Annex B: Modelling Taxes

1.   Which Taxes have been Included

The following taxes have been included in the model:

- Employee National Insurance (NI)
- Income Tax on Savings
- Non-Savings Non-Dividend (NSND) Income Tax
- Council Tax
- Indirect Taxes, including VAT

2.   Methodology

2.1   Uprating Incomes

Incomes in the Family Resources Survey have been uprated in line with Office for National Statistics (ONS) methods.[1] Historical values for indices are taken from ONS. Forecast values are taken from the Office for Budget Responsibility.[2]

Average Earnings: Historic: ONS Forecasts: OBR (Table 1.1)	**CPIH** Historic: ONS Forecasts: OBR (Table 1.1)
RPI Historic: ONS Forecasts: OBR (Table 1.1)	**RDEP** Historic: BOE. Weighted average of CFMHSCV & CFMHSCW. Feb 20 figure used for Apr 20.

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[1] https://www.ons.gov.uk/peoplepopulationandcommunity/personalandhouseholdfinances/incomeandwealth/methodologies/nowcastinghouseholdincomeintheukmethodology2016. See Table 1 on this page.
[2] https://obr.uk/efo/economic-and-fiscal-outlook-march-2020/

Based on the above, the following values have been used.

Date	Average Earnings (%)	Inflation (CPIH) %	Inflation (RPI) %	RDEP (%)
2012 APR	1.2	2.8	3.5	1.9
2013 APR	1.4	2.2	2.9	1.9
2014 APR	0.6	1.7	2.5	1.4
2015 APR	2.7	0.3	0.9	1.2
2016 APR	2.2	0.7	1.3	1.0
2017 APR	2.2	2.6	3.5	0.6
2018 APR	2.7	2.2	3.4	0.7
2019 APR	3.4	2.0	3.0	0.8

2.2   Direct Taxes

A rules based approach has been used to model direct taxes. The NSND tax calculations were calculated by applying the 2019/20 Scottish Rate of Income Tax rates. Calculations were checked using the following online tax calculators:

- HMRC tax calculator, and;
- Listentotaxman.com

This enabled checks to the penny to be made to ensure that the tax calculations work correctly.

Rates and bands for Employee National Insurance and Income tax on savings was obtained from the Overview of Tax Legislation and Rates (OOTLAR) publication 2019/20.[3]

Council Tax bands and local authority information are contained within the Family Resources Survey. Council Tax amounts are applied using this information, using the 2019/20 charges set by local authorities.[4]

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[3]
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/872423/Overview_of_Tax_Legislation_and_Rates_2020.pdf
[4] https://www.gov.scot/publications/council-tax-datasets/

2.3   Indirect Taxes

2.3.1   The Source Data

The Effects of Taxes and Benefits on household income (ETB)[5] has been produced annually since the early 1960s, with comparable estimates available from 1977 onwards. The main purpose of ETB is to provide quantitative analysis of the effects of government intervention (through taxes and benefits) on the income of private households in the UK, allowing analysis of long-term trends.

The ETB dataset, derived from the Living Cost and Food Survey (LCFS), contains around 5,000 households per year. It is designed to be representative of UK private households. The ETB is weighted to the UK private household population.

We use information on indirect taxes in the ETB dataset for 2008 through to 2016, and apply this information via a model to the Households Below Average Income (HBAI) dataset.

The advantage of using the ETB is that all taxes have already been calculated by ONS and applied to the raw LCFS data.

2.3.2   Which Indirect Taxes?

The ETB contains indirect taxes **paid by households**. These types of taxes can be divided into two key types; those on final goods and services and those on intermediate goods. Final goods and services are those that are sold to final users (in this case household consumers), while intermediate goods are those that are used in the production of final goods. For example, in the case of a company importing washers to produce water taps to sell to consumers, the washer is the intermediate good and the tap is the final good.

In producing the ETB analysis, ONS assume that the incidence of intermediate taxes is born by the consumer who purchases the final good (in this case, households). ONS assume that companies pass on the full cost of intermediate taxes to the consumer in the price of the final good, although allowances are made for the proportion of the tax paid by public authorities and foreign consumers. In the above example the company would pass on any import duties on the washer to the consumer of the tap.

From the ETB Survey for UK Private Households 2016/17 (the most recent year available), households paid £177bn in indirect taxes. Around half of household indirect tax is VAT. However, intermediate taxes makes up a fifth. Fuel duty, Vehicle Excise Duty, and taxes on alcohol and tobacco make up a further fifth. The remaining tenth is accounted for by a wide range of smaller taxes (Table 1).

Table 1: Components of Indirect Taxes in the ETB dataset paid by UK Households: 2016/17

Breakdown of Indirect Taxes paid by Households	£m	%
Total VAT paid by households	83,126	46.9%
Total intermediate taxes	39,011	22.0%
Duty on hydrocarbon oils	13,605	7.7%
Total duties on alcohol	9,649	5.4%
Total duties on tobacco	7,958	4.5%
SDLT/LBTT	5,893	3.3%
Vehicle excise duty	4,822	2.7%
Television licence	3,169	1.8%
Insurance premium tax	2,660	1.5%
Air passenger duty	2,197	1.2%
Betting taxes	2,064	1.2%
Camelot national lottery fund	1,662	0.9%
Total customs duties	962	0.5%
Other taxes on final goods and services	439	0.2%
Total indirect taxes paid by households	**£177,218**	**100.0%**

Source: ETB 2016/17

2.3.3 The Indirect Taxes Model

We take the ETB dataset as a starting point and model the total weekly amount of indirect taxes paid by each household. We do not model the individual components of indirect tax separately (e.g. VAT, Alcohol duty, tobacco duty, etc.). We use nine years of ETB data (a sample of around 48,000 records).

Taking the log of weekly tax and weekly disposable income (unequivalised), we find these both to be approximately normally distributed. The slight skewness of the distribution is due to inflation between different years of the survey. We apply general linear modelling to these variables as we want the error term to be normally distributed.

The general linear model we fit to the ETB data is:

log_indirt=log_disinc + childs +nadfem+nadmal +noretd +data_year + gorx

Where the variables are:

- Childs=number of children
- Nadfem = number of adult females
- nadmal= number of adult males
- noretd = number of retired people in the household
- data_year = year of survey.
- Gorx= government region

We apply the above model to the same variables in the FRS and HBAI datasets to predict how much indirect tax each individual household pays. In the HBAI, disposable income is defined as gross household income (ESGINCHH), minus income tax, national insurance and Council Tax and Scottish Water Charges.

2.3.4   How good are our estimates?

The short answer is we don't know.

- There is a lack of verifiable outturn data for Scotland. Scottish shares of taxes are estimated by both HMRC and GERS. The lack of verifiable outturn data for VAT has led to a delay in the VAT assignment powers coming to Scotland.
- We don't know how much indirect taxes are paid by households rather than businesses. This particular affects VAT, Fuel Duty and Vehicle Excise Duty (VED). VAT is collected by businesses, with no register of the purchasers address. Fuel duty is paid on fuel. How many miles are for business trips rather than personal use? VED depends on the class of vehicle.

 The next best question we can ask is do our estimates look reasonable.

Table 2: Typical Predicted values for Indirect Taxes compared with Estimates for Outturn data for Scotland.

Year	Modelled - Indirect Taxes for Households (£m)	Estimated Outturn (ALL) (£m)	Proportion of Outturn for Households
12/13	10,927	14,197	77%
13/14	11,124	14,926	75%
14/15	11,325	15,427	73%
15/16	11,529	15,838	73%
16/17	11,736	16,146	73%
17/18	11,948	16,820	71%

Compared to our estimated outturn data,[6] around 71%-77% of indirect taxes is paid by households. This seems reasonable. Looking at VAT - the largest indirect tax - the household sector accounts for over 70 per cent of VAT receipts so the above figures seem plausible.[7] In addition, comparing the 2016/17 ETB with UK outturn data, we estimate between 67% and 73% of indirect tax is paid by households.

We therefore assume that the 2019/20 figure is adequate for our purposes.

[6] https://www.gov.uk/government/statistics/disaggregation-of-hmrc-tax-receipts
[7] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/803475/Disaggregated_tax_and_NICs_receipts_-_methodological_note.pdf

3. Values in the Report

After running ten simulations of the model, the average values for taxes for 2019/20 are:

Tax	Amount (£)
Employee NI	5,273,997,821
Savings Tax	156,863,644
Indirect Taxes	12,904,965,300
NSND Income Tax	12,139,802,986
Council Tax	2,771,023,405
Total	**33,246,653,156**

3.1 NSND Income Tax: A Comparison with Scottish Fiscal Commission forecasts.

The Scottish Fiscal Commission (SFC) is the official forecaster of NSND Income Tax in Scotland. For 2019/20, they forecast receipts of £11,677 million.[8] Forecasts and forecast errors for earlier years where outturn data is available are shown below.

SFC Income Tax Budget Setting Forecasts	Forecast £ million	Outturn £ million	Error £ million	Relative Error (%)
2019/20 (set February 2019)	11,677	-	-	-
2018/19 (set February 2018)[9]	12,177	11,556	621	5.4%
2017/18 (set February 2017)[10]	11,857	10,916	941	8.6%
2016/17 (set February 2016)[11]	11,267	10,719	548	5.1%

Our projection of £12,140m is around £463m (+4%) higher than the SFC forecast above. Although we have used some different data sources – particularly different survey data – our estimate is similar to the SFC forecast. We would not expect forecasts from different models to exactly match.

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[8] https://www.fiscalcommission.scot/wp-content/uploads/2020/02/Scotlands-Economic-and-Fiscal-Forecasts-February-2020.pdf
[9] https://www.fiscalcommission.scot/wp-content/uploads/2020/10/Forecast-Evaluation-Report-September-2020-Income-Tax.pdf
[10] https://www.fiscalcommission.scot/wp-content/uploads/2019/10/Forecast-Evaluation-Report-September-2019.pdf
[11] https://www.fiscalcommission.scot/wp-content/uploads/2019/10/Forecast-Evaluation-Report-September-2018.pdf

4.   Coverage

Using Government Expenditure and Revenue Scotland (GERS)[12] statistics from 2009/10 to 2018/19 we produce an estimate for Total Non-North Sea taxes for 2019/20. This estimate is £57,757 million.

	Total Non-North Sea taxes (Millions)
2009/10	42,201
2010/11	45,177
2011/12	46,297
2012/13	47,566
2013/14	51,639
2014/15	51,639
2015/16	53,689
2016/17	52,652
2017/18	53,292
2018/19	56,090
2019/20	57,757 (estimated)

With total taxes in our model of £33,247 million, this gives an estimate of around 58%.

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[12] https://www.gov.scot/publications/government-expenditure-revenue-scotland-gers/pages/3/