

## ANALYTICAL NOTE 3: TAX FORECASTING ERROR DECOMPOSITION

The Department of Finance is responsible for producing tax forecasts twice a year – in the *Stability Programme Update* and in the annual *Budget*. The approach used by the Department for one-year-ahead forecasts can be summarised using the following equation:

$$REV_{T+1} = (REV_T - T_T)(1 + (B_{T+1}^G E)) + T_{T+1} + M_{T+1} + J_{T+1}$$

where  $REV_{t+1}$  is the one year ahead forecast for a particular tax head;  $REV_t$  is an estimate of the yield for that tax head in the current year, i.e., the year in which the forecast is made;  $T_t$  are one-off items affecting the yield in the current year;  $B_{t+1}^G$  is the projected growth rate for the year ahead in the appropriate macroeconomic variable that best captures the tax base for each tax (i.e., the macro driver);  $E$  is the elasticity measuring the responsiveness of tax revenue to the tax base;  $T_{t+1}$  are one-off items affecting the yield in the coming year;  $M_{t+1}$  is the estimated static yield from any changes in policy affecting receipts for a particular tax in the coming year; and  $J_{t+1}$  is a judgement factor applied by the Department of Finance.

Building on analysis in previous FARs (IFAC 2012a, IFAC 2013a), this note focuses on the source of tax forecasting errors, decomposing the errors into three types:

- (1) starting point errors, i.e., errors caused by using an incorrect estimate of the yield for a particular tax in the current year ( $REV_t$ );
- (2) macro driver errors, i.e., errors caused by using an incorrect estimate of the projected growth rate in the macro driver ( $B_{t+1}^G$ ); and
- (3) other errors, i.e., errors caused by using incorrect estimates of any other component of the forecast. These include one-off items ( $T_t$  and  $T_{t+1}$ ); estimates of the yield from any changes in policy for the coming year ( $M_{t+1}$ ); judgement factor ( $J_{t+1}$ ); and the elasticity,  $E$ .

The exercise is carried out for one-year-ahead errors for four of the main tax heads: VAT; corporation tax; excise; and the “Pay As You Earn” (PAYE) component of income tax.

First, Department of Finance forecasts are replicated using the same data that were used in the official forecasting process. For VAT and corporation tax, data for  $REV_t$  are taken from *Budget* publications while data for the PAYE component of income tax and excise duty were provided by the Department of Finance; data for  $M_{t+1}$  are taken from *Budget* publications; and information about,  $B_{t+1}^G$ ,  $T_t$ ,  $T_{t+1}$

and E was provided by the Department for the 2004-2012 period.<sup>1</sup> The judgement term,  $J_{t+1}$ , is defined as the difference between the forecast published by the Department (the official forecast) and the forecast generated in this replication exercise.

For VAT and corporation tax, the forecasting process follows the equation above, with nominal personal consumption and nominal GDP as the macro drivers, respectively. The process for excise duty differs slightly in that it consists of two parts: the first part relates to Vehicle Registration Tax (VRT) (the macro driver is the expected increase in the demand for new cars multiplied by the expected increase in the price of new cars); the second part involves forecasting excise duty minus VRT (the macro driver is the projected growth rate in nominal personal consumption excluding cars).<sup>2</sup> In the case of PAYE, the equation is modified to include two macro drivers – the expected growth in non-agricultural wages and non-agricultural employment – each of which is multiplied by an elasticity factor.

Starting point errors can be identified by estimating the equation using actual outturn data for  $Rev_t$ , which is published in the end year Exchequer statement, in place of the estimate used by the Department at the time the forecast was made.<sup>3</sup> All other values in the equation remain unchanged (i.e., those used by the Department of Finance at the time the forecast was made). By comparing the result to the official forecast, we isolate the degree to which the official forecast is inaccurate due to the use of an incorrect estimate of  $Rev_t$ .<sup>4</sup> For example, the total VAT forecast error in 2004 was €325 million, but is reduced to €213 million when the actual yield for 2003 is used instead of the estimated yield (from the Budget). The starting point error in this case is €112 million. Similarly, the macro driver error is identified by estimating the equation using the correct value for  $B_{t+1}^g$  published in the *National Income and Expenditure Accounts* (NIE), and keeping all other values the same as those used in the official forecast.<sup>5</sup> The “other” forecast error is calculated as a residual, i.e., the overall forecast error for a particular tax head minus the starting point error and the macro driver error. All errors are calculated in euro.

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<sup>1</sup> Due to data limitations, we cannot decompose the forecast errors for other components of income tax, capital taxes, customs duties or stamp duties, or for the period before 2004.

<sup>2</sup> In the case of excise, the measure of personal consumption expenditure is adjusted to include expenditure by Irish residents abroad and exclude expenditure of non-Irish residents in Ireland.

<sup>3</sup> Outturn data for PAYE, VRT and excise excluding VRT are provided by the Department of Finance.

<sup>4</sup> This approach ignores any impact of interactions between the starting point error and the base growth error. It is likely that any interaction terms would be relatively small and this approach greatly simplifies the analysis.

<sup>5</sup> Outturn data for non-agricultural employment, which feeds into the PAYE forecast, are taken from the Quarterly National Household Survey. In the case of VRT, outturn data for new car sales and prices were provided by the CSO.

Figures N5-N8 detail the decomposition of tax errors for each of the tax heads. While there is some variation across tax heads, most of the total errors are dominated by “other” errors, with macro driver errors sometimes making a significant contribution.<sup>6</sup> Unsurprisingly, the relative share of macro driver errors rose around the time of the economic crisis, contributing substantially to the larger total errors across tax heads in 2008-2009. For VAT and PAYE in 2009, for example, the macro driver error accounted for around three-quarters and two-thirds, respectively, of the gross error, reflecting the underestimation in the fall in both personal consumption and earnings. Given the timing of the *Budget* in December over the 2004-2012 period, substantial information is available on the current year outcome when the forecasts are made. Therefore, starting point errors have generally been quite small, although corporation tax provides an exception in 2009. This probably reflects the relatively lumpy nature of corporation tax receipts around the end of the year. It will be interesting to see whether moving the Budget to October will have an effect on starting point errors (IFAC, 2013b).

For all tax heads, the “other” error category, which captures, inter alia, errors relating to  $M_{t+1}$ ,  $J_{t+1}$ ,  $E$ ,  $T_t$ ,  $T_{t+1}$ , plays a dominant role. “Other” errors accounted for almost 60 per cent of VAT forecast errors on average and peaked at 90 per cent in 2007.<sup>7</sup> While macro-driver errors are the main contributors for PAYE, “other” errors still contributed over 45 per cent on average to the gross error since 2004.<sup>8</sup> In the case of PAYE, other errors – which may include judgement – act to offset a portion of the large macro errors during the downturn. In the case of corporation tax, other errors are likely due to the difficulty in forecasting the effects of policy changes.<sup>9</sup> For excise, although not shown in the graph, the VRT component of excise duty is dominated by ‘other’ errors while the starting point error is quite small.<sup>10</sup>

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<sup>6</sup> A study by the IMF looking at the 1995-2003 period concluded “... revenue forecast errors can be largely explained by errors in the outlook for growth”. (IMF (2005) p.15.)

<sup>7</sup> In 2007, a series of VAT policy measures were expected to cost the State €213 million, such as: a change in the registration threshold for SMEs; a change in the cash accounting threshold for small firms; a reduction in the required number of returns for small firms; and a reduction in the VAT rate on child car seats.

<sup>8</sup> For PAYE, starting point errors are particularly small, as receipts are relatively constant from month to month.

<sup>9</sup> Although the rate of corporation tax has not changed since 2003, various policy changes have been introduced, for example, incentives for expenditure on research and development, changes in liability depending on accounting periods, or alternative thresholds for start-up/small companies.

<sup>10</sup> This is probably due to the fact very few cars are sold in the month of December, and as a result, at *Budget* time, it is easier to predict  $Rev_t$  for VRT than is the case for other tax heads.

FIGURE N5: VAT

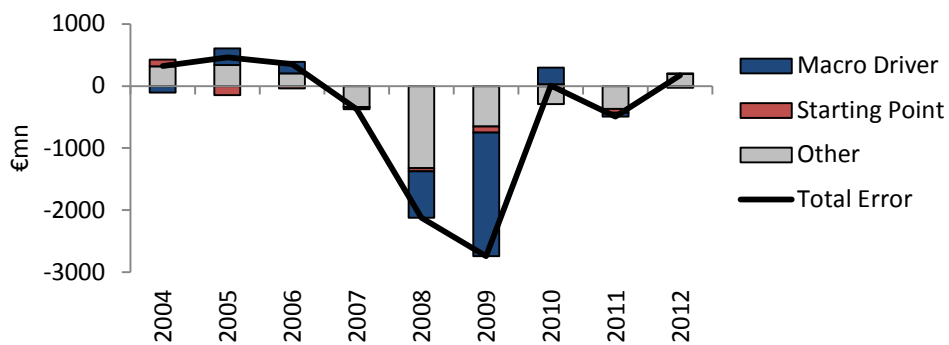


FIGURE N6: CORPORATION TAX

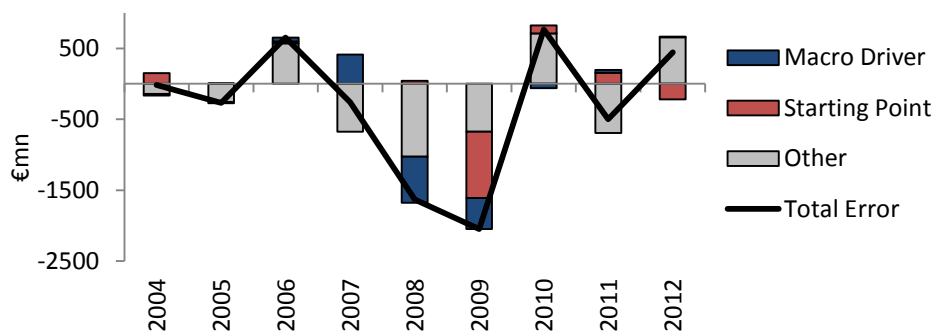


FIGURE N7: EXCISE

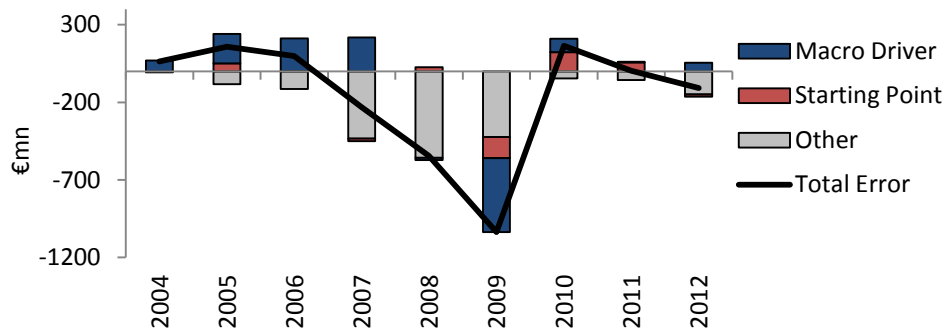
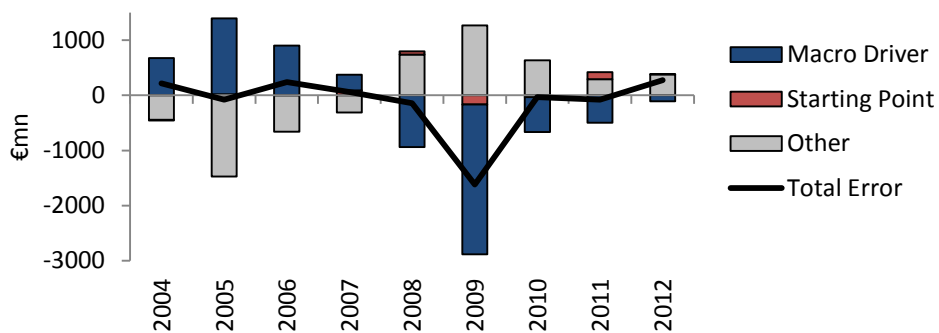


FIGURE N8: PAYE



Source: Internal calculations.