will wait until the public finance projections have been finalised before confirming decisions on tax and spending policy. PSF work closely with their tax and spending policy colleagues, and with HMRC, to ensure that these policy changes are properly taken into account.

PSF are also responsible for producing the public finances documentation published at each Budget or Pre Budget Report. All the tax numbers included, and the associated text are agreed with HMRC colleagues.

## 2 FORECASTING METHODS

As the methods used are highly tax specific and reflect the particular types of tax existing in the UK, only a summary of the very different methods used for some of the major taxes is given here. The table below, as published in Budget 2006, shows the relative importance of the major taxes.



Income tax in the UK is collected in a variety of different ways and most of these are forecast separately.

The largest component is known as Pay As You Earn (PAYE), which accounts for over 85 per cent of total income tax (around £130bn). It is deducted at source from wages and salaries, and some pension income, and paid over to HMRC by employers/pension fund managers, usually on a monthly basis. The forecasting model uses Treasury determinants on wages and salaries to project forward tax liabilities. Increases in wages and salaries are split into those due to changes in numbers employed and those due to changes in earnings. The progressive nature of the income tax system means there is a large difference between the average marginal tax rate, which is applied to changes stemming from higher earnings, than the average tax rate, which is applied to changes from higher employment numbers. The tax rate projections are primarily derived from HMRC's personal tax model, a microsimulation model based on the tax records of a sample of around 400,000 individuals. The PAYE model has generally performed well. The main problems in recent years have been connected with forecasting the amount of tax collected from bonus payments, especially those paid in the financial sector, as the level of these payments has changed considerably from year to year. It is therefore necessary to adjust the modelled tax rates to allow for the assumed level of bonuses in the light of forecasts of financial sector profits.

TABLE 1  
Current receipts: a proportion of GDP

	Per cent of GDP						
	Outturn 2004-2005	Projections 2005-2006	2006-2007	2007-2008	Estimate 2008-2009	2009-2010	2010-2011
Income tax (gross of tax credits)	10.8	11.1	11.2	11.4	11.5	11.7	11.8
National insurance contributions	6.6	7.0	7.0	7.0	7.0	7.1	7.1
Non-North Sea corporation tax <sup>1</sup>	2.6	2.9	3.2	3.4	3.4	3.4	3.4
Tax credits <sup>2</sup>	-0.4	-0.4	-0.4	-0.4	-0.3	-0.3	-0.3
North Sea revenues <sup>3</sup>	0.4	0.8	0.8	1.0	1.0	0.9	0.8
Value added tax	6.2	6.0	6.0	6.0	5.9	5.9	5.8
Excise duties <sup>4</sup>	3.3	3.2	3.1	3.1	3.0	3.0	2.9
Other taxes and royalties <sup>5</sup>	6.6	6.9	7.1	7.1	7.1	7.1	7.2
<b>Net taxes and national insurance contributions<sup>6</sup></b>	<b>36.2</b>	<b>37.5</b>	<b>38.0</b>	<b>38.5</b>	<b>38.7</b>	<b>38.7</b>	<b>38.7</b>
Accruals adjustments on taxes	0.1	0.2	0.2	0.2	0.2	0.2	0.1
Less EU transfers	-0.4	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3
Other receipts <sup>7</sup>	2.3	2.4	2.5	2.5	2.5	2.5	2.5
<b>Current receipts</b>	<b>38.3</b>	<b>39.7</b>	<b>40.3</b>	<b>40.9</b>	<b>41.0</b>	<b>41.0</b>	<b>41.0</b>

Source: Office for National Statistics, U. K.

Notes: <sup>1</sup> National accounts measure, gross of enhanced and payable tax credits.

<sup>2</sup> Tax credits scored as negative tax in net taxes and national insurance contributions.

<sup>3</sup> Includes oil royalties, petroleum revenue tax and North Sea corporation tax.

<sup>4</sup> Fuel, alcohol and tobacco duties.

<sup>5</sup> Includes council tax and money paid into the National Lottery Distribution Fund, as well as other central government taxes.

<sup>6</sup> Includes VAT and 'own resources' contributions to EU budget. Cash basis.

<sup>7</sup> Mainly gross operating surplus and rent, excluding oil royalties.

Income tax collected via self assessment amounted to around £18bn in 2005-2006. This covers tax due on the profits from self employment and other unincorporated businesses and other tax which cannot be collected during the tax year itself. The forecasting model follows the same principles as the PAYE model but the data on the main determinants is not nearly as good or timely as for PAYE and it has been more difficult to identify the main drivers of changes to these receipts.

Almost all National Insurance Contributions (around £86bn) are collected alongside income tax, with the bulk being paid by employers and employees. This is forecast using a similar process to PAYE. Payments by the self employed are part of the self assessment system and are forecast by the same model used for self assessment income tax.

Corporation tax raised around £42bn in 2005-2006. About £7½ bn of this was from North Sea oil companies, which have a different tax regime. The remainder is forecast mainly using a microsimulation model based on the tax records of all large companies and a sample of smaller ones.<sup>2</sup> This approach allows for changes in profits, losses and allowances to be modelled at the company level, although group relief (which involves interactions between companies) is modelled at an aggregate level using regression techniques. The major challenges in forecasting corporation tax in recent years have been associated with the tax paid by financial companies. The financial sector is very important in the UK and accounts for, on average, about 30% of the non-oil corporation tax yield but the tax liabilities of these companies have been very volatile, growing by around 20% in some years and falling by up to around 15% in others. Moreover, unlike profits of non-financial companies where there is a fairly close relationship between profits as measured in the National Accounts and taxable profits, there is no external data available to use as a good indicator of financial company taxable profits.

Value Added Tax receipts amounted to £73 bn in 2005-2006. The methods used to forecast VAT have changed several times in recent years. Before the mid 1990s a model based on a projection of the underlying tax base was used. This was split into individual components (durable and non-durable consumers expenditure, government procurement and investment). Different VAT factors were applied to each sector reflecting the different proportion of spending subject to VAT. The equation seemed to break down in the mid 1990s when the effective

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2. Total sample size is about 15,000 companies. Further details on the corporation tax model can be found in Eason (2000).

tax rate declined each year, resulting in large over-forecasts of VAT. As a result the equation was replaced by a much simpler one which just assumed that VAT would be determined by consumers expenditure, as projected by the Treasury model, and a deliberately cautious assumption that the effective tax rate would decline each year by 0.05 percentage points was introduced in the November 1997 Pre Budget Report.

This simplified model worked well until 2000, but the effective tax rate then started to fall by more than 0.05 percentage points a year. HMRC were then doing much more work on compliance strategies for indirect taxes and had developed methods for measuring the “VAT gap”, the difference between the VAT theoretical tax liability (VTTL) and actual VAT receipts. Since Budget 2004, the VAT projections have been based on this approach.<sup>3</sup> Each component of the VTTL is projected separately in line with Treasury economic forecasts using data on both the tax base and on the trends in the proportion theoretically subject to VAT. The forecast for receipts in the current year is based on recent outturns and judgements about the effects of changes to the economy, and this forecast is used to construct an estimate of the VAT gap. The VAT gap is then projected in line with the NAO-audited assumption to increase by 0.5 percentage points each year, before the effects of legislative changes and other special factors.

Receipts from **excise duties** on fuel, alcohol and tobacco raised £39bn in 2005-2006. Econometric models<sup>4</sup> are used to forecast receipts from excise duties on fuel (£23 bn in 2005-2006) and on alcoholic drink (£8bn in 2005-2006). Demand models have been estimated for petrol, diesel, beer off-sales, beer on-sales, wine and spirits. Demand is assumed to be a function of own prices, prices of close substitutes and complements and broader economic variables. The fuel models also use a variable to capture changes in fuel efficiency. The equations are carefully monitored and re-estimated on a regular basis.

Other central government taxes are forecast individually using a variety of different methods. A different approach is used for council tax, the main tax raised by local government. As council tax rates are determined annually by individual local authorities, not by central government, a stylised assumption that rates will increase in line with the historical average is used. Since changes to council tax are broadly balanced by changes to locally financed expenditure, they have little material impact on the fiscal aggregates.

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3. Further details on the VAT model are available in UK Treasury.

4. Further details on the alcohol demand equations are available in Huang (2003).



### 3 RECEIPTS MONITORING AND SHORT TERM FORECASTING

The UK attaches considerable importance to detailed monitoring of the public finances. This enables emerging trends or possible deviations from forecast pattern to be observed as quickly as possible. HMRC provide regular reports on a monthly basis, and more specific information at particular times of the year, around the important due dates for the major taxes.

The amount of information available, and its timeliness, varies considerably from tax to tax. The usual pattern is that a limited amount of information is available quickly but more detailed analysis, which requires access to tax assessment data has to wait until much later. For example information on PAYE receipts in a day is available during the next working day. However the amount of information is limited to the total amount paid over by the employer. Hence, some information on the tax paid by different industries is available promptly, but nothing on the number of employees paying tax or on the distribution of their earnings is available until much later. As the amount paid over comprises income tax and national insurance (compulsory social) contributions the split between these has to be estimated using algorithms. The employers will send details of the amount of tax and NIC deducted from each employee but not until well after the end of the tax year.

Whenever the monitoring reveals significant, unexpected deviations from the expected pattern of receipts, HMRC will be asked to investigate further. This will involve HMRC analysts contacting operational experts within HMRC, who might then contact the companies involved directly.

The Government also attaches considerable importance to transparency, which is one of the key principles set out in the *Code for Fiscal Stability*. Figures showing provisional outturns for the public finances are published monthly, jointly by the Office for National Statistics and the Treasury. This publication includes some series for the major taxes, and more detail is published at the same time by HMRC.

The monitoring exercise also feeds directly into the important work done on short term forecasting. These are done on a regular basis, mainly for the purposes of cash flow management. The UK Debt Management Office (DMO) is responsible for carrying out the Government's debt management policy of minimising financing costs over the long term and for managing the aggregate cash needs in the most cost-effective way. As receipts for individual taxes tend to be concentrated over particular time periods, the level of receipts will vary considerably, both from month to month and within each month. The profile of receipts will also be very different from that of expenditure. This means

that on certain days the DMO will need to borrow substantial amounts from the money markets while on others the flow will be in the other direction. The DMO needs good projections of likely cashflow for several months ahead so it can plan its major operations, but it also needs forecasts on a daily basis in order to plan its day to day money market operations effectively.

Government cash flow is monitored by Treasury intra-day as part of the cash management operation. Whilst it is not generally possible to identify individual taxes, deviations from expectations of cash receipts over specific days in the month can give an early indication of the likely outturn for particular taxes.