Scottish Fiscal Commission

Current Approach to Forecasting
September 2017

Contents

1. Introduction

What is this report?

1.1. This report sets out the Scottish Fiscal Commission's intended approach to forecasting the economy, taxes and social security payments. This allows us to inform interested users of our forecasts about our planned approach and the development work that is taking place in the Commission.

Approach to forecasting

1.2. The Commission is currently going through a process of developing forecasting models and processes to assist us fulfilling our statutory remit. This report sets out - at a reasonably high level - the Commission's current intended approach to forecasting and some potential developments. These approaches and any developments will feed into the Commission's forecasts published alongside the Scottish Government Draft Budget later in the year. The forecasts produced for the Draft Budget 2018-19 and future Draft Budgets may differ in some details to what is set out in this note.

1.3. The starting point for many of the Commission's current models were those inherited from the Scottish Government analytical teams who produced the forecasts for Draft Budget 2017-18. These models and forecasts were scrutinised by the Commissioners over the last three Budget rounds. The Commission has spent this year updating, developing and refining these models and developing new forecasting models where appropriate.

Limitations of forecasting

1.4. The future is uncertain. Forecasting is an inexact science and at any point in time there are a range of potentially valid and reasonable forecasts that could be made. A forecast cannot generally be judged to be right or wrong at the time of making.

1.5. The past is an imperfect guide to the future in a rapidly changing global economic, social, political and technological environment. Analytical models, based on historic data and theory, can help provide some insight into how the economy and public sector finances may change over time, but all models have limitations. Forecasts cannot be expected to perfectly predict the future.

1.6. The Commission will always have to rely on some subjective judgement in creating its forecasts where there exists uncertainty or limited evidence. For example, the Commission may form judgements on:

- The long term outlook for productivity in Scotland, reflecting the global economic situation
- Behavioural responses to any changes in fiscal policies in Scotland and the UK
- The likely trends in migration, population and trade as the United Kingdom's relationship with the European Union changes

1.7.   There are a range of possible approaches on factoring each of these issues into the forecast. Judgements will be made on the basis of the best evidence and intelligence available at the time of publication, but may change from one forecast to the next as the economy evolves and our understanding develops along with it.

1.8.   The Commission will aim to present informed and transparent forecasts which provide the best, unbiased judgement against a broad range of possible outcomes. In doing so, the Commission recognises that forecasts will be subject to forecasting error: the economy may not develop fully as expected, the effect on tax receipts may not be entirely as predicted and input data may be revised. Forecasting is an on-going process of intelligence gathering, learning from previous forecasts, reflection and refinement.

1.9.   In recogntion of the likelihood that outturns will differ from forecasts, the Commission will evaluate its forecasting performance. The Commission will publish an annual assessment of how and why outturn differed from the forecast and how it will implements measures to deliver continuous improvement in its approach to forecasting.

Background to the Commission

1.10.   The Scottish Fiscal Commission is a non-Ministerial Department and is structurally and operationally independent of the Scottish Government. More details about the remit and history of the Commission, including previous publications, can be found on our website: www.fiscalcommission.scot

1.11.   From April 2017 the Scottish Fiscal Commission became responsible for producing independent economic and fiscal forecasts for the Scottish Budget.[1]

1.12.   The Commission is required to produce independent forecasts of:

- Revenue from fully devolved taxes and Non-Domestic Rates
- Non-savings Non-dividend income tax receipts
- Onshore Gross Domestic Product (GDP) in Scotland
- Devolved demand-led social security expenditure

1.13.   The Commission will produce forecasts at least twice a year. We will also produce annual Forecast Evaluation Reports, and will from time to time publish working papers on related subjects.

1.14.   This report has been published alongside our first annual Forecast Evaluation Report.[2]

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[1] Scottish Fiscal Commission Act 2016 (link)

[2] Scottish Fiscal Commission (2017) Forecast Evaluation Report 2016-17 (link)

Comments & contact

1.15. This is one of the Commission's first reports as a statutory body, and we welcome comments from users about the content and format of our publications.

1.16. All charts and tables in this publication have also been made available in spreadsheet form on our website.[3] A full glossary of terms is also available on our website.[4] If you have any feedback, or would like to request further information about any of our analysis, please email info@fiscalcommission.scot

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[3] Scottish Fiscal Commission Current Approach to Forecasting Charts and Tables (link)

[4] Scottish Fiscal Commission Glossary of Terms (link)

2. Economic Forecasts

Overview

2.1. The Commssion produces economic forecasts for two reasons:

- To fulfil its remit of providing quarterly onshore GDP growth forecasts[5] and;
- To provide information on the economic variables that feed into the Commissions fiscal forecasts, such as wages, employment and hours worked that feed into the income tax forecast.

2.2. The forecasts are created on a consistent basis through a large and disaggregated economic forecasting system. This produces forecasts of a number of economic factors to help shape the forecasts of the critical variables mentioned above or sense check the forecast.

2.3. The Commission's economic forecast will focus on GDP disaggregated by the components of expenditure: household consumption; government spending and; trade, and also the labour market. We do not plan to produce separate forecasts of:

- different industries – for example manufacturing or construction
- individual regions of Scotland
- incomes of different types of households – e.g. by type/level of income
- the UK as a whole

2.4. The remit of the Commission requires that we produce GDP growth forecasts for onshore Scotland, that is, excluding economic activity in the UK Continental Shelf - although we do consider the oil & gas extraction industry's impact on the onshore economy, such as through the supply chain.

Modelling approach

Overview of modelling approach

2.5. A range of models are used to forecast the economy. These include theory-based structural econometric models of the economy, empirically based time-series models, and simple trend projection models. Whilst the models used can help provide insight and guidance, judgement plays an important role. Judgment is required in both how the models are operated, and how the results from different models are used and combined. Ultimately, the forecast will be driven by the judgement of the Commissioners, rather than depending mechanically on the output of any one model.

2.6. Short-term forecast models attempt to anticipate any shocks or volatility in the economy, primarily driven by shocks to the demand side of the economy. This volatility is modelled with less theoretical and more empirically driven

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[5] Onshore GDP is used as a shorthand in referring to Scotland's GDP excluding the value of oil, gas and other hydrocarbons produced in the Scottish sector of the UK continental shelf as defined in the Scottish Fiscal Commission Act 2016 (link). This is the same basis as the headline GDP figures published by the Scottish Government (link).

time-series approaches, using recent economic data and surveys of the Scottish and UK economies. This approach, based on ARIMA models (see Box 2.1 below) is appropriate for the first few quarters of the forecast, but has a limited time horizon, after which more structural and theoretical models are needed.

2.7.   The long-run outlook is anchored to theoretical supply constraints of the Scottish economy. We combine trend forecasts of population, the labour market and productivity (the amount that can be produced per hour worked) to generate potential output or the maximum amount of goods and services the economy can sustainably produce. This forecast in particular will be heavily influenced by the judgement of the Commissioners.

2.8.   The final part of the forecast process is to connect the short-run forecasts to the long run supply projections. This is primarily done using a large structural model of the Scottish economy called SGGEM (see box 2.2). Some components of aggregate demand, such as trade and public sector output, are constructed in stand-alone models. Otherwise, the pathway of the labour market, wages, inflation and consumption are modelled using a theoretical framework, aiming to align demand with supply over the forecast horizon. Consideration will also be given at this stage to any additional factors that may affect the pathway of the economy over the forecast horizon. There is further discussion of this in the "Handling uncertainty" section below.

Box 2.1: ARIMA models

An ARIMA (Auto-Regressive Integrated Moving Average) model is a basic type of statistical forecasting model and a building block to many more advanced forecasting models.

Figure 2.1: Illustrative example of ARIMA model forecast
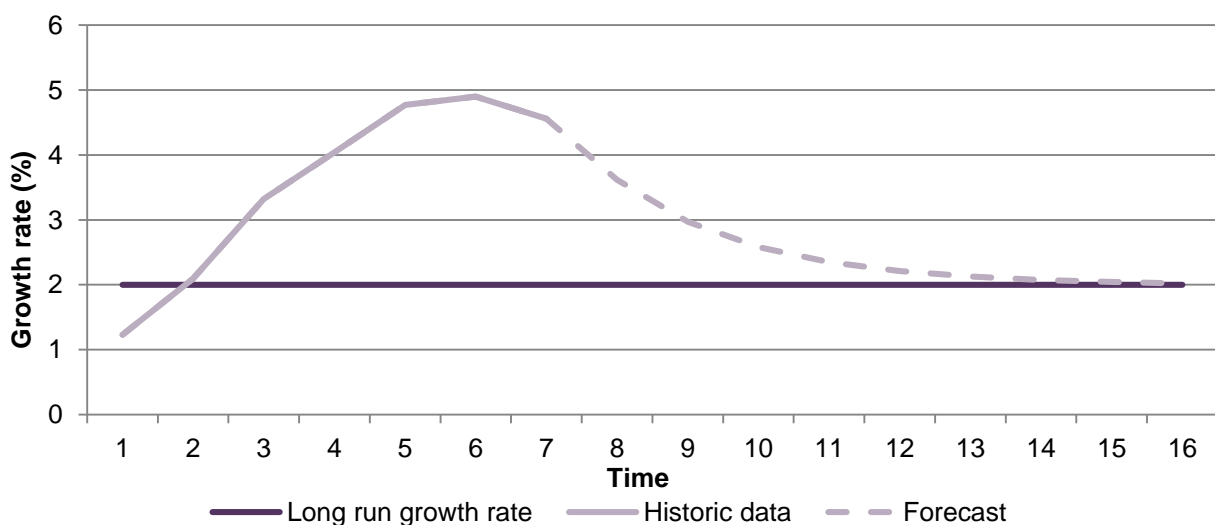
Source: Illustrative Analysis by Scottish Fiscal Commission

The growth rate of economic variables such as GDP will vary over time. However, they often show some persistence in the growth rate varying around a central point or trend. By

looking at historic patterns in the data, an ARIMA model will project how an economic variable will move from its current position to return to its longer term trend as illustrated in Figure 2.1.

In this example, the variable has a long run growth rate of 2%. Recent data has shown the variable growing by around 5%, but the growth rate is already starting to revert to trend. An ARIMA model predicts the pathway the variable will take back towards its long run trend. This simple single variable approach can be built on by including additional variables and forecasts in the model.

ARIMA models make the simplifying assumption that variables will return to their historic growth rates over time. In the Commission, an ARIMA model may be used as a simple starting point, from where judgement, market intelligence or more sophisticated models can be built to consider the future pathway of a variable in more depth.

Step-by-step

2.9.   Figure 2.2 sketches out the main components of our current forecasting process.

Figure 2.2: Schematic representation of economic forecasting process
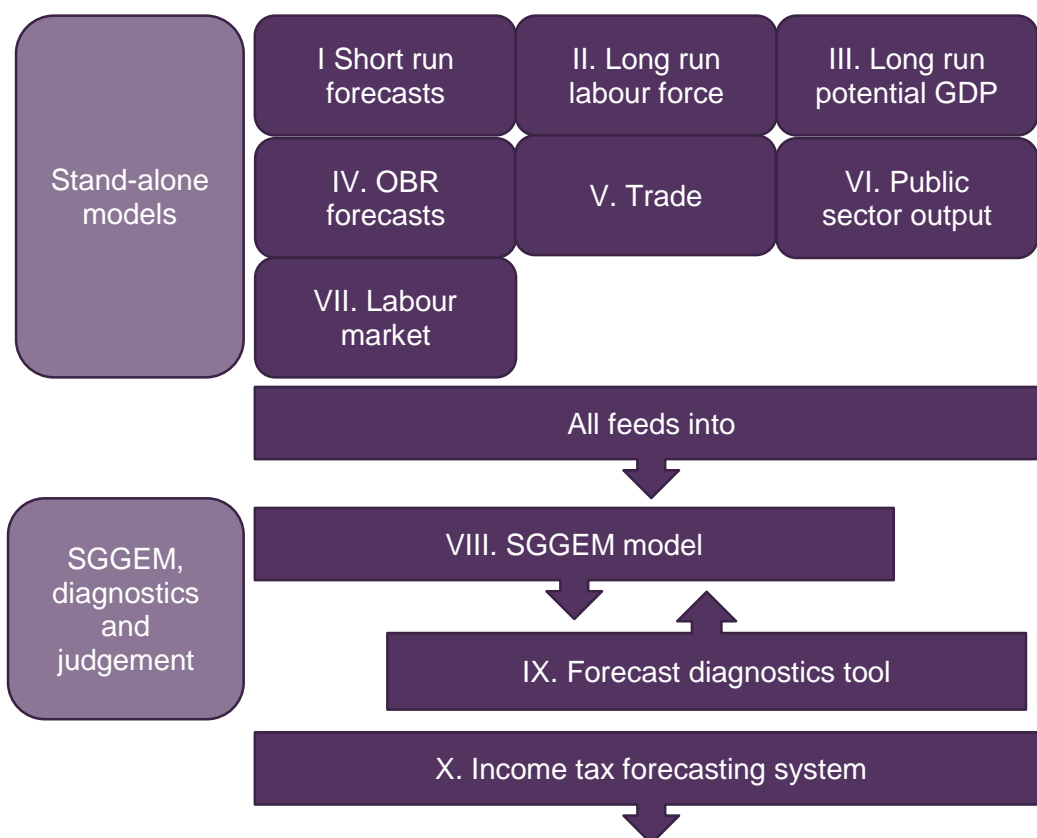
2.10.   The current steps to creating an economic forecast at the SFC are:

I. **Short run forecasts:** Economic statistics by their nature are only available with a lag. We analyse timely surveys of the Scottish economy alongside other alternative sources of data to build up a picture of what is happening in Scotland today and the likely pathway in the near future. Statistical models are used to create short run forecasts for up to 2 quarters ahead. For each key variable, a number of ARIMA models (see Box 2.1) are created, each with a single exogenous predictor variable. These are then averaged together using their relative predictive power, based on historic fit, to create the short run forecast.

II. **Long run labour force:** The size of the potential labour force is forecast over the long run (i.e. those either in employment or actively searching for employment). The starting point for this are ONS population projections with detailed age and gender demographics. Forecasts for labour force participation rates are then applied by age and gender, to create total trend labour force levels. As well as feeding into the rest of the economic forecasts, this projection is used in the income tax forecasting system.

III. **Long run potential output:** Over our forecast horizon of 5 years, forecasts of GDP are anchored to our forecasts of potential output – the maximum capacity the economy can sustain to produce goods and services. This depends primarily on growth in productivity, the amount of goods and services that can be produced for a given amount of labour input. See the "Productivity" section below for more discussion on this key judgement. Combining forecasts of the size of the labour force with forecasts of productivity, with assumptions about trends in unemployment and average hours worked, produces a forecast of potential output.

IV. **OBR forecasts:** The UK economy affects Scotland in two ways. Firstly, through a number of economic variables that Scotland shares with the UK as a whole, such as interest rates and exchange rates. Secondly, the rest of the UK is Scotland's largest trade partner. The starting point for these elements of the forecast is to consider the latest available OBR forecasts for the UK.

V. **Trade model:** Trade is challenging to model. Trade between Scotland and the rest of the UK is modelled based on growth in demand in both economies. Trade between Scotland and the rest of the world is then modelled considering the OBR's UK trade forecasts, with some adjustment for Scottish circumstances.

VI. **Public sector output:** Government spending is a significant component of GDP. Public sector output is forecast by considering the available information on spending plans of both the Scottish and UK Governments in Scotland.

VII. **Labour market adjustments:** Combining the short run forecasts and the long run trend forecasts of the labour force, we create a medium term adjustment pathway for employment and unemployment. A long-run trend rate of unemployment is targeted in the forecast, with additional judgement applied based on available intelligence on the state of the Scottish labour market

VIII.   **SGGEM model:** The SGGEM model sits at the core of the economic forecasting process. It is an extension to NIESRs[6] long-standing NiGEM macroeconometric model.[7] More detail on the SGGEM model is available in Box 2.2. All of the above projections are fed into SGGEM which is then used to create forecasts for remaining variables and time periods.

IX.   **Forecast diagnostics tool:** Forecasts from SGGEM are then analysed in a separate diagnostics tool. This is to check the characteristics of the forecast and allow Commission forecasters and the Commissioners to hone and sense-check key judgements. The steps above can be repeated to tweak the forecast and apply further judgement as necessary. These diagnostic checks include the productivity to wages ratio, the savings ratio and net trade as a share of GDP.

X.   **Income tax forecasting system:** Once the economic forecasts are complete, the forecasts of wages, employment and hours worked are fed into the income tax forecasting system.

Box 2.2: SGGEM

SGGEM is an extension to NIESRs NiGEM macroeconometric global forecasting model. SGGEM is owned by the Scottish Government and was commissioned from NIESR by the Scottish Government.

The NiGEM/SGGEM models contain sub-models of every major global economy. It can be used to model and forecast individual economies or the global economy. From NiGEM, the UK model has been split between Scotland and the rest of UK. The model captures the monetary, fiscal and trade relationships between the two economies.

SGGEM is used to forecast the economy over the medium term, given the short-run and long-run forecasts described above. At any point in time, the Scottish economy will have a degree of disequilibrium, with prices, wages, unemployment and the output gap, amongst other variables, away from their long run trends. The SGGEM model provides a framework which helps the Commission consider how these variables will return to their long run trends as the economy returns towards equilibrium.

The SGGEM model also helps to:
- impose discipline on the forecast, ensuring that all variables and their relationship to each other are considered
- provides an accounting system to ensure the forecast is consistent and adds together as it should
- explore the impact on the forecasts of different assumptions and judgements

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[6] NIESR – The National Institute of Economic and Social Research, a charity and Britain's longest established independent research institute (link)

[7] For further information on the NiGEM model see (link)

SGGEM is a tool that provides a framework in which the SFC can develop its forecasts. A large number of variables in SGGEM are in effect fixed using the processes described in the previous section. SGGEM then creates baseline forecasts of any remaining variables. However, these are then further adjusted based on the SFCs analysis and judgements.

Productivity

2.11. Productivity - the amount of output that can be produced for a given amount of labour input - is arguably the most important part of the whole economic forecast. The pathway of productivity defines the future potential size of the economy as well as feeding into the pathway of wages.

Figure 2.3: Scottish actual productivity (GDP per hour worked) and trend, index 2013 = 100
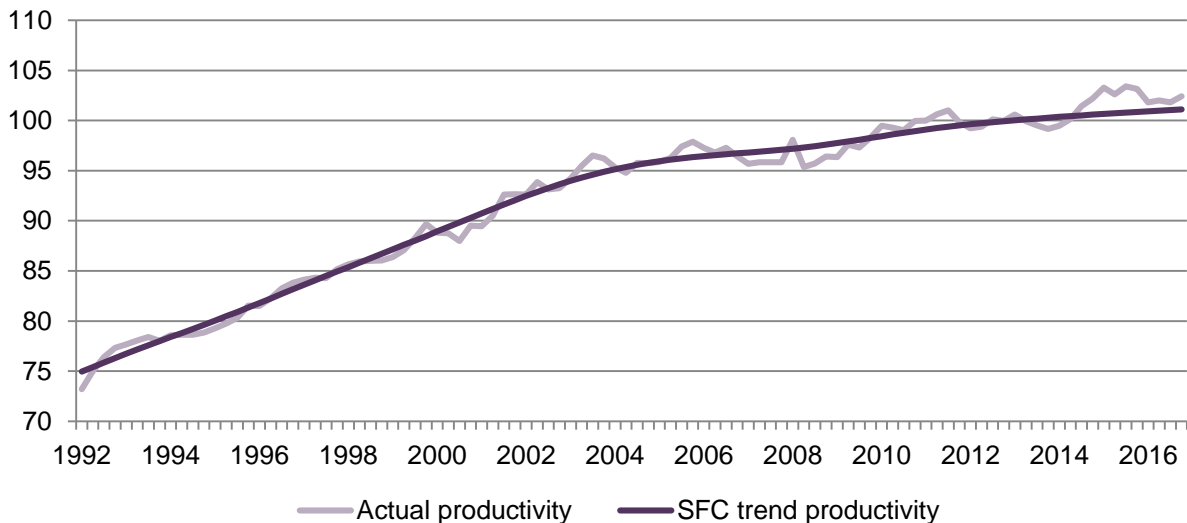
Source: SFC analysis based on SG QNAS (link) and ONS data (link)

2.12. Productivity and the Commission's estimate of historic trend productivity are shown in Figure 2.3. As with many developed economies, productivity growth has been markedly slower in the last decade than in the preceding few decades. The growth rate of productivity appears to have hit a turning point around 2004, after which it has grown at a markedly slower rate. The Commission will be required to make an important judgement about the future pathway for productivity in order to inform the forecast of potential output and therefore GDP.

Handling uncertainty

2.13. The future is unknown and forecasting faces many kinds of uncertainty. In some cases, historic data can be used to anticipate and quantify the range of possible outcomes and the Commission may choose to explore and present some of these risks in a quantified form.

2.14. In other cases, the uncertainty faced is novel and there is limited evidence and historic data that can help to predict possible outcomes. In such cases, more judgement must be used.

2.15. The commission will at times present a range of scenarios around its main forecast to show the sensitivity of the forecast to different key judgements. This may include, for example, showing the impact of varying assumptions on productivity, population, migration or trade.

2.16. The relationship between the United Kingdom and the European Union is changing and this will have an impact on the Scottish economy. The Commission will need to make broad assumptions around what it considers to be the most likely changes and their impact over the next 6 years. For example, judgements will be required about impacts on trade, currency and migration. The Commission may also consider alternative scenarios to help judge the sensitivity of its forecast. The Commission will not make a specific forecast of the effect of these changes compared to a forecast of what might have happened on the basis of the current arrangements.

3. Income Tax

Overview

3.1.   The Scotland Act 2016 transferred to the Scottish Parliament the power to set non-savings and non-dividend[8] (NSND) income tax rates and thresholds, with the exception of the personal allowance. Since April 2017 the Scottish Government receives all the revenue from income tax on the NSND income of Scottish taxpayers.

3.2.   The responsibility for defining the income tax base, including setting or changing income tax reliefs and the personal allowance continues to rest with the UK Government. HMRC remains responsible for the collection and management of Scottish income tax. It is HMRC's responsibility to decide who is and who is not a Scottish taxpayer as provided for in legislation. The Scotland Act 2012 defines a Scottish taxpayer as someone who is a UK taxpayer and has their main place of residence in Scotland.

3.3.   Table 1 below details the latest February 2017 income tax NSND forecast, published by the Scottish Government.

Table 3.1: February 2017 NSND Scotland income tax forecast (£ million)

	2017-18	2018-19	2019-20	2020-21	2021-22
NSND Income Tax Forecast	11,857	12,320	12,943	13,681	14,595

Source: Scottish Government Draft Budget 2017-18: Updated income tax policy forecasts (link)

Draft Budget 2017-18

3.4.   For the December 2016 Draft Budget 2017-18, the Scottish Government proposed to hold the higher rate threshold flat in real terms (£43,430 in cash terms).

3.5.   However, as part of the parliamentary process for agreeing the Draft Budget, the Scottish Government announced that for 2017-18, it will hold the higher rate threshold for NSND income unchanged in cash terms at £43,000 – below the level set by the UK Government of £45,000.

Modelling approach

3.6.   Future income tax revenues will be primarily driven by the number of taxpayers and their incomes. Forecasts of earnings and employment are taken from the core economic forecast. Relatively small changes in these economic determinants may lead to significant changes in the income tax forecast.

3.7.   The income tax system has a progessive structure where tax rates increase with income. Therefore, the data on the distribution of incomes are an essential input

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[8] This is primarily income from employment, pensions and property

into the forecast. These are captured by using the detailed income tax dataset the Survey of Personal Incomes (SPI – see Box 3.1). The economic determinants are applied to the SPI dataset to forecast income tax over the forecast horizon.

3.8.   There are a number of processes involved in creating the income tax forecasts as illustrated in the schematic in Figure 3.1.

Figure 3.1: Schematic representation of income tax forecasts

I. Core economic determinants forecast

II. Income by type forecast	III. Number of taxpayers forecast

IV. SPI income tax forecasting model

V. Direct impact of policy change

VI. Behaviour impact and other adjustments
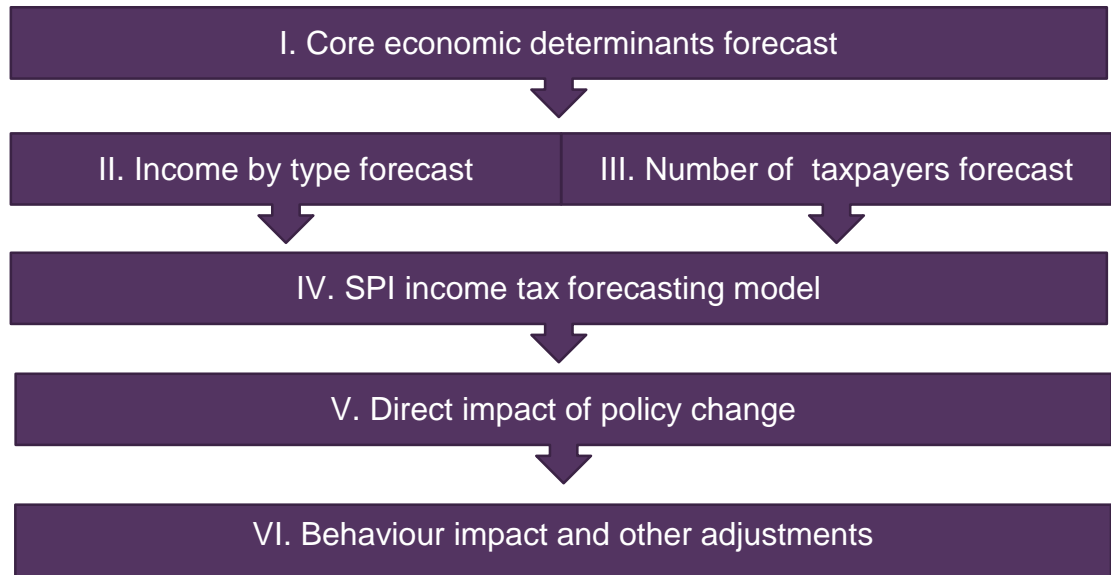
I.   **Core forecast determinants**, population, employment and earnings. The starting point is to take the forecast of core economic determinants to provide a forecast of total earnings growth, employment and population. The income tax forecast is particularly sensitive to changes in these determinants.

II.   **Income by type forecast**. The growth rates of different types of income are then forecast separately. These rates are primarily based on the economic forecast determinants with some additional analysis. The income types are:

- State pension income
- Occupation, personal or other pension income
- Income from employment - private sector
- Income from employment - public sector
- All other income

III.   **Number of taxpayers forecast**. The number of taxpayers is forecast taking account of changing demographics and labour market trends. The starting points for this are the ONS population projections, unemployment and participation rates from the Annual Population Survey (APS) and projections from the core economic forecast. This results in a forecast of employment levels by age which is used as a proxy to forecast the number of taxpayers by age.

IV. **SPI Data – Survey of Personal Incomes model**. The forecasts of incomes and numbers of taxpayers are applied to the income tax SPI dataset (see Box 3.1) to forecast the distribution of taxpayers and their incomes. Future tax policies can then be applied to these forecast incomes to create a baseline forecast of Scottish NSND Income Tax liabilities. In addition to the overall liability figures, the model provides additional information on the number of taxpayers by tax band and age.

V. **Impact of a policy change**. By varying the assumed future policies, the direct impact on revenues of a change in policy can also be projected

VI. **Behavioural impact and other adjustments**. Taxpayers may adjust their behaviour as a result of changes in tax policy. However, these behavioural responses *tend* to be restricted to a small number of high income taxpayers. Whilst behaviour change is an important aspect to capture, the scale of the impact of behaviour change is likely to be limited in the context of total income tax revenues. Additional modelling based on the available academic literature on taxpayer behaviour is done to capture this potential behaviour change.

3.9. It may be necessary to make additional ad hoc adjustments to the forecast. For the Draft Budget 2017-18 a number of off-model adjustments of this kind were made. For example, an adjustment was made to account for an increase in the number of people expected to incorporate, and therefore pay tax on dividends or profits rather than employment income. A further adjustment was also made to deduct the basic rate element of Gift Aid that charities claim from HMRC.

Box 3.1: The Survey of Personal Incomes

HMRC creates the Survey of Personal Incomes (SPI), which is a single consistent source of income tax data. This is HMRC's primary resource for UK income tax analysis and is also relied on by the OBR for income tax forecasts and policy costings.

The SPI is a 1% to 2% sample of all HMRC income tax taxpayer records, containing over 40,000 individual taxpayer records for Scotland alone. It provides details, at the individual taxpayer level, of incomes by source and allowances, deductions and reliefs. These individual taxpayer records can be grossed up to get whole of Scotland values.

The Commission uses a publicly available version of the SPI called the Public Use Tape (PUT), which makes the SPI anonymous and groups some records to stop any private information being disclosed.

4. Land and Buildings Transaction Tax

Overview

4.1. The Scotland Act 2012 devolved Stamp Duty Land Tax to the Scottish Parliament from April 2015. Following this, Land and Buildings Transaction Tax (LBTT) replaced Stamp Duty Land Tax in Scotland.

4.2. LBTT is paid on the purchase of property and land. The two components of LBTT are residential and non-residential (commercial) property. Residential LBTT also includes the Additional Dwelling Supplement (ADS) which is payable on additional residential properties such as second homes or buy-to-let properties.

Modelling approach

Core residential component (LBTT excluding ADS)

4.3. Forecasts of house prices and transactions are the key drivers of future LBTT revenues.

4.4. The core residential LBTT is a progressive tax so the charge is proportionate to the actual price of the property. The percentage rate for each band in LBTT is applied only to the part of the price over the relevant threshold and up to the next threshold.[9] The rates currently applied are shown in Table 4.1.

Table 4.1: LBTT rates and bands

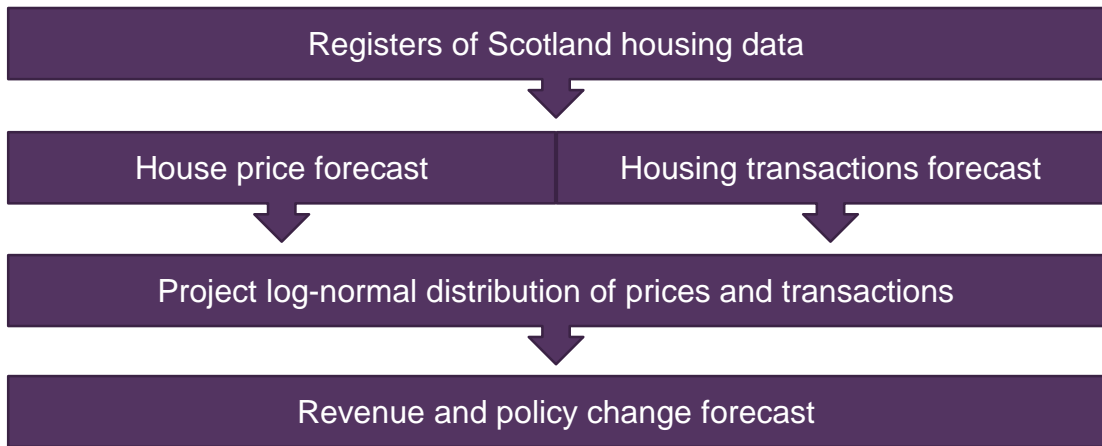| Purchase price	LBTT rate
Up to £145,000	0%
Above £145,000 to £250,000	2%
Above £250,000 to £325,000	5%
Above £325,000 to £750,000	10%
Over £750,000	12%

Source: Revenue Scotland (link)

4.5. The core residential LBTT model uses publicly available quarterly data from Registers of Scotland [10] to create a simplified and representative distribution of house prices and transactions in Scotland. This distribution is then projected forwards to produce a 5 years forecast of the price, distribution and number of transactions in Scotland. Figure 4.1 represents the structure of the model.

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[9] Revenue Scotland information on LBTT (link)

[10] Registers of Scotland quarterly house price statistics (link)

Figure 4.1: Schematic representation of LBTT forecasting process

Registers of Scotland housing data

House price forecast | Housing transactions forecast

Project log-normal distribution of prices and transactions

Revenue and policy change forecast

4.6.   First, data on house prices and transactions in Scotland are collected from Registers of Scotland data. Statistical ARIMA models (see Box 2.1) are then used to forecast the growth of mean and median house prices and the volume of transactions over the forecast horizon.

4.7.   House price-transactions data are modelled as a statistical distribution as shown in Figure 4.2 below. The distribution of residential house prices is modelled using the log-normal distribution, which is defined by two parameters, mean and median house prices.

4.8.   Figure 4.2 presents the observed price-transactions distribution and the fitted log-normal distribution.

Figure 4.2: Fitted distribution compared to observed distribution 2016-17
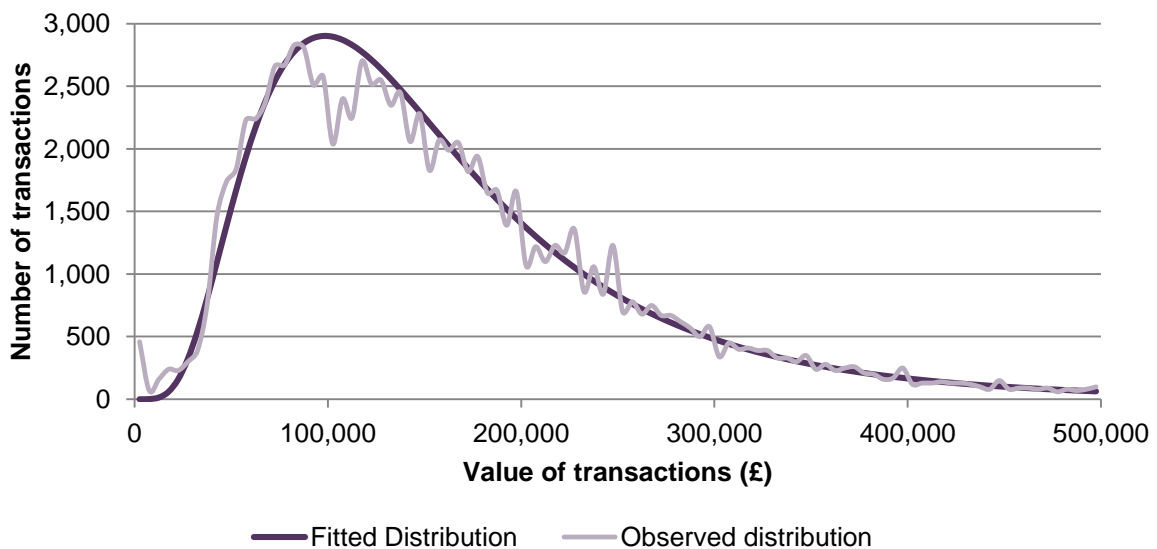
Source: Revenue Scotland residential transactions and SFC analysis

4.9.   The future shape of the log-normal distribution is predicted by applying the forecasts of mean and median house prices and housing transactions. The

predicted log-normal distribution can then be used to estimate the number and value of transactions in a specific band over the forecast horizon.

4.10. The forecast number and value of transactions can then be used to forecast revenues arising from LBTT.

4.11. Some further ad-hoc adjustments are then made to these values to take account of specific issues such as forestalling in the event of a policy change.

Additional Dwelling Supplement (ADS)

4.12. The ADS is charged at 3 per cent on the value of additional residential properties, such as buy-to-let properties or second homes, priced at £40,000 and above.

4.13. ADS paid may be reclaimed when the tax payer sells their previous main residence within 18 months of the date of transaction that was liable to the ADS supplement.

4.14. The model uses a combination of Revenue Scotland data and the mean price and transactions forecast from the core residential model.

4.15. The ADS forecast model first calculates gross revenues by projecting the ADS tax base. The ADS tax base is created by combining projections of ADS transactions and prices. Total transactions are projected by taking a share of total residential transactions based on historic observations. The projection of prices for ADS are assumed to be the same as for the residential prices.

4.16. Secondly, the gross revenue is then adjusted for the estimated reclaim rate. The reclaim rate is an extrapolation of the historic reclaim rate. At this point, an extrapolation of the current reclaim rate is needed as ADS has been in existence for less than 18 months.

Non-residential

4.17. Non-residential revenues are significantly influenced by a small number of transactions generating most of the revenue. This makes non-residential revenues volatile and difficult to forecast.

4.18. The non-residential LBTT model uses estimates of growth in prices and transactions published by the OBR. The OBR price and transactions growth rates are assumed suitable for Scotland because the trends in non-residential revenue transactions, average prices and revenues have historically been similar in Scotland and the UK.

4.19. The non-residential revenue forecast is calculated by applying the price and transaction growth rates to an average of the previous three years of revenues uplifted by inflation.

4.20. We will be reviewing the overall methodology used to forecast non-residential LBTT as we prepare to produce our first forecasts for the Draft Budget 2018-19. In particular, we will be investigating further the possibility of combining data from

HMRC and Revenue Scotland to create Scotland-specific average price and transactions data series for non-residential properties.

5. Non-Domestic Rates

Overview

5.1.   Non-Domestic Rates (NDR) is an annual tax paid by the owner, tenant or occupier of non-domestic properties.

5.2.   The amount of tax paid is dependent on the rateable value of the property, the tax rate (also known as poundage and currently set at 46.6 pence)[11] and any reliefs, exemptions or supplements applied to the property, as illustrated in Figure 5.1.

Figure 5.1: NDR bill calculations
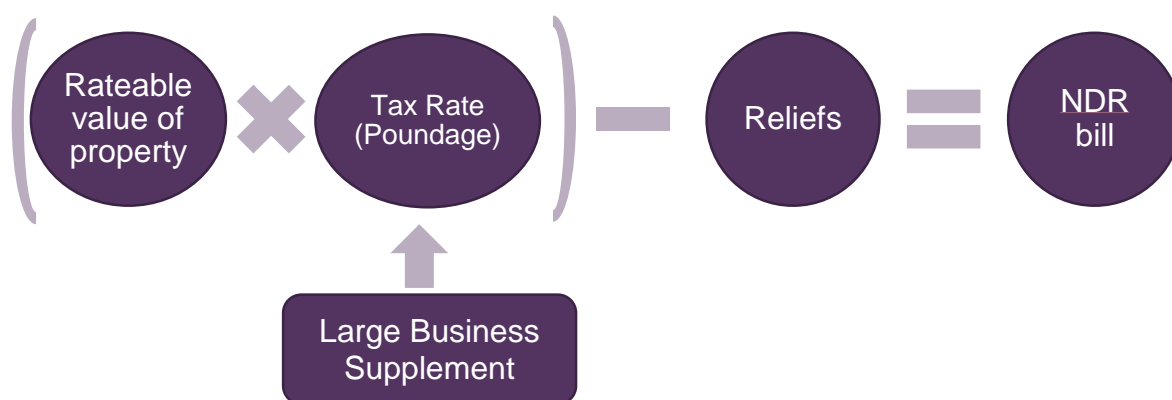
5.3.   Every non-domestic property in Scotland (with some exemptions) is assigned a rateable value (RV) by independent Scottish Assessors. While the method used to determine RV depends on the type of property being valued, they can be thought of as being broadly based on analysis of annual rental values. RV is typically revalued on a regular basis- usually every five years – with all properties assessed with reference to a single point in time, known as the 'tone date'.[12]

5.4.   Businesses have the right to appeal the RV of their property, and can do so in an attempt to have their NDR liability reduced. The main types of appeal in Scotland are revaluation appeals, which can only be lodged within 6 months of a revaluation taking place, and running roll appeals which can be lodged at any time.[13]

5.5.   While NDR is collected by local authorities, the Scottish Government retains control over the administration of the tax. This includes control over such decisions as the poundage, the system of mandatory and discretionary reliefs available to businesses, and the date at which a revaluation of properties will take effect.

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[11] Business Rates Guidance (link)

[12] A revaluation was initially planned for April 2015, but was delayed until 2017 thus mirroring the UK government's decision to delay the revaluation in England until April 2017.

[13] Running roll appeals are lodged on the grounds of error, new interest, or a material change in circumstances (MCC). Appeals on the grounds of error must be lodged whilst the roll is in force. Appeals for MCC must be lodged no later than six months after the roll ceases to be in force.

5.6. Revenue collected from NDR is effectively pooled at the national level, before being redistributed back to local authorities by the Scottish Government.

5.7. The amount that local authorities collect, minus any amounts that they are allowed to retain through certain policies, is known as the 'contributable amount'.[14] This is the figure that the Commission will forecast.

5.8. The amount distributed back to local authorities by the Scottish Government is known as the 'distributable amount'. The size of this figure will, in part, depend on expectations of the amount of NDR revenue to be raised but is ultimately a policy decision taken by the Government. Because of this, the Commission will not produce any forecast of the distributable amount.

5.9. In any given year, the amount distributed by the Government is unlikely to match the amount of NDR raised by local authorities. The NDR pool is based on the differences between collected and distributed amounts over multiple years and is used by the Scottish Government to manage the surplus or deficit accrued as a result of the difference between these two figures. The latest available audited figures for the NDR pool indicate a £289 million deficit.[15]

Modelling approach

5.10. From 1st April 2017 the Scottish Fiscal Commission will be responsible for producing five-year forecasts of NDR. Previously the Commission was only responsible for scrutinising the economic determinants underpinning the Scottish Government's NDR forecasts, defined as buoyancy and inflation.

5.11. The current model used to forecast the contributable amount of NDR makes use of available data from the Scottish Assessors and Local Authority NDRI returns. The model can be split into four key stages, which are outlined below.

Stage 1: Estimating the size of the tax base

5.12. The total rateable value of properties in Scotland is the Non-Domestic Rates tax base. Changes to this base tend to be relatively small from year-to-year. The model uses data from the Scottish Assessors Association (SAA) on total rateable value in Scotland.

5.13. Before forecasting changes to the tax base, an assumption is made regarding the amount of RV expected to be lost over the course of the forecast as a result of successful revaluation appeals. The amount and profile of revaluation appeals loss is based on historic data, but may be adjusted to reflect specific intelligence regarding any potential large appeals loss risks.

5.14. After adjusting the SAA data to account for the effect of revaluation appeals on the tax base, a forecast of 'buoyancy' can be made. Buoyancy is the growth in the tax base after accounting for the effect of revaluation appeals. This captures a number

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[14] Current policies that allow local authorities to retain a part of their NDR income include the Business Rates Incentivisation Scheme and Tax Incremental Financing.

[15] Scottish Government White Paper Account 2015-16 (link)

of factors such as the construction and demolition of properties but also administrative effectson the SAA data, such as the resolution of running roll appeals which can occur at any point of the revaluation cycle and for which specific data is not available.

5.15. The current approach to modelling buoyancy resulted from scrutiny and challenge sessions between the Commission and the Scottish Government and is based on applying an adjustment to the long-run average to reflect the observation that buoyancy has typically been higher in the earlier years of a revaluation cycle and lower in later years.[16]

Stage 2: Estimating the (gross) bill faced by the tax base

5.16. After producing a forecast of RV based on how expected revaluation appeals losses and buoyancy will affect the tax base, the total tax liability before reliefs and other deductions is estimated.

5.17. There are two rates applied to the tax base which must both be forecast:

- Poundage: The headline tax rate (poundage) is applied to the entire tax base. This has typically been uprated each year by inflation using September RPI, with OBR forecasts of future inflation used to uprate the poundage in subsequent years.

- Large Business Supplement (LBS): properties above a certain RV threshold are liable to pay LBS, which is an additional tax rate paid over and above poundage. Currently, it is assumed the proportion of RV liable to pay LBS remains constant and in the absence of specific policy announcements the rate is assumed to remain fixed.

Stage 3: Estimating the income foregone by relief schemes

5.18. The Gross NDR bill due on a property may be reduced by relief entitlement. The model uses data on current relief expenditure as the basis for future forecasts.

5.19. Relatively simple methods are currently used to project the amount of expenditure from existing reliefs, such as moving averages of previous values, or by uprating relief spending in line with gross income where appropriate.

5.20. When there is a known change to a relief which has not yet happened, or a new relief is to be introduced, a separate forecast is produced. Often this will involve using a data source known as the 'billing system', which contains information on all properties in Scotland claiming relief and can be linked to the valuation roll. This allows for modelling to be carried out to, for example, determine the number of properties that will be affected by a change to an existing relief, which can then be incorporated into the forecast of relief expenditure.

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[16] This is because running roll appeals are typically only resolved once revaluation appeals are settled, meaning successful running roll appeals will influence the buoyancy data later in a revaluation cycle.

Stage 4: Estimating any other adjustments

5.21. Finally, there are a number of other factors which need to be accounted for before an estimate of income can be derived. The largest factor is backdating of appeals losses to reflect refunds of associated overpayments in prior years. Other examples include write-offs where it has been identified that rates cannot be recovered from a particular property or accounting for bad debts.

5.22. The final set of adjustments made relate to schemes that allow local authorities to retain a part of their NDR income, which currently includes the Business Rates Incentivisation Scheme and Tax Incremental Financing projects.

5.23. The Commission is currently reviewing all parts of the NDR model to consider whether it could be improved upon in any way. The main focus will be on incorporating the effect of revaluation cycles into the forecast methodology. This will be necessary as the Commission is required to produce five-year forecasts of NDR, so we will need to account for the effect revaluation cycles have on tax revenues.

6. Air Departure Tax

Overview

6.1.   From April 2018, Air Departure Tax (ADT) will replace UK Air Passenger Duty (APD) in Scotland. In June 2017 the Scottish Parliament passed the primary legislation enabling ADT. ADT will broadly mirror the structure of APD.[17]

6.2.   APD is a tax paid on passengers departing from UK airports. The amount of tax paid depends on the passenger's class of travel and their final destination. Under APD, destinations fall into two bands based on flight distance from London. The higher band applies to countries further than 2,000 miles from London. As APD applies to the final destination, connecting flights are exempt. ADT will include this exemption.

6.3.   There are a number of other exemptions to ADT included in the Bill, such as passengers under the age of 16 travelling in the lowest class.

6.4.   The rate of APD paid is determined by the class of travel. The reduced rate applies where passengers are travelling in the lowest class available. The standard rate applies to passengers travelling in any other class of travel and the higher rate applies to private jets.

6.5.   The Scottish Government will present the proposed tax rates and bands for ADT with the secondary legislation. This is due in the autumn.

Modelling approach

Historic data

6.6.   APD tax forms are returned on a company-by-company basis. There are therefore no historic data on APD receipts or passengers paying APD in Scotland. We have undertaken extensive work to estimate a historic time series using a range of data sources.

6.7.   The Civil Aviation Authority (CAA) airport data provide information on total passenger numbers for all Scottish airports.[18]

6.8.   Figure 6.1 displays the time series of total passenger numbers departing Scottish airports showwing that that aside from the financial crisis 2008 - 2010, the number of passengers departing from Scottish airports has increased over the past 14 years.

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[17] Air Departure Tax (Scotland) Act 2017 (link)

[18] Civil Aviation Authority UK Airport Data (link)

**Figure 6.1:** Passengers departing Scottish airports by year, millions
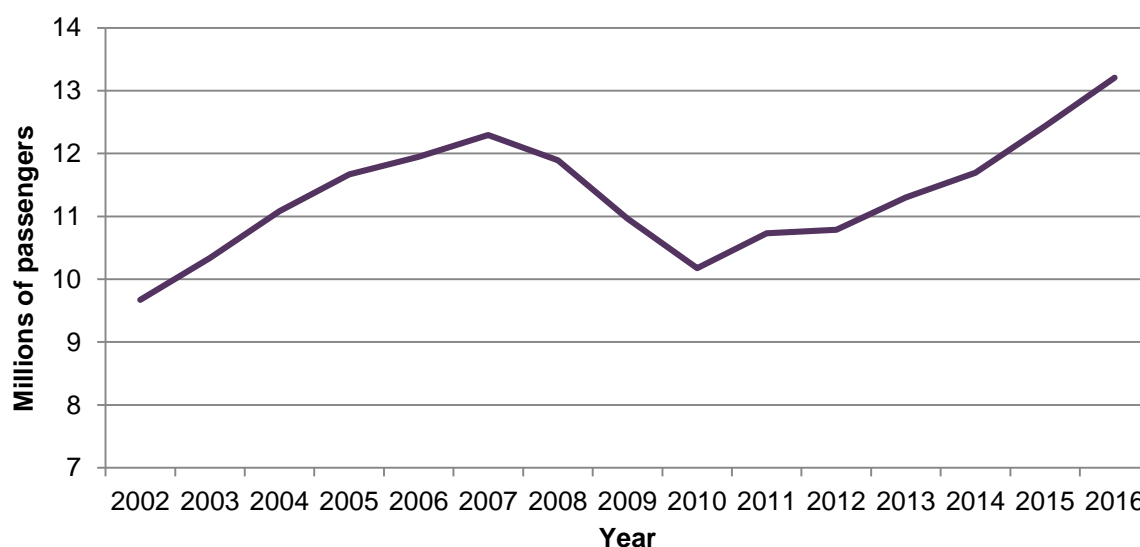
6.9. The CAA airport data provides passenger numbers for each Scottish airport. However, we need another data source in order to exclude exempt passengers and to calculate the tax paid by the remaining passengers. For this information, we use the CAA departing passenger survey. The survey runs every year interviewing passengers departing certain UK airports. The survey covered Scottish airports in 2005, 2009, 2013 and 2015-16.[19] The next survey of Scottish airports is due in 2018.

6.10. Our approach to calculating our time series follows the approach adopted by Government Expenditure and Revenue Scotland (GERS) to estimate the Scottish share of APD.[20] The estimate from GERS is shown in Figure 6.2.

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[19] Civil Aviation Authority Departing Passenger Survey results (link)

[20] Scottish Government (2017) Government Expenditure & Revenue Scotland 2016-17 (link)

Figure 6.2: Estimated historic Scottish APD receipts (£ million)
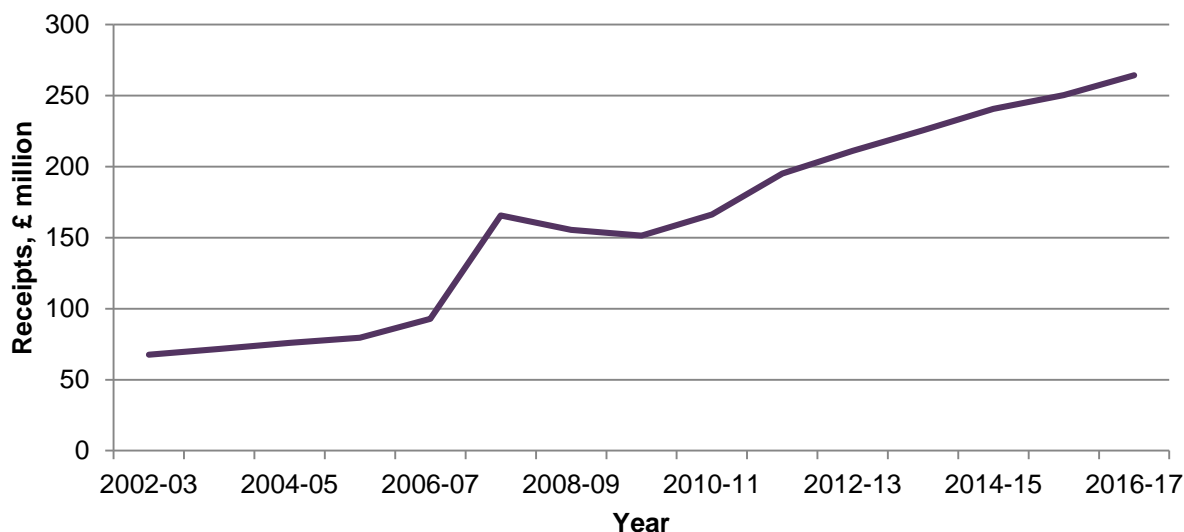
Source: Scottish Government (August 2017) Government Expenditure and Revenue Scotland (GERS) 2016-17 (link)

Forecasting

6.11. We are in the process of developing a model to forecast ADT receipts. The model currently uses the historic time series of Scottish passengers to forecast future passenger numbers. The CAA survey data allocates these passengers into the different bands and classes. The appropriate tax rate will then be applied to these passengers to estimate total ADT receipts.

6.12. We have engaged with the OBR on their forecasting approach for the UK APD regime. Their forecats uses the correlation between GDP and the number of passengers in each tax band to forecast receipts. A separate adjustment is made to account for the rise in low cost operators. We will review their methodology alongside other approaches and considering the available data to assess the most appropriate methodology to forecast ADT receipts.

Policy considerations

6.13. The Scottish Government has committed to a 50% reduction in the overall tax burden of ADT by the end of the current session of the Scottish Parliament and to abolish the tax when resources allow. The Scottish Fiscal Commission's remit requires us to produce forecasts accounting for the Scottish Government's policy. We may not consider the effect of any alternative policy. We are building our forecasting approach with the capability to estimate the fiscal impact of any changes in the rates and bands of ADT compared with the UK APD regime.

6.14. The forecasting approach will be flexible in the event of any changes to the structure of the tax.

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7. Scottish Landfill Tax

Overview

7.1.   Scottish Landfill Tax (SLfT) is a tax on the disposal of waste to landfill. The power to set a tax on landfill deposits was devolved to the Scottish Government as a result of the Scotland Act (2012). From 1st April 2015 Revenue Scotland become responsible for collecting revenue for the newly created SLfT, which replaced the previous UK-wide tax.

7.2.   The amount of tax payable is determined by the weight of waste being disposed of on the basis of two rates. The current standard rate of SLfT is £86.10 per tonne and the lower rate is £2.70 per tonne for certain inert materials such as naturally occurring soil and rocks. Since devolution the Scottish Government has chosen to match the stated policy of the UK government, which since the 2014 Budget has been to uprate the tax rates annually in line with RPI.

Modelling approach

7.3.   The approach makes use of outturn data from Revenue Scotland on the amount of standard and lower rate waste being landfilled, which is then projected forward to give a baseline level of landfill waste over the forecast horizon.

7.4.   Adjustments are then made to this baseline to take into account anticipated increases in the capacity of alternative waste treatment facilities across Scotland. These facilities are an alternative to landfilling waste, and once on-line can be expected to reduce the level of waste being landfilled.[21] The Commission is reviewing the projections of alternative treatment capacity previously used and will be working with specialists, including the Scottish Environmental Protection Agency (SEPA), to ensure these projections are up-to-date and reflect the likely timescales for these facilities coming on-line.

7.5.   After accounting for changes to alternative waste treatment capacity across Scotland in the baseline, a forecast of revenue is made by applying the relevant tax rate to the forecast amount of waste. The rates of tax for landfill have previously been assumed to increase with RPI, in line with the current stated UK government policy. The maximum 5.6% contribution allowed to the Scottish Communities Landfill Fund is then netted off to give a final forecast of revenue.

7.6.   A summary of the Scottish Government's central forecast for the Draft Budget 2017-18 alongside a forecast produced by the OBR around the same time are shown in Figure 7.1.

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[21] We can be confident these facilities will divert waste from landfill for several reasons, including: long-term contracts local authorities have entered into with operators of these sites; the relative cost of gate fees at Energy from Waste facilities compared to landfill; the ban on biodegradable municipal waste to landfill from 2021; and experience from the two local authorities in Scotland currently with access to an Energy from Waste facility.

Figure 7.1: SG and OBR SLfT forecast – November/December 2016 (£ million)
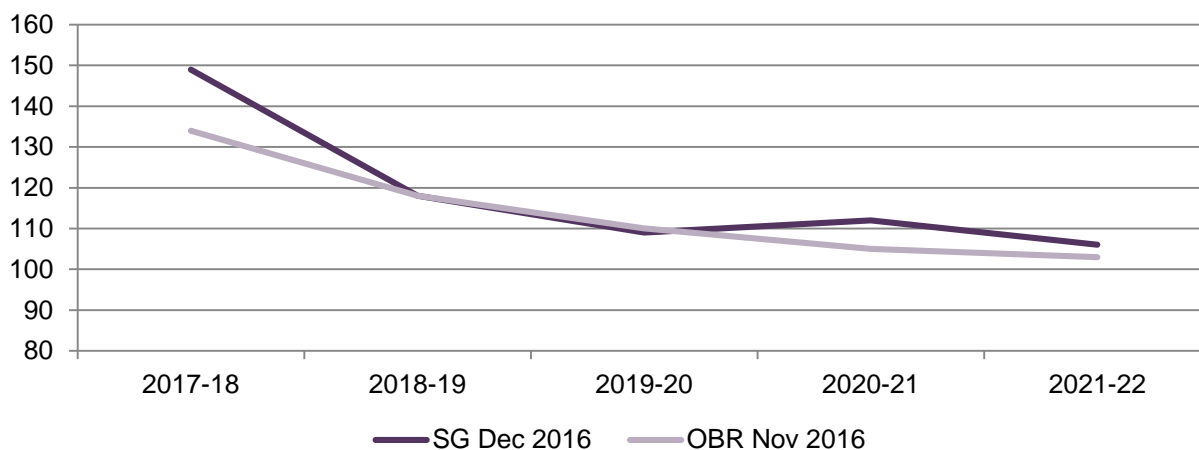
Source: Scottish Government (2016) Draft Budget 2017-18 Devolved Taxes Methodology Report (link) and OBR (November 2016) Devolved taxes forecast (link)

Table 7.1: SG and OBR devolved taxes forecast- November/December 2016 (£ million)

	2017-18	2018-19	2019-20	2020-21	2021-22
SG Dec 2016	149	118	109	112	106
OBR Nov 2016	134	118	110	105	103

Source: Scottish Government (2016) Draft Budget 2017-18 Devolved Taxes Methodology Report (link)

7.7. The SFC will look to build upon the methodology currently used for forecasting SLfT with a view as to whether it could be improved upon in any way. In particular, we will focus our attention on the areas highlighted in the SFC's Draft Budget 2017-18 report as areas for development. These include:

- Reviewing the baseline assumption to identify the most appropriate method to adopt.
- Monitoring and updating information on planned increases to alternative waste treatment capacity to ensure the projections and assumptions used are up-to-date and as accurate as possible.
- Assessing the impact the export market for waste may have on the forecast.
- Developing the evidence base around the effect of relevant policies on landfill, in particular the ban on biodegradable municipal waste going to landfill by 2021.

8. Devolved Demand-Led Social Security Expenditure

Overview

8.1.   The Scottish Fiscal Commission is responsible for producing forecasts of devolved demand-led social security expenditure to inform the Scottish Government's budget. The Scotland Act 2016 devolved a number of demand-led social security benefits to Scotland. These benefits are:

- Disability Living Allowance
- Personal Independence Payment
- Attendance Allowance
- Carer's Allowance
- Industrial Injuries Disablement Benefit
- Severe Disablement Allowance
- Sure Start Maternity Grant (to be replaced by the Best Start Grant)
- Funeral Payments (to be replaced by Funeral Expense Assistance)
- Winter Fuel Payments
- Cold Weather Payments

8.2.   The transfer of these powers will be phased with the first benefits due to be devolved from summer 2018. The Scottish Government has announced that an increased Carer's Allowance will be devolved from summer 2018 and the Best Start Grant and the Funeral Expense Assistance will be devolved by summer 2019.[22]

Modelling approach

8.3.   The Commission has begun preparations to forecast the demand-led social security benefits likely to be included in the Draft Budget 2018-19, this builds on work already undertaken in the Scottish Government to develop forecast models for the benefits being devolved. This development work will continue over the autumn. Our first forecasts of devolved demand-led social security expenditure will be published to accompany the Scottish Government's Draft Budget 2018-19 and will cover the benefits devolved in 2018-19.

8.4.   The benefits being devolved are largely linked to ill-health, disability, maternity, caring and age. Demographics, eligibility criteria and the take-up rates for these benefits will be important factors in determining the level of expenditure on each benefit rather than other common factors, for example the performance of the economy. This presents challenges for forecasting expenditure and, particularly in the case of changes to benefits, a wide range of data sources will be used to estimate expenditure.

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[22] Scottish Government news release on Social Security benefits (link)

8.5.   Some benefits, such as Carer's Allowance, Attendance Allowance, PIP and DLA are paid regularly. Expenditure on these benefits will be forecast by estimating the number of claimants in receipt of the benefit (caseload). The caseload is forecast using historic administrative data from DWP on the new claimants flowing on to the benefit, and the off flow as claimants leave the benefit. This approach is often referred to as a stocks and flows model, with the caseload being the stock and the on-flows and off-flows being the flows. The on-flows and off-flows are estimated by age and gender. Many of the benefits being devolved are linked to demographics and the probability of entitlement increases with age. Therefore the forecasts of the future caseloads will be linked to population projections. The expenditure is then calculated by multiplying the caseload by average amounts received.

8.6.   Other benefits such as the Best Start Grant and Funeral Expense Assistance are not paid on a regular basis. These are largely one-off payments with eligibility linked to a particular event or characteristic. A separate approach will be required to forecast expenditure on each of these benefits. In the case of the Best Start Grant population projections and NHS data will be used to estimate the number of births and the number of first births in Scotland along with the number of children starting nursery and school each year. Modelling of entitlement to qualifying benefits will estimate the proportion of births and children in families eligible for the grant. Not all those eligible claim benefits; the proportion of eligible families claiming the grant is referred to as the take-up rate. The take-up rate of the grant will be modelled taking into account estimates of the current take-up rate and the potential behavioural effects due to increases in the amount paid or changes in the administration of the grant.

9. Abbreviations

ADS	Additional Dwelling Supplement
ADT	Air Departure Tax
APD	Air Passenger Duty
ARIMA	Autoregressive Integrated Moving Average
CAA	Civil Aviation Authority
DLA	Disability Living Allowance
DWP	Department for Work and Pensions
GDP	Gross Domestic Product
GERS	Government Expenditure and Revenue Scotland
HMRC	HM Revenue & Customs
LBS	Large Business Supplement
LBTT	Land and Buildings Transaction Tax
MCC	Material Change in Circumstance
NDR	Non-Domestic Rates
NDRI	Non-Domestic Rates Income
NHS	National Health Service
NIESR	National Institute of Economic and Social Research
NiGEM	National Institute Global Econometric Model
NSND	Non-Savings Non-Dividend
OBR	Office for Budget Responsibility
ONS	Office for National Statistics
PIP	Personal Independence Payment
PUT	Public Use Tape
QNAS	Quarterly National Accounts Scotland
RPI	Retail Price Index
RV	Rateable Value
SAA	Scottish Assessors Association
SEPA	Scottish Environment Protection Agency
SFC	Scottish Fiscal Commission
SG	Scottish Government
SGGEM	Scottish Government Global Economic Model
SLfT	Scottish Landfill Tax
SPI	Survey of Personal Incomes

A full glossary of terms is available on our website.[23]

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[23] Scottish Fiscal Commission Glossary of Terms (link)

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