**How the design of the fiscal settlement potentially builds in excess forecast variability: and what can be done about it.**

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Introduction.

This note explains why the way the current fiscal settlement has been designed has certain adverse implications, which are likely to lead to increased uncertainty in the forecasts of the resources available within the Scottish budget. A number of recommendations are made about the way the budgetary process should be handled, in order to minimise these adverse effects. This note is illustrated by reference to some of the figures in the May 2018 Scottish Fiscal Settlement, and March 2018 Office for Budget Responsibility projections, (the latest available at time of drafting). While these specific forecasts are likely to have been overtaken by more up-to-date projections by the time this note is read, this in no way diminishes the value of the earlier projections as demonstrating the general point being made here.

Variability in the differences of large numbers.

It is a truism in statistics that, when one is forecasting a quantity which is itself the difference of two large forecast numbers, then the resulting forecast is liable to be subject to considerable variability. This happens because of the following formula for the variance of the difference between two random variables, x and y: namely

 var(x – y) = var(x) + var(y) - 2cov(x, y) (1)

[Here var(x), the variance of x, is a standard measure of the degree of variation in a random variable and is, technically, the average squared deviation of x from its mean. Cov(x, y), the covariance between x and y, is a standard measure of the association between x and y, and is related to the degree of correlation between x and y as follows:

 Correlation(x, y) = $\frac{cov(x, y)}{√var\left(x\right)var(y)}$ ]

When x and y are large quantities, it will often be the case that their forecasts have correspondingly large variances. If so, then the implication of formula (1) is that the variance of (x – y) will be large, because of the large positive var(x) and var(y) terms in formula (1), unless x and y are also highly positively correlated, in which case the variance terms will to some extent be offset by the -2cov(x,y) term.

As a corollary: anything which tends to reduce the correlation between x and y will, other things being equal, have the effect of increasing the variance of (x – y) .

In practical terms, the above leads to the following commonsense principles which should be applied when handling quantities which are estimated as differences of forecast large numbers: –

(a) treat any such estimate with great caution, since the variance, i.e., uncertainty, of the estimate is likely to be large.

(b) try, as far as possible, to understand the basis of all such forecasts, and, in particular, any apparently puzzling features, before putting confidence in the forecast.

(c) take any steps which can reasonably be taken to increase the degree of correlation between the x and y forecasts.

Forecasting the effect of the fiscal settlement.

None of the above is rocket science. But it does, nevertheless, have important implications for forecasting the effect of the fiscal settlement on the Scottish budget.

The effect of the fiscal settlement, and Scottish tax changes, is given by the difference between Scottish devolved tax receipts and the block grant adjustment. These are both large numbers: if one concentrates, as will be the case in this note, on the income tax element, then the relevant figures are shown in table 3.8 of the Scottish Fiscal Commission report of May 2018, as shown here:-



(Note that the figures in row 1 of this table relate to the income tax element of Scottish tax receipts. Note also that, although T3.8 attributes the BGA estimates in row 2 to the Scottish Government, they are effectively derived from OBR’s March 2018 forecast of rUK NSND receipts.)

The variance of the forecasts of the numbers in rows 1 and 2 are likely to be large, particularly towards the end of the forecast period: so we are very much in the territory described in the preceding section.

In fact, the figures in table 3.8 suggest that the Scottish budget could experience a very significant benefit from the operation of the fiscal settlement over the period. As can be seen, table 3.8 projects that the difference between projected Scottish NSND receipts and the block grant adjustment could increase progressively from -£159 million in 2017/18 to £405 million in 2022/23.  In other words, the Scottish budget could experience an annual benefit of £564 million in 2022/23 relative to 2017/18, due to the operation of the fiscal settlement, and policy decisions on Scottish income tax.

The principles in the previous section suggest this effect should be treated with a good deal of caution: and this is particularly the case when the following puzzling features of the figures are considered.

By dividing the year to year rate of increase in the Scottish NSND figures in table 3.8 by the projected year to year rate of increase in the Scottish population, it is possible to infer the implied rate of increase in Scottish per capita NSND receipts. Moreover, the year to year rate of increase in the BGA is the projected rate of increase in rUK per capita NSND receipts, multiplied by the rate of increase in the Scottish population. So, by dividing the year to year rate of increase in the BGA figures in table 3.8 by the projected year to year rate of increase in the Scottish population, it is possible to infer the implied rate of increase in rUK per capita NSND receipts. The results of these calculations are shown in the following table.



So, implicit in the figures is a rate of increase in per capita NSND receipts in Scotland after 2018/19 which is well above the corresponding rate in rUK: and this is true throughout the period, not just in 2018/19 when the Scottish income tax changes could be expected to have a significant effect on the figures.

What is puzzling is how this contrasts with what is projected by SFC and OBR for per capita GDP growth, and also nominal average earnings. Table 2 shows the SFC and OBR projections for per capita GDP growth.



As can be seen, the SFC is projecting consistently lower growth in GDP per capita in Scotland than the OBR was projecting for the UK as a whole, although the gap was projected to diminish through time. And there is a similar picture for nominal average earnings, as shown in Table 3.



Note that it is not being suggested here that either the SFC’s NSND projections, or the OBR’s projections, are necessarily wrong. Both the SFC and the OBR have highly skilled modellers: and it may well be, once the relevant figures are decomposed, that there is a plausible explanation for the puzzling figures above. But the important thing is that this decomposition needs to be done, and the basis for the above apparent anomaly thoroughly understood, before one could put much trust in the favourable T3.8 effect on the Scottish Budget.

In fact, in its report on the 2018/19 draft budget, the Finance Committee, (on the basis of the earlier projections then current), picked up precisely this point. They noted that, despite the SFC’s forecast of slightly slower GDP per capita growth for Scotland than the OBR forecast for the UK as a whole, the SFC was forecasting a higher rate of growth in income tax liabilities per capita for Scotland than the OBR was forecasting for the UK. In its reply, (letter of 19 February 2018 to the Finance Committee), the SFC noted that this was due to modelling differences between the Commission and the OBR, differences in economic factors, and, most importantly, different policy choices in the UK and Scotland.

The SFC then went on to quantify the effect of the Scottish income tax changes of 2018/19, and the effect of higher Scottish public sector pay growth, as explaining 2.5% of the growth in per capita NSND revenues in 2018/19.

However, overall, the SFC’s explanation is inadequate: the policy changes would largely affect the early years in the period: but the forecast differential between Scottish and rUK growth rates in per capita NSND receipts is actually pronounced throughout the projection period, as Table 1 above shows. And merely stating that there are modelling differences, and differences in economic factors, does not contribute any meaningful understanding, or confidence, in what is going on. In fact, quite the reverse: the more there are differences between the OBR and the SFC in modelling approach, and economic assumptions, the lower the correlation is likely to be between the OBR and SFC forecasts – and hence, (in line with formula 1), the greater the likely variance of the resulting estimate of the fiscal settlement effect.

The situation is unsatisfactory. Given that the differential in Table 3.8 is liable to feed directly into the forecast of the Scottish Government’s future finances, the following things, (in an ideal world), would need to be done:-

(i) rather than simply publishing the NSND and BGA estimates, as in Table 3.8 of the SFC report, the SFC, (or somebody), should attempt a detailed reconciliation: in particular, this would identify in detail how any features like the puzzling differential movement in NSND per head, as compared with GDP per head, are actually projected to arise.

(ii) The more the OBR and the SFC are using different modelling techniques, or using different population projections, or are making different assumptions on economic trends, then the lower the correlation between their respective forecasts, and the greater the likely variance of the forecast fiscal settlement effect. Without seeking to compromise the independence of either body, there should be some form of liaison between OBR and SFC so that, as far as possible, they are adopting common ground on techniques and assumptions. This would have the effect of increasing the correlation between the OBR and SFC forecasts and hence reducing the overall variance of the projected fiscal settlement effect. And even if, (as is likely), it was not possible to achieve totally common ground, the exercise would have the benefit of identifying where, and why, areas of difference remained: and hence would make the reconciliation exercise at (i) much simpler.

Longer Term Implications.

The recommendations at the end of the preceding section are important: but they still amount to little more than making the best of a bad job. It is an inherent flaw in the design of the present fiscal settlement that the projected finances of the Scottish Government depend on the difference between two large, and inherently difficult to forecast, quantities. This will inevitably add a significant level of uncertainty to the future finances of the Scottish Government. As with other aspects of the fiscal settlement, (for example, the potential for negative feedback effects), it would appear that inadequate attention was paid to this particular aspect when the fiscal settlement was being cobbled together. When the fiscal settlement comes to be reviewed, consideration should be paid to modifications which would avoid the kind of problems discussed in this note.

One possibility, (and there will be others), was the suggestion made by the present author, in evidence to the House of Lords Economic Affairs Committee on 9 September 2015. Rather than the type of modified Holtham indexation actually adopted, this would involve the block grant adjustment being increased by a fixed percentage each year, (subject to periodic review). This would immediately considerably reduce the kinds of problem identified here. This proposal is not advanced here as a panacea – it has its own downsides. But the important point is that it illustrates that there are alternatives available. And when the current fiscal settlement comes to be reviewed, the net should be cast wide over a range of possible options: and there should be a proper consideration of the likely implications, and downsides, of how each possible solution would behave in practice.

Note

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