Report for Ofcom

Documentation of fully allocated cost model for LLU and WLR charge controls

16 July 2013

Chris Lambert, Tom Rebbeck, James Allen

Ref: 36198-285

Contents

Analysys Mason Limited
Bush House, North West Wing
Aldwych
London WC2B 4PJ
UK
Tel: +44 (0)845 600 5244
Fax: +44 (0)20 7395 9001
london@analysysmason.com
www.analysysmason.com
Registered in England No. 5177472

1 Introduction

For the wholesale local access (WLA) and wholesale fixed analogue exchange line (WFAEL) markets, Ofcom is consulting on its view that Openreach has significant market power (SMP) and on its proposal that charge controls are a necessary remedy to Openreach's ability to set excessive levels of charges in the respective markets. Specifically, Ofcom is proposing charge controls for loop local unbundling (LLU) and wholesale line rental (WLR) services for the three-year period starting on 1 April 2014.

As part of this market review, Ofcom has asked Analysys Mason to build a current cost accounting (CCA), financial capital maintenance (FCM), fully allocated cost (FAC) model (the Cost Model), to calculate how the nominal costs of relevant products will change over the period of the charge controls. The Cost Model is ultimately used to calculate the values of X for a CPI-X glide path for the products (and baskets of products) in the charge controls.

The objective of the Cost Model for the LLU and WLR charge controls is to estimate how the allowed costs of providing the relevant services will change over the period of the proposed charge controls, in order to calculate a value of X for each of the charge controls.

This document is designed as a guide for users of the Cost Model, a redacted version of which has been published as part of the consultation process.

The rest of this report is structured as follows:

- *Section 2: Conceptual overview of the Cost Model*. This section provides a simplified view of how the model works and the main inputs for each calculation.
- *Section* 3*: Structure of the Cost Model.* This section provides a short overview of how to read the model and a description of the model sheets.
- *Section 4: Description of the worksheets*. In this section, for each of the worksheets in the model, a short description of the purpose of the sheet is included, the preceding and dependent sheets named and an overview of the contents of the sheets is provided. For the most important elements of the model, such as unit capital and operating costs, a more detailed description of the calculations is included.
- *Section 5: Cost Model adjustments.* One of the key aims in our approach to building the Cost Model was to make it transparent for the user. However, in a number of places in the model, data were not available; the provided data had to be adapted or subjected to manual adjustments. This section of the document describes the adjustments and explains where they are made in the Cost Model.

This document provides an overview of each of the calculations in the Cost Model. However, it does not provide details on a cell-by-cell basis. This documentation is designed to be used in conjunction

with the model. As a working version of the model is published alongside this document, users can best understand the individual calculations by analysing the model itself.

Openreach data inputs are taken from submissions from the relevant s.135 Information Requests pertaining to any future LLU and WLR charge controls, issued by Ofcom in early 2013, as well as relevant excerpts from the Regulatory Financial Statements (RFS).

Other inputs used in the model include Ofcom's regulatory asset value (RAV) adjustments, costs volume elasticity **(**CVE) and asset volume elasticity (AVE) also provided by Ofcom, historical inflation from the Office for National Statistics (ONS) and inflation forecasts using the average of independent forecasts compiled by HM Treasury.

Disclaimer:

The terms and conditions on which Ofcom is making available the model are set out below.

The model described in this document has been developed to help stakeholders understand Ofcom's estimations on how the allowed costs of providing the relevant services will change over the period of the proposed charge controls, in order to calculate the value of X for the charge controls.

All right, title and interest in the Cost Model constructed in Excel are owned by Ofcom. Such title and interest is protected by intellectual property laws. While you may freely use the Cost Model for the purposes for which it is provided, as set out in the accompanying model documentation, it is not to be modified in any way or used for commercial gain or otherwise without the prior written permission of Ofcom.

No representation or warranty is given as to the accuracy, completeness or correctness of the Cost Model and it is provided 'as is'. It is provided without any representation or endorsement made and without warranty of any kind, whether express or implied, including but not limited to the implied warranties of satisfactory quality, fitness for a particular purpose, non-infringement, compatibility, security and accuracy.

Ofcom does not accept any responsibility for any loss, disruption or damage to your data or your computer system which may occur whilst using the Cost Model or material derived from the Cost Model. Ofcom does not warrant that the functions contained in the Cost Model will be uninterrupted or error free. Also, Ofcom does not warrant that defects will be corrected, or that the Cost Model provided is free of viruses.

In no event will Ofcom be liable for any loss or damage including, without limitation, indirect or consequential loss or damage, or any loss or damages whatsoever arising from use or loss of use of, data or profits arising out of or in connection with the use or otherwise of the provided Cost Model. By using this Cost Model, you agree to the above.

These Terms and Conditions shall be covered by and construed in accordance with the laws of England and Wales. Any dispute arising under these Terms and Conditions shall be subject to the exclusive jurisdiction of the Courts of England and Wales.

2 Conceptual overview of the Cost Model

This section provides a simplified view of how the model works and the main inputs for each calculation.

The model is constructed around the costs and volumes of network components.[1] Each of Openreach's products' (e.g. WLR Basic Rental) costs are calculated in terms of a number of underlying network components (e.g. E-side copper capital). Some network components are shared across many different products (e.g. E-side copper capital is used by WLR and metallic path facility (MPF) products), while others are consumed by a smaller set of products (e.g. PSTN line cards are consumed only by WLR).

2.1.1 Component volumes

The first stage of the Cost Model is to derive a measure of the total required usage of each component, based on product volumes and usage factors. Usage factors describe the quantity of each component used by each product (e.g. the usage factor of PSTN line cards for WLR will be 1, as a single PSTN line card is used in each WLR product); these usage factors are later used for cost allocation.

The initial stage of the Cost Model calculates component volumes based on product volumes and usage factor data provided by Ofcom, with 2011/12 actuals as provided by BT (see Figure 2.1).

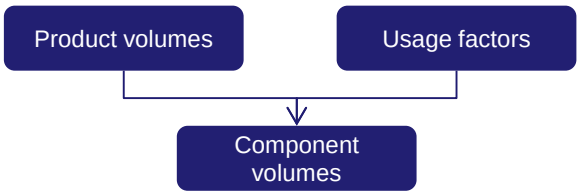


Figure 2.1: Elements of component volumes calculation [Source: Analysys Mason, 2013]

For 2011/12, the Cost Model derives the total utilisation (component volumes) of each component based on product volumes and usage factors, as adjusted by Ofcom. For future years (from 2012/13 to 2016/17), future product volumes and usage factors were used to calculate future component volumes.

2.1.2 Unit annualised capital cost

The next step is to calculate unit annualised capital cost per component (see Figure 2.2).

[1] See Annex B for BT's full list of Network components
http://www.btplc.com/Thegroup/RegulatoryandPublicaffairs/Financialstatements/2012/PADS_2012.pdf

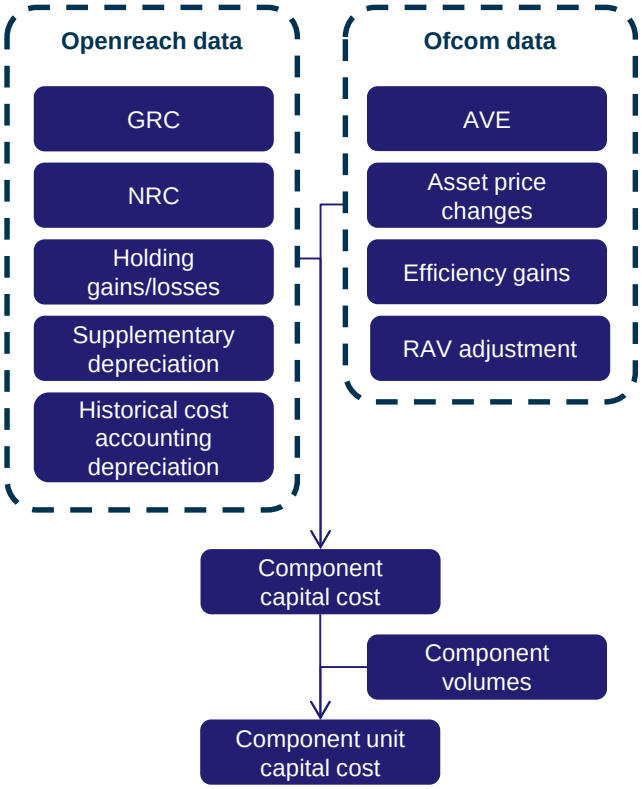


Figure 2.2: Elements of component unit capital cost [Source: Analysys Mason, 2013]

Openreach capital cost data have been provided (partially redacted for publication of this model) such as gross replacement cost (GRC), net replacement cost (NRC), and holding loss/gain for each asset class for the historical period. These asset class data are then distributed over the components to give capital cost figures for each component – rather than each asset – for the historical period, (e.g., the total GRC value for duct as an asset class is apportioned to E-side copper capital, D-side copper capital and LLU tie cables).

For future years, the capital costs by component are forecast based on the AVE, efficiency gains, component volumes and asset price changes supplied by Ofcom. The component unit capital cost is derived from these data, using the component volumes calculated previously.

Within these calculations, the capital cost values for the duct and cable asset classes are replaced by RAV values for the years covered by these charge controls.[2] The non-RAV figures (also included in the model) are used to cross-check the base year outputs with published RFS data.[3]

2.1.3 Unit opex

At this point, the unit opex figures are calculated (see Figure 2.3).

[2] In the unit capital costs (RAV) sheet

[3] This is to ensure a like-for-like comparison as, in BT's published RFS data, no RAV adjustment is applied.

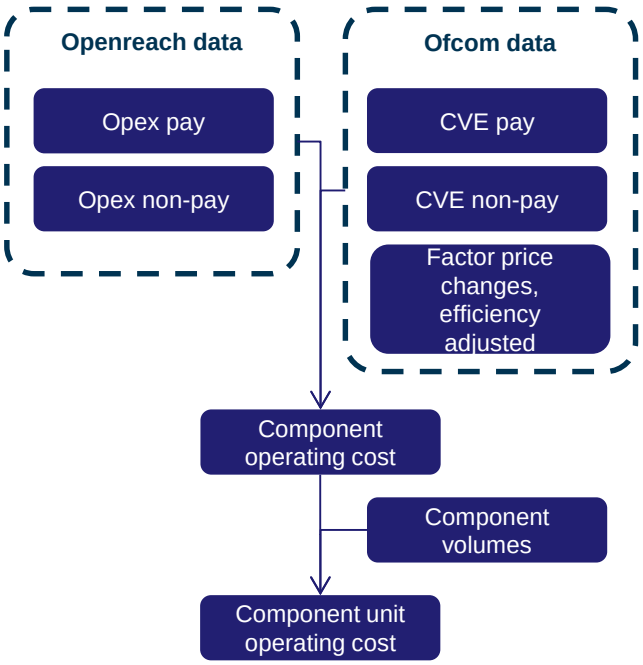


Figure 2.3: Elements of component unit operating cost [Source: Analysys Mason, 2013]

For previous years, Openreach has provided pay and non-pay opex on a per-component basis, to give total opex per component. For future years, per component values for pay and non-pay opex are calculated based on the product volume demand growth forecasts, usage factors, factor price changes adjusted for efficiency gains and the pay and non-pay CVEs provided by Ofcom. Using the relevant component volumes for each year, unit opex is calculated.

2.1.4 Unit product costs

The subsequent step is to calculate the unit product costs (see Figure 2.4).

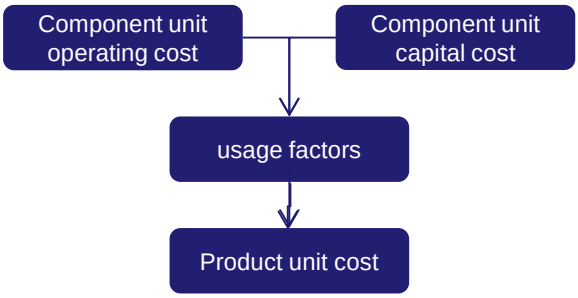


Figure 2.4: Elements of product unit cost [Source: Analysys Mason, 2013]

Up to this point, the Cost Model has calculated unit capital and unit operating cost for each component. These figures are summed and multiplied by relevant usage factors to calculate product unit costs.

2.1.5 Forecast LRIC

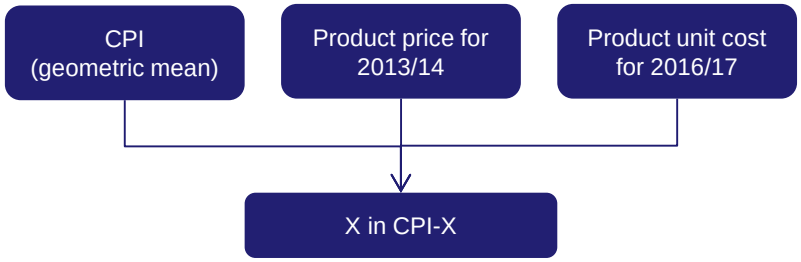
A number of products are proposed to be regulated with reference to their forecast LRIC rather than forecast FAC costs, or based on the difference in their LRIC compared with that of another regulated product. Forecast long-run incremental cost (LRIC) has been calculated by applying an historical LRIC/FAC ratio to the forecast FAC.

For prices regulated at LRIC, the unrecovered common cost is then recovered over the main rental products. This is done in such a way so as to ensure the price differentials for the main rental products reflect their LRIC difference.

2.1.6 Single products

The X in a CPI-X glide path is the yearly percentage change required to equalise unit costs and unit charges at the end of the glide path, i.e. 2016/17, the final year of the charge control.

Figure 2.5: Calculating the value for X in CPI-X for individual products [Source: Analysys Mason, 2013]



The X-value is fixed for the control period and as such it must be based on the forecast for CPI inflation, rather than the inflation figure for the base year. To ensure the correct unit cost target is achieved, the value for X is based on a geometric average of the forecast CPI inflation rates for the period of the charge controls.

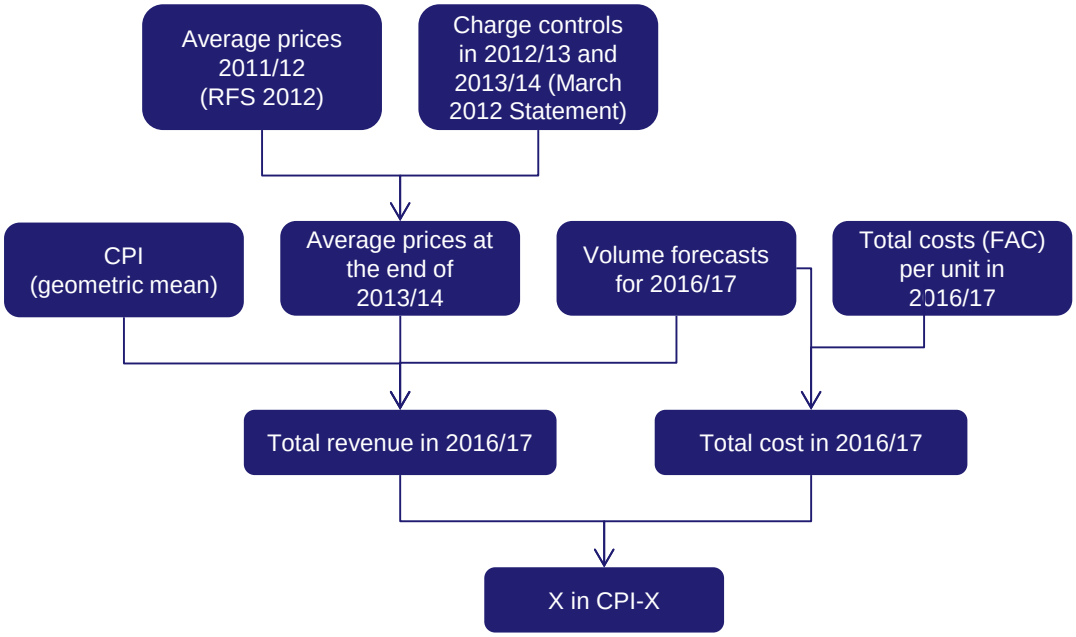
On the 'X (products)' spreadsheet, we calculate the X-value for individual products. To perform this calculation, the following inputs are used for each product:

- Proposed charge (as adjusted for LRIC adjustments) (in nominal terms) in 2016/17
- CPI geometric mean (for the charge control period, 2013/14–2016/17)
- product price in 2013/14

2.1.7 Baskets of products

The next step is then to calculate the X-values for the charge controls.

Figure 2.6: Elements of (S)MPF and Co-Mingling X in CPI- X [Source: Ofcom, 2013]



The reasoning behind the basket design proposals are set out in Section 4 of the consultation document.

On the 'X (MPF, SMPF baskets)' spreadsheet, we calculate the X-value for both the MPF and shared MPF (SMPF) baskets. To perform this calculation, the following inputs are used:

- total volume forecasts for MPF Ceases, MPF New Provide and SMPF Ceases (aggregates[4] as in BT's RFS 2012) in 2016/17
- FAC (in nominal terms) for MPF Ceases, MPF New Provide and SMPF Ceases in 2016/17
- CPI geometric mean (for the charge control period, 2013/14–2016/17)
- average prices for MPF Ceases, MPF New Provide and SMPF Ceases in 2013/14. The average prices for MPF Ceases, MPF New Provide and SMPF Ceases in 2013/14 are based on the average price stated in BT's RFS 2012 (page 55) and our charge controls set out in the March 2012 Statement.

The X-value for both the MPF and SMPF baskets is computed such that the expected joint total revenue for MPF Ceases, MPF New Provide and SMPF Ceases are brought into line with their expected joint total costs by the end of the charge control period (2016/17).

On the 'X (Co-Mingling baskets)' spreadsheet, we calculate the X-value for the Co-Mingling basket. To do this calculation, we use the following inputs:

[4] BT's RFS products which are used in basket calculations are aggregates of individual items on the price list.

- total volume forecasts for MPF Room Build, MPF Tie Cables and MPF Hostel Rentals in 2016/17 (aggregates[5] as in BT's RFS 2012)
- FAC (in nominal terms) for MPF Room Build, MPF Tie Cables and MPF Hostel Rentals in 2016/17
- CPI geometric mean (for the charge control period, 2013/14–2016/17)
- average prices for MPF Room Build, MPF Tie Cables and MPF Hostel Rentals in 2013/14. The average prices for MPF Room Build, MPF Tie Cables and MPF Hostel Rentals in 2013/14 are based on the average price stated in BT's RFS 2012 (page 55) and our charge controls set out in the March 2012 Statement.

The X-value for the Co-Mingling basket is computed such that the expected joint total revenue for MPF Room Build, MPF Tie Cables and MPF Hostel Rentals are brought into line with their expected joint total costs by the end of the charge control period (2016/17).

[5] BT's RFS products which are used in basket calculations are aggregates of individual items on the price list.

3 Structure of the Cost Model

This section provides a short overview of how to read the Cost Model, and describes the Cost Model sheets.

The Cost Model is entirely self-contained (i.e. there are no external links to other workbooks). The Cost Model itself takes data inputs from two main sources – Openreach and Ofcom – but all information needed to perform the CCA FAC and RAV calculations is contained within the Cost Model.

The Cost Model is designed to be read in a left-to-right, top-to-bottom style, with worksheets only using data from preceding – not subsequent – worksheets.

The published edition of the Cost Model is fully functioning, in order to give stakeholders a complete view of the methodology used to make the CPI-X calculations. Users can adjust the scenarios of the Cost Model by, for example, entering alternative volume forecasts or alternative AVE and CVE figures. Annex B contains a complete list of the available scenario adjustments.

Figure 3.1 summarises the content of each worksheet in the workbook.

Figure 3.1: Summary of contents by worksheet [Source: Analysys Mason, 2013]

Worksheet name	Worksheet contents
Contents	Describes the contents of the Cost Model
Version history	Log of changes to the published Cost Model
Style guidelines	Description of the formatting used in the Cost Model
Data reference sheets 1a–10	Cost Model inputs
Inflation	Inflation figures used in the Cost Model (Ofcom provided)
Control panel	Scenario selection for the Cost Model
Parameters	Constants, sensitivities and rates used in the cost and RAV models
Products & components	List of products and components used in the Cost Model
Product volume scenarios	Data inputs for variable product volume forecast scenarios
Product volumes	Product volumes selected as outputs for the Cost Model
Usage factors 11–12	Usage factors for 2011/12 as provided for reference by Openreach
Usage factor scenarios	Openreach and Ofcom usage factor inputs
Usage factor future	Usage factors selected as outputs for the Cost Model
Component volumes	Component volumes selected as outputs for the Cost Model
Component volume growth	Rates calculated from component volume outputs
Capital costs 11–12	Component capital costs for 2011/12
Asset life adjustments	Adjustment to asset lives of certain assets
AVE scenarios	AVE inputs as used in the Cost Model, plus user AVE scenarios

Worksheet name	Worksheet contents
Asset price changes	Nominal and real rates calculated from asset price change outputs
Unit capital costs	Cost Model calculation of unit component capital maintenance
Cable RAV model	Re-format of Ofcom RAV model copper inputs
Cable RAV adjustment	Component-allocated RAV copper adjustments selected as outputs for the Cost Model
Duct RAV model	Re-format of Ofcom RAV model duct inputs
Duct RAV adjustment	Component-allocated RAV duct adjustments selected as outputs for the Cost Model
Capital costs 11–12 (RAV %)	Cost category weightings for copper and duct asset type calculations
Unit capital costs (RAV)	RAV model calculation of unit component capital maintenance
Opex 11–12	Component operational costs for 2011/12
CVE scenarios	CVE inputs as used in the model, plus user CVE scenarios
Unit opex	Cost Model calculation of total component unit operational maintenance
Product costs	Component cost stacks and total product costs
Total SMPF volumes scenarios	Data inputs for SMPF product volume forecast scenarios
Total MPF volumes scenarios	Data inputs for MPF product volume forecast scenarios
LRIC adjust, single migrations	LRIC:FAC ratio adjustments for single migration, connection and conversion products
LRIC adjust, bulk migrations	LRIC:FAC ratio adjustments for bulk migration products
LRIC adjust, transfers	LRIC:FAC ratio adjustments for transfer products
LRIC adjust, rentals	LRIC:FAC ratio adjustment for rental products and common cost redistribution
LRIC adjust, connections	LRIC:FAC ratio adjustments for connection products
Product cost scenarios	Total product cost calculations as outputs
X (products)	Calculations for CPI-X values
X (MPF, SMPF baskets)	Calculation of CPI-X values for the SMPF and MPF ancillary baskets
X (Co-Mingling basket)	Calculation of CPI-X value for the Co-Mingling basket
X (products) ACTUAL	Calculations for CPI-X values using costs from the unredacted version of the model
X (MPF, SMPF baskets) ACTUAL	Calculation of CPI-X values for the SMPF and MPF ancillary baskets using costs from the unredacted version of the model
X (Co-Mingling basket) ACTUAL	Calculation of CPI-X value for the Co-Mingling basket using costs from the unredacted version of the model

4 Description of worksheets

In this section, each of the worksheets is described, including the role of each sheet in the Cost Model, and the precedent and dependent sheets. Specific comments relating to each sheet are also included. For the most important elements of the Cost Model, such as unit capital and operating costs, a more detailed description of the calculations is included.

In the published version of the model, adjustments have been made to either redact, aggregate or randomise data. Where this is the case, the data has been highlighted according to the key set out in the style guidelines to explain the change made to the redacted version.

4.1 Cost Model inputs

The following section describes each of the Cost Model input sheets.

Figure 4.1: Description of data ref sheet 1a worksheet [Source: Analysys Mason, 2013]

Data ref sheet 1a	
Purpose	Ofcom product volume forecasts for SMPF
Precedent sheets	None
Dependent sheets	Total SMPF volume scenarios, Data ref sheet 2b
Key functions	Alternative scenarios are included to test model sensitivities
Specific comments	None

Figure 4.2: Description of data ref sheet 1b worksheet [Source: Analysys Mason, 2013]

Data ref sheet 1b	
Purpose	Ofcom product volume forecasts
Precedent sheets	Data ref sheet 2a
Dependent sheets	Product volume scenarios
Key functions	Alternative scenarios are included to test model sensitivities
Specific comments	None

Figure 4.3: Description of data ref sheet 2 worksheet [Source: Analysys Mason, 2013]

Data ref sheet 2	
Purpose	Capital costs 2011/12
Precedent sheets	None
Dependent sheets	Capital costs 11–12
Key functions	None
Specific comments	None

Figure 4.4: Description of data ref 3 worksheet [Source: Analysys Mason, 2013]

Data ref 3	
Purpose	Historic Net Current Asset (NCA) data
Precedent sheets	None
Dependent sheets	Capital costs 11–12
Key functions	None
Specific comments	None

Figure 4.5: Description of data ref sheet 4 worksheet [Source: Analysys Mason, 2013]

Data ref sheet 4	
Purpose	Operating expenditure data for 11–12
Precedent sheets	None
Dependent sheets	Opex 11–12
Key functions	None
Specific comments	None

Figure 4.6: Description of data ref 5, 6 and 7 worksheet [Source: Analysys Mason, 2013]

Data ref sheets 5, 6 and 7	
Purpose	Component to product usage factors 09–10, 10–11 and 11–12
Precedent sheets	None
Dependent sheets	Usage factors 11–12
Key functions	None
Specific comments	Data from previous years are for reference only

Figure 4.7: Description of data ref 8, 9 and 10 worksheet [Source: Analysys Mason, 2013]

Data ref sheets 8, 9 and 10	
Purpose	Historic AVE and CVE data
Precedent sheets	None
Dependent sheets	CVE scenarios
Key functions	None
Specific comments	None

Figure 4.8: Description of Inflation forecasts worksheet [Source: Analysys Mason, 2013]

Inflation forecasts	
Purpose	RPI, CPI and GBCI forecasts
Precedent sheets	None
Dependent sheets	Parameters
Key functions	None
Specific comments	Data sourced from the ONS and HM Treasury

4.2 Cost Model calculations

The following section describes each of the Cost Model calculation sheets.

Figure 4.9: Description of control panel worksheet [Source: Analysys Mason, 2013]

Control panel	
Purpose	Scenario selection for the Cost Model
Precedent sheets	None
Dependent sheets	Product volume scenarios, Parameters, AVE scenarios, CVE scenarios, Product costs, Product cost scenarios, Usage factor future
Key functions	User interface for scenario selection. Each scenario is described, given a named range and each choice within each scenario is assigned a dummy number. The user selects the desired scenario with the corresponding number from a drop-down menu
Specific comments	The 'Control panel' sheet enables the user to select from the available scenarios that will vary the inputs to and outputs from the Cost Model. The Excel CHOOSE function used to make scenario switches in this Cost Model requires named ranges and as such, each scenario selection is given a named range on this sheet. A hyperlink allows the user to navigate to the source data. • **Volume demand scenarios:** Product volumes can either be defined by the user, or Ofcom forecasts, scenarios 5–7 can be selected • **Inflation:** The user can to switch between RPI or CPI inflation rate for calculation of Xs in the Cost Model. The default setting is the CPI inflation rate.

	• **AVEs/CVEs:** The user can select either Ofcom AVEs and CVEs or user-defined AVEs or CVEs. • **RAV adjustment:** The published outputs from the Cost Model are based on RAV adjusted costs. However, for comparison with BT's RFS data, non-RAV adjusted figures may also be selected. • **LRIC:FAC cost ratios:** Ofcom has made adjustments to the calculated FAC cost of certain products based on a LRIC to FAC ratio. The user may decide which cost forecast results to use as an input to the glide path indexation calculations. The base case in the model uses a volume weighted LRIC:FAC cost ratio • **Usage factors:** The outputs in this Cost Model are based on Ofcom's usage factors. As an alternative, the Openreach figures from the base year – 2011/12 – can be chosen.

Figure 4.10: Description of parameters worksheet [Source: Analysys Mason, 2013]

Parameters	
Purpose	Constants, sensitivities and rates used in the cost and RAV models
Precedent sheets	Control panel, Inflation rates
Dependent sheets	The elements in the parameters sheet are used across most of the Cost Model
Key functions	Multiplication constants, rates and ratios are created as named ranges
Specific comments	Adjustments to any of these values must be made here, as these named ranges link through into the Cost Model and cannot subsequently be altered. The 'Parameters' worksheet lists the constants, rates and sensitivities used by the Cost Model. These parameters are given named ranges so the calculations are more easily followed. Sensitivities should not be altered anywhere in the Cost Model other than on this sheet. • **Integers**: So that the calculations in the Cost Model do not feature hardcoded integers in cells (i.e. L5*1 000 000), integers employed in the Cost Model are listed here. Named ranges are created in order to more easily reference and identify the use of these figures in calculations. • **RAV assumptions**: The valuation and apportionment percentage for Copper and Duct are required as the RAV model has applications beyond these charge controls. The values entered for these percentages have been supplied by Ofcom. • **Sensitivities**: Values can be manually altered for efficiency gain (capex and opex), factor price changes (pay and non-pay), and WACC. The default inputs are Ofcom data. • **LRIC:FAC Ratios**: The ratios for use in the LRIC adjustment calculations can be manually altered here. The current default values have been provided by Ofcom. • **Inflation**: The RPI and CPI inflation rates and forecasts are provided here.

Figure 4.11: Description of products and components worksheet [Source: Analysys Mason, 2013]

Products & components	
Purpose	List of products and components used in the Cost Model
Precedent sheets	None
Dependent sheets	The elements in the parameters sheet are used across much of the Cost Model
Key functions	The product and component lists link into the Cost Model as named ranges from here
Specific comments	The list of products, components and super components used in the FAC calculation are listed here. Super components are listed as certain Openreach data points are not supplied at a component levels. This does not affect the Cost Model as all of the components involved directly map to super components. • **Product list**: the named range master product list used in the Cost Model. • **Super component list**: a complete list of the super components relating to these charge controls. • **Component list**: the named range master component list for use in the Cost Model. The mapping of components to super components is also shown here.

Figure 4.12: Description of product volume scenarios worksheet [Source: Analysys Mason, 2013]

Product volume scenarios	
Purpose	Data inputs for variable product volume forecast scenarios
Precedent sheets	Data ref sheet 1b
Dependent sheets	Product volumes
Key functions	Lists Ofcom volume forecast scenarios and provides space for alternative user scenarios.
Specific comments	The Cost Model includes space for up to 10 product volume scenarios. In the redacted version of the Cost Model, three Ofcom scenarios have been included (scenarios 5, 6 and 7). The default setting used for these charge controls, is scenario 6, 'Ofcom, medium volumes'.

Figure 4.13: Description of product volumes worksheet [Source: Analysys Mason, 2013]

Product volumes	
Purpose	Product volumes as selected as inputs for the Cost Model
Precedent sheets	Product volume scenarios
Dependent sheets	Component volumes
Key functions	Display the volumes that will be used as inputs to the Cost Model. The final volume forecast values are created as named ranges to be linked into the Cost Model
Specific comments	The volumes used in the model, selected in the Control panel, are shown here. The volumes for each year are created as named ranges for use in the model.

Figure 4.14: Description of usage factors 11–12 worksheet [Source: Analysys Mason, 2013]

Usage factors 11–12	
Purpose	Usage factors for 2011/12 as provided for reference by Openreach
Precedent sheets	None (data reference sheets only)
Dependent sheets	Usage factor scenarios
Key functions	The usage factors are linked directly from Openreach submissions and are used for deriving 2011/12 historical component volumes, as well as forecast years if the Openreach scenario is chosen on the 'Control panel' sheet
Specific comments	The usage factors for each year have been created as a named range.

Figure 4.15: Description of usage factors scenarios worksheet [Source: Analysys Mason, 2013]

Usage factor scenarios	
Purpose	The options for usage factors for future years are displayed here. Ofcom inputs for future usage factors are shown. As an alternative, Openreach 2011-12 usage factors are also included.
Precedent sheets	Usage factors 11–12
Dependent sheets	Usage factor future
Key functions	The Openreach and Ofcom usage factor scenarios are shown here and created as named ranges to feed through into the Usage factor future sheet
Specific comments	The key differences between the Ofcom forecasts and Openreach data from 2011/12 are highlighted in yellow. A discussion of these differences is included in Section 5.7

Figure 4.16: Description of usage factor future worksheet [Source: Analysys Mason, 2013]

Usage factor future	
Purpose	Usage factors as selected as outputs for the Cost Model
Precedent sheets	Usage factor scenarios
Dependent sheets	Product costs, Capital costs 11–12, Capital costs 11–12 (RAV %), Component volumes
Key functions	The usage factor scenario selected for use in the Cost Model on the 'Control panel' sheet. The usage factor sets for each of the forecast years are created as named ranges
Specific comments	The Ofcom future year forecasts were used as the default for the Cost Model.

Figure 4.17: Description of component volumes worksheet [Source: Analysys Mason, 2013]

Component volumes	
Purpose	Component volumes as outputs for the Cost Model
Precedent sheets	Product volumes, Usage factors 11–12, Usage factor future
Dependent sheets	Component volume growth
Key functions	Calculation of component volumes for each product per year derived from product volumes and component usage factors. The component totals are created as named ranges to feed in the 'Component volume growth' sheet
Specific comments	For each year (historical, base and forecast) component volumes are calculated on the 'component volumes' sheet as a product of product volumes and usage factors. The resultant total component volume values for each year are created as named ranges.

Figure 4.18: Description of component volume growth worksheet [Source: Analysys Mason, 2013]

Component volume growth	
Purpose	Rates calculated from component volume outputs
Precedent sheets	Usage factor scenarios
Dependent sheets	Product costs, Capital costs 11–12, Capital costs 11–12 (RAV %), Component volumes, Unit capital costs, Unit opex
Key functions	The annual changes in component volumes are converted into a growth rate/rate of decline
Specific comments	None

Figure 4.19: Description of capital costs 11–12 worksheet [Source: Analysys Mason, 2013]

Capital costs 11–12	
Purpose	Component capital costs for 2011/12
Precedent sheets	Data reference sheets 2
Dependent sheets	Unit capital costs, Usage factors 11–12, Asset life adjustment, Capital costs 11-12 (RAV %)
Key functions	The AVEs and capex values for each component and cost category are calculated or linked here and created as named ranges for subsequent use
Specific comments	These sheets are identical in format and contain the component data submitted by asset class by Openreach, with the exception of a few calculations: • Most values have been multiplied by 1 000 000 as submitted data have GBP millions as a unit, not GBP. The only exception to this is NCA data which was submitted in GBP thousands • The 'Capital expenditure' and 'Disposals and retirements' cost categories have been calculated as equal to the sum of the HCA depreciation and the supplementary depreciation (i.e. the OCM depreciation) for each year

	• NCA values have been calculated using usage factors as a proxy as NCA values from Openreach are provided by product and not component. • No usage factors are supplied for the component CF189 EVOTAM Testing Systems. To include these costs in the Cost Model, they have been added to the values for CF187 LLU Line Testing Systems for each cost category. • For 2011–12, a number of manual adjustments have been made to the data. These are discussed in more detail in Section 5.2 Within each cost category, the sums of the values for each component across asset classes are created as a named range for that year and cost category for future use in the Cost Model (e.g. Component_GRC_2011_12).

Figure 4.20: Description of Asset life adjustments worksheet [Source: Analysys Mason, 2013]

Asset life adjustments	
Purpose	Adjusts asset lives of certain assets
Precedent sheets	Capital costs 11–12
Dependent sheets	Unit capital costs
Key functions	Adjusts OCM depreciation and assets lives of the *CL175 Local exchanges general frames capital* component and the 'other network equipment' asset class
Specific comments	See section 5 for an explanation of the changes in this sheet.

Figure 4.21: Description of AVE scenarios worksheet [Source: Analysys Mason, 2013]

AVE scenarios	
Purpose	This sheet provides Ofcom's values for AVEs. Users can also add their own AVE inputs
Precedent sheets	None
Dependent sheets	Unit capital costs
Key functions	The selection of AVE data is made using the control panel.
Specific comments	None

Figure 4.22: Description of asset price changes worksheet [Source: Analysys Mason, 2013]

Asset price changes	
Purpose	Nominal rates calculated from asset price changes outputs
Precedent sheets	Parameters
Dependent sheets	Unit capital costs
Key functions	Forecast asset price change rates.
Specific comments	The forecast RPI rate is applied to cable and duct prices only

Figure 4.23: Description of unit capital costs worksheet [Source: Analysys Mason, 2013]

Unit capital costs	
Purpose	This sheet calculates the total unit component capital costs.
Precedent sheets	Parameters, Component volume growth, Usage factor future, Asset price changes, Capital costs 11–12
Dependent sheets	Product costs
Key functions	Calculation of total component unit capital costs. Named ranges are created for all of the forecast cost categories for simplification of calculation
Specific comments	A discussion of the specific adjustments to this sheet can be found in Section 5.3 Each of blocks on the sheet are described below: • **AVEs**: The AVEs selected for the modelled scenario. • **Weighted GRC**: The weighting of the GRC value assigned to each asset type for each component is calculated here as the GRC of each asset type divided by the total component GRC. • **OCM depreciation**: The base year OCM depreciation is calculated here by component asset type as the GRC value divided by a base year asset life. The sum total OCM depreciation for each component is also calculated. • **Asset lives**: Asset lives are calculated per component for each asset type as the GRC divided by the OCM. • **Asset price changes**: Figures transposed from a previous sheet. • **Asset price changes by component weighted by GRC**: For each **c**omponent and each year, this is calculated as the sum of the product of base year GRC weights by asset type and the asset price changes. • **Sensitivity inputs**: Data linked from a previous sheet. • **AVEs weighted by GRC**: Figures calculated for each year as the sum of the products of the base year component asset AVEs and the weighted **GRC percentages**. The values are calculated for the base year and assumed to be the same for each subsequent year. • **Capital Expenditure (steady state)**: For base and historical years, these data are linked from the capital costs sheets. For future years, the previous year's value is multiplied by the annual asset price change and the capex efficiency gain. • **Disposals**: For base and historical years, data are linked from capital costs sheets. For future years, the previous year's value is multiplied by the annual asset price change. • **GRC (steady state)**: For base and historical years, data are linked from capital costs sheets. For future years, the previous year's value is multiplied by the annual asset price change and added to the sum of that year's capital expenditure and disposals. • **OCM depreciation (steady state)**: For the historical years, data are linked from the capital costs sheets. For the base year, the data are linked from the calculation described earlier in Figure 4.27. For the future years, the steady state GRC is divided by the asset life for each component. • **NRC (steady state)**: For base and historical years, data are linked from capital costs sheets. For future years, the previous year's value is multiplied by the annual asset price change and added to the sum of that year's capital expenditure and OCM depreciation. • **Additional GRC**: Additional capex for the previous years is multiplied by the current year's asset price change and the added to the current year's

	additional capex. • **Additional OCM Depreciation**: Additional GRC for each year is divided by the component asset life. • **Cumulative Additional OCM Depreciation**: Additional OCM for the previous year is multiplied by the current year's asset price change and the added to the current year's additional OCM. • **Additional NRC**: This is the additional GRC minus the cumulative additional OCM for each year. • **Total GRC**: For base and historical year, this is equal to the steady state GRC. For the future years this is the sum of the steady state GRC and the additional GRC for each year. • **Additional Capex**: Total GRC for the previous year is multiplied by the asset price change, the component volume change rate and the AVE for each component. • **Total Capital Expenditure**: For the base and historical years, this is equal to the capital expenditure. For future years, Capex (steady state) is summed with Additional Capex. • **Total OCM Depreciation**: For the base and historical year, this is equal to the OCM Depreciation (steady state) (see earlier Figure 4.27). For the future years this is the sum of the OCM Depreciation (Steady state) and Additional OCM. • **Total NRC**: For base and historical year, this is equal to the NRC (steady state). For the future years this is the sum of the steady state NRC and the additional NRC for each year. If the calculated value is negative, a value of 1% is used in the Cost Model. • **NCA (steady state)**: For base and historical years, data are linked from the capital costs sheets. For the future years, the base year data NCA value is used. The input data from BT were stated as GBP million. The Cost Model treats inputs as GBP thousands as we believe the units to have been incorrectly labelled. • **Total Return on Capital**: For each year this is the sum of the Total NCA and the Total NRC multiplied by the nominal WACC. • **Total Holding Loss/(Gain)**: For the base and historical year, the sum of the holding loss and CCA adjustment is as submitted in the capital costs sheets. For the future years it is the total NRC for that year multiplied by the asset price change. • **Total capital cost**: Figure is calculated as the sum of Total OCM depreciation, Total Return on Capital and Total Holding Loss/(Gain). • **Unit Capital Cost**: For each component and each year, this is the total capital cost divided by the number of components for that year.

Figure 4.24: Description of cable RAV model worksheet [Source: Analysys Mason, 2013]

Cable RAV model	
Purpose	Reformat of Ofcom RAV model cable inputs
Precedent sheets	None (data reference sheets only)
Dependent sheets	Cable RAV adjustment
Key functions	Reproduction of the pertinent years of the copper RAV model
Specific comments	GRC, NRC and OCM are calculated for cable as an asset class in total, pre-1997 and post-1997 terms. Where necessary these calculations are active, but where possible the data are hardcoded for the sake of simplicity.

Figure 4.25: Description of cable RAV adjustment worksheet [Source: Analysys Mason, 2013]

Cable RAV adjustment	
Purpose	Component-allocated RAV copper adjustments as outputs for the Cost Model
Precedent sheets	Capital costs 11–12, Cable RAV model
Dependent sheets	Unit capital costs (RAV)
Key functions	Calculation of the percentage of the copper RAV value apportioned annually for the forecast years to components *CL171 E side copper capital* and *CL173 D side copper capital*, based on 2011/12 for GRC, NRC and operating capital maintenance (OCM) depreciation
Specific comments	For each year of the charge controls, the RAV values for GRC, NRC and OCM are apportioned to components using the weighting of each component as a portion of the total value for cable as an asset class for each cost category in the base year.

Figure 4.26: Description of duct RAV model worksheet [Source: Analysys Mason, 2013]

Duct RAV model	
Purpose	Reformat of Ofcom RAV model duct inputs
Precedent sheets	None (data reference sheets only)
Dependent sheets	Duct RAV adjustment
Key functions	Reproduction of the pertinent years of the duct RAV model
Specific comments	GRC, NRC and OCM are calculated for duct as an asset class in total, pre-1997 and post-1997 terms. Where necessary these calculations are active, but where possible the data are hardcoded for the sake of simplicity.

Figure 4.27: Description of duct RAV adjustment worksheet [Source: Analysys Mason, 2013]

Duct RAV adjustment	
Purpose	Component-allocated RAV duct adjustments as outputs for the Cost Model
Precedent sheets	Capital costs 11–12, Duct RAV model
Dependent sheets	Unit capital costs (RAV)
Key functions	Calculation of the percentage of the duct RAV value apportioned annually for the forecast years to components *CL171 E side copper capital* and *CL173 D side copper capital*, based on 2011/12 values for GRC, NRC and OCM
Specific comments	For each year of the charge controls, the RAV values for GRC, NRC and OCM are apportioned to components using the weighting of each component as a portion of the total value for duct as an asset class for each cost category in the base year.

Figure 4.28: Description of capital costs 11–12 (RAV %) worksheet [Source: Analysys Mason, 2013]

Capital costs 11–12 (RAV %)	
Purpose	Cost category weightings for copper and duct asset type calculations
Precedent sheets	Capital costs 11–12, Unit capital costs, Usage factor future
Dependent sheets	Unit capital costs (RAV)
Key functions	Calculation of the percentage of each component cost category value comprised of all asset types minus cable and duct, for use in supplementing the cable and duct CCA values with RAV values
Specific comments	None

Figure 4.29: Description of unit capital costs (RAV) worksheet [Source: Analysys Mason, 2013]

Unit capital costs (RAV)	
Purpose	Component-allocated RAV copper adjustments as outputs for the Cost Model
Precedent sheets	Parameters, Component volume growth, Capital costs 11–12, Cable RAV adjustment, Duct RAV adjustment, Capital costs 11–12 (RAV %), Unit capital costs
Dependent sheets	Product costs
Key functions	The total unit component capital costs calculated on the 'Unit capex' sheet are replaced with RAV equivalent values for components *CL171 E side copper capital* and *CL173 D side copper capital*

Unit capital costs (RAV)	
Specific comments	The majority of these calculations are simply linked for the 'unit capex' sheet. Those that are not are detailed below. • **OCM Depreciation**: For cable and duct asset types, values are calculated as the asset apportionment total (see Figure 4.14) multiplied by the asset OCM RAV adjustment value. • **GRC (steady state)**: CCA value is multiplied by the proportion of the GRC that is allocated to assets other than cable and duct in the base year. It then adds the product of the asset apportionment total (see Figure 4.14) and the asset GRC RAV adjustment value for each of the asset types. • **OCM Depreciation (steady state)**: The CCA value is multiplied by the proportion of the OCM that is allocated to assets other than cable and duct in the base year. The resulting figure is then added to the product of the asset apportionment total and the asset OCM RAV adjustment value for each of the asset types. • **NRC (steady state)**: The CCA value is multiplied by the proportion of the NRC that is allocated to assets other than cable and duct in the base year. The resulting figure is then added to the product of the asset apportionment total and the asset NRC RAV adjustment value for each of the asset types.

Figure 4.30: Description of opex 11–12 worksheets [Source: Analysys Mason, 2013]

Opex 11–12	
Purpose	Component opex costs for 2011/12 as provided for reference by Openreach
Precedent sheets	Data ref sheet 2
Dependent sheets	Unit opex
Key functions	Calculation of total component opex for 2011/12
Specific comments	For the 11–12 year data, a number of manual adjustments have been made to the input data. The description for this and the reasoning is provided in Section 5.4.

Figure 4.31: Description of CVE scenarios worksheet [Source: Analysys Mason, 2013]

CVE scenarios	
Purpose	This sheet provides Ofcom's values for CVEs. Users can also add their own CVE inputs
Precedent sheets	None (data reference sheets only)
Dependent sheets	Unit opex
Key functions	The selection of CVE data is made using the control panel
Specific comments	None

Figure 4.32: Description of unit opex worksheet [Source: Analysys Mason, 2013]

Unit opex	
Purpose	Cost Model calculation of total component unit operational maintenance
Precedent sheets	Parameters, Component volume growth, Unit opex 11–12, CVE scenarios

Dependent sheets	Product costs
Key functions	Calculation of total component unit opex costs. Named ranges are created for all of the forecast cost categories for simplification of calculation
Specific comments	A discussion of the specific adjustments to this sheet can be found in Section 5.4 Each of blocks on the sheet are described below: • **CVEs, pay and non-pay**: The CVEs selected for the modelled scenario. • **Sensitivity inputs**: The annual opex efficiency gain figures are listed here. • **Factor price changes, efficiency adjusted**: This multiplies the chosen pay and non-pay factor price changes by the efficiency gain. • **Opex, pay**: For base and historical years, data are linked to the opex costs sheets. For the future years, the value for the previous year is multiplied by the efficiency-adjusted pay factor price change, the product of the component volume growth rate and the pay CVE. • **Opex, non-pay**: For base and historical years, data are linked to the opex costs sheets as described. For future years, the value for the previous year is multiplied by the efficiency-adjusted non-pay factor price change, the product of the component volume growth rate and the non-pay CVE. • **Total opex**: Calculated as the sum of the pay and non-pay opex. • **Unit opex**: For each component, total opex is divided by the number of components.

Figure 4.33: Description of product costs worksheet [Source: Analysys Mason, 2013]

Product costs	
Purpose	Component cost stacks and total product costs
Precedent sheets	Usage factors11–12, Usage factor future, Unit capital costs, Unit capital costs (RAV), Unit opex
Dependent sheets	LRIC adjust, single migrations; Product cost scenarios
Key functions	Forecast component cost stacks and total product costs are calculated here
Specific comments	Adjustments to LLU Line test systems are discussed in section 5.5 Each of the blocks on the sheet are described below: • **Total unit costs**: For historical and base years, total unit cost is the sum of the unit capex and unit opex for each component. For future years, the input of capex will come either from the CCA or RAV calculations, depending upon the selected scenario. • **Total unit cost per year**: Total unit cost per year transposes Total unit cost data per component for use in the total cost per product calculation. • **Total cost per product:** Total cost per product is calculated for each year as the sum of the product of the usage factors and the total annual unit costs for each component. In the block ‘Annual cost stacks’ a drop down menu in column E can be used to select a product. The grouped data in the rows above this contain the underlying data and calculations for this drop down menu.

Figure 4.34: Description of Total SMPF volume scenarios worksheet [Source: Analysys Mason, 2013]

Total SMPF volume scenarios	
Purpose	Data inputs for SMPF product volume forecast scenarios
Precedent sheets	Data ref sheet 1a, Control panel
Dependent sheets	LRIC adjust, rentals; LRIC adjust bulk migrations; LRIC adjust, single migrations
Key functions	Lists Ofcom SMPF volume forecast scenarios and provides space for alternative user scenarios
Specific comments	None

Figure 4.35: Description of Total MPF volume scenarios worksheet [Source: Analysys Mason, 2013]

Total MPF volume scenarios	
Purpose	Data inputs for MPF product volume forecast scenarios
Precedent sheets	Data ref sheet 1b, Control panel
Dependent sheets	X (MPF, SMPF baskets), X (Co-Mingling basket)
Key functions	Lists Ofcom SMPF volume forecast scenarios and provides space for alternative user scenarios
Specific comments	None

Figure 4.36: Description of LRIC adjust, single migrations worksheet [Source: Analysys Mason, 2013]

LRIC adjust, single migrations	
Purpose	LRIC:FAC ratio adjustments for single migration, connection and conversion products
Precedent sheets	Parameters, Product volumes, Product costs
Dependent sheets	LRIC adjust, rentals
Key functions	Calculation of the adjustment to the Cost Model output for the selected products based on the pre-determined LRIC:FAC ratio
Specific comments	The FAC cost for the new products *WLR + SMPF simultaneous provides* and *WLR conversions* are based on a set addition to the FAC cost of *MPF single migrations* and *SMPF new provides*

Figure 4.37: Description of LRIC adjust, bulk migrations worksheet [Source: Analysys Mason, 2013]

LRIC adjust, bulk migrations	
Purpose	LRIC:FAC ratio adjustments for bulk migration products
Precedent sheets	Parameters, Product volumes, Product costs
Dependent sheets	LRIC adjust, rentals
Key functions	Calculation of the adjustment to the Cost Model output for the selected products based on the pre-determined LRIC:FAC ratio
Specific comments	None

Figure 4.38: Description of LRIC adjust, transfers worksheet [Source: Analysys Mason, 2013]

LRIC adjust, transfers	
Purpose	LRIC:FAC ratio adjustments for transfer products
Precedent sheets	Parameters, Product volumes, Product costs
Dependent sheets	LRIC adjust, rentals
Key functions	Calculation of the adjustment to the Cost Model output for the selected products based on the pre-determined LRIC:FAC ratio
Specific comments	None

Figure 4.39: Description of LRIC adjust, rentals worksheet [Source: Analysys Mason, 2013]

LRIC adjust, rentals	
Purpose	LRIC:FAC ratio adjustment for rental products and common cost redistribution
Precedent sheets	Parameters, Product volumes, Product costs; LRIC adjust, single migrations; LRIC adjust, bulk migrations; LRIC adjust, transfer; LRIC adjust, rentals
Dependent sheets	Product cost scenarios
Key functions	Calculation of the adjustment to the Cost Model output for the selected products based on the pre-determined LRIC:FAC ratio, as well as redistribution of the common costs
Specific comments	This sheet also contains a cross-check to ensure all costs have been captured correctly from the calculations across the ‘LRIC adjust’ sheets

Figure 4.40: Description of LRIC adjust, connections worksheet [Source: Analysys Mason, 2013]

LRIC adjust, connections	
Purpose	LRIC:FAC ratio adjustment for connection products
Precedent sheets	Parameters, Product volumes, Product costs
Dependent sheets	Product cost scenarios
Key functions	Calculation of the adjustment to the Cost Model output for the selected products based on the pre-determined LRIC:FAC ratio, as well as redistribution of the common costs
Specific comments	This sheet also contains a cross-check to ensure all costs have been captured correctly from the calculations across the 'LRIC adjust' sheets

Figure 4.41: Description of product cost scenarios worksheet [Source: Analysys Mason, 2013]

Product cost scenarios	
Purpose	Total product cost calculations as outputs
Precedent sheets	Parameters, Product costs; LRIC adjust, single migrations; LRIC adjust, bulk migrations; LRIC adjust, transfer; LRIC adjust, rentals
Dependent sheets	X (products)
Key functions	Compiled here are the data sets for the *LRIC:FAC cost ratios* scenarios, created as named ranges for selection of the final product cost outputs used for the calculation of X-values
Specific comments	None

Figure 4.42: Description of X (Products) worksheet [Source: Analysys Mason, 2013]

X (products)	
Purpose	Calculation of CPI-X values
Precedent sheets	Parameters, Products & components, Product cost scenarios
Dependent sheets	None
Key functions	Calculations of the X values for the final CPI-X determinations
Specific comments	Adjustments to the 2013/14 are discussed in section 5

Figure 4.43: Description of X (MPF, SMPF baskets) worksheet [Source: Analysys Mason, 2013]

X (MPF, SMPF baskets)	
Purpose	Calculation of CPI-X values for the SMPF and MPF ancillary baskets
Precedent sheets	Total SMPF volume scenarios, Total MPF volume scenarios, Product cost scenarios, X (products)
Dependent sheets	None
Key functions	Calculations of the X values for the final CPI-X determinations
Specific comments	This sheet also contains a cross-check to ensure that the sub-cap on each and

	every charge in the MPF/SMPF ancillary baskets is below a certain threshold (computed with base on projected DSAC information).

Figure 4.44: Description of X (Co-Mingling basket) worksheet [Source: Analysys Mason, 2013]

X (Co-Mingling basket)	
Purpose	Calculation of CPI-X value for the Co-Mingling basket
Precedent sheets	Total SMPF volume scenarios, Total MPF volume scenarios, Product cost scenarios, X (products)
Dependent sheets	None
Key functions	Calculations of the X values for the final CPI-X determinations
Specific comments	This sheet also contains a cross-check to ensure that the sub-cap on each and every charge in the Co-Mingling basket is below a certain threshold (computed with base on projected DSAC information).

Figure 4.45: Description of X (Products) ACTUAL worksheet [Source: Analysys Mason, 2013]

X (products) ACTUAL	
Purpose	Calculation of CPI-X values, based on the costs calculated in the unredacted full version of the model
Precedent sheets	Parameters, Products & components, Product cost scenarios
Dependent sheets	None
Key functions	Calculations of the X values for the final CPI-X determinations
Specific comments	Adjustments to the 2013/14 are discussed in section 5

Figure 4.46: Description of X (MPF, SMPF baskets) ACTUAL worksheet [Source: Analysys Mason, 2013]

X (MPF, SMPF baskets) ACTUAL	
Purpose	Calculation of CPI-X values for the SMPF and MPF ancillary baskets, based on the costs calculated in the unredacted full version of the model
Precedent sheets	Total SMPF volume scenarios, Total MPF volume scenarios, Product cost scenarios, X (products)
Dependent sheets	None
Key functions	Calculations of the X values for the final CPI-X determinations
Specific comments	This sheet also contains a cross-check to ensure that the sub-cap on each and every charge in the MPF/SMPF ancillary baskets is below a certain threshold (computed with base on projected DSAC information).

Figure 4.47: Description of X (Co-Mingling basket) ACTUAL worksheet [Source: Analysys Mason, 2013]

X (Co-Mingling basket) ACTUAL	
Purpose	Calculation of CPI-X value for the Co-Mingling basket, based on the costs calculated in the unredacted full version of the model
Precedent sheets	Total SMPF volume scenarios, Total MPF volume scenarios, Product cost scenarios, X (products)
Dependent sheets	None
Key functions	Calculations of the X values for the final CPI-X determinations
Specific comments	This sheet also contains a cross-check to ensure that the sub-cap on each and every charge in the Co-Mingling basket is below a certain threshold (computed with base on projected DSAC information).

5 Cost Model adjustments

An important aim in developing this Cost Model was to make it transparent for the user. This section of the document provides a more detailed description of any specific adjustments that have been made to inputs or outputs in the Cost Model. Where data have been adjusted, this section of document explains what has been done and the rationale for the adjustment.

5.1 Usage factor scenarios

Usage factors in the model differ in Ofcom's inputs from the Openreach 2011/12 data (e.g. E-side current is 1.05 compared to 1.20). The reasons for the Ofcom adjustments are set out in Section 6 and Annex 13 of the consultation document.

5.2 Adjustments to Capital costs 2011-12

There are a number of adjustments to capital costs:

- Adjustment to 2011/12 asset lives to include an asset life and depreciation for those assets where an asset has a 2011/12 value but no depreciation.
- Adjustment to 2011/12 NRC value for 'PSTN Line Cards' to GBP11. As set out in Section 6 of the consultation document Ofcom proposes to uplift the NRC of Linecards to ensure that the FAC cost if GBP11 in 2011/12 as a proxy for steady state.
- Adjustment to 2011/12 'Local exchange general frames current' asset life to derive a 40-year average life. Ofcom would not expect asset lives of any of the components to exceed the longest asset life for a sector (i.e. duct at 40 years). There are three cost components where the weighted average asset life is greater than 40. These are:
  - Pair gain
  - Linecards
  - Local exchange general frames capital.

Ofcom makes a separate adjustment for linecards costs to replicate a steady state, therefore does not propose to adjust the linecard asset lives.

Ofcom does not consider that in a steady state copper network that serves voice and broadband customers, there would be ongoing expenditure on DACs. Ofcom does not propose to adjust the asset life for Pair Gain, which is consistent with its approach to not adjust the usage factor for WLR rentals E-side and D-side copper capital services.

5.2.1 Constraint on Total NRC

A constraint on NRC values has been applied so that a negative value is replaced with 1% of GRC value. Ofcom considers that assets carrying traffic have an economic value so this is reflected through this constraint.

5.3 Adjustments to Opex 2011–12

There are a number of adjustments to operating costs:

- Removal of negative operating costs, as Ofcom does not consider these are appropriate for forecasting costs forward to 2016/17.
- Adjustment to 2011/12 operating costs to ensure the starting place closely reconciles to the 2011/12 RFS (this is explained in Section 6 of the consultation document).
- As no usage factors are supplied for the component CF189 EVOTAM Testing Systems, to include these costs in the Cost Model they have been added to the values for CF187 LLU Line Testing Systems for each cost category.

5.3.1 CF189 EVOTAM capital costs

As CF189 EVOTAM testing systems capital costs have already been added to those for CF187 LLU line testing systems in the Cost Model inputs, any values for EVOTAM on the Opex 2011-12 sheet have been set to 0 to avoid double counting.

5.4 Adjustments to Product costs

5.4.1 LLU line testing costs

In line with Ofcom's proposed adjustment to broadband line testing costs, the Cost Model shows an adjustment to final product costs in each year which sets the broadband line testing costs to GBP3.77 for both MPF and SMPF rentals. This is explained in Section 6 and Annex 13 of the consultation document.

5.5 Adjustments to X-factor calculation for WLR for printed directory costs

As Ofcom proposes to remove printed directory costs from the WLR charge immediately from when the WLR charge controls take effect from 1 April 2014, there is a separate calculation for the glide path for WLR charges in the X (products) sheet.

5.6 Total SMPF volume scenarios

The costs provided by BT relate to total WFAEL and external-only WLA services. This means that in order to generate unit costs, the Cost Model should use total WFAEL and external-only WLA services (i.e. the Cost Model does not include volumes for internal SMPF services). In order to generate FACs, the Cost Model uses external-only SMPF data (this also applies to MPF tie cables). However, when calculating any adjustments for LRIC pricing or calculating basket Xs, we use the total volumes. This is explained in detail in Annex 13 of the consultation document and can be adjusted on the 'Total SMPF volume scenarios' sheet.

Annex A Glossary

- **Asset volume elasticity (AVE)**: The percentage increase in capital costs required for a 1% increase in volume.
- **BT**: British Telecommunications plc.
- **Charge control**: A control which sets the maximum price that a communication provider can charge for a particular product or service.
- **Class of work (CoW)**: The general ledger account coding system employed by Openreach.
- **Common costs**: Costs which are shared between two or more of the services supplied by a firm.
- **Consumer price index (CPI)**: The official measure of inflation of consumer prices of the UK by the ONS.
- **Costs volume elasticity (CVE)**: The percentage increase in operating costs for a 1% increase in volume.
- **Current cost accounting (CCA)**: An accounting convention, where assets are valued and depreciated according to their current replacement cost whilst maintaining the operating or financial capital of the business entity.
- **Dropwire**: The part of the network that uses a copper line from the distribution point to and including the PSTN network terminating equipment (NTE).
- **Ducts**: Underground pipes which hold copper and fibre lines.
- **Fully allocated cost (FAC)**: An accounting approach under which all the costs of the company are distributed between its various products and services. The fully allocated cost of a product or service may therefore include some common costs that are not incremental to the service.
- **General Building Cost Index (GBCI)**: A national index that measures the cost of construction works, including materials and labour. The GBCI is published by the Building Cost Information Service (BCIS), a service of the Royal Institute of Chartered Surveyors. Information on the GBCI and the GBCI data, including 5-year forecasts, are available from BCIS at http://www.bcis.co.uk/.
- **Gross replacement cost (GRC)**: The cost of replacing an existing tangible fixed asset with an identical or substantially similar new asset having a similar production or service capacity.
- **Historic cost accounting (HCA)**: A method of accounting under which assets and liabilities are recorded at the values at which they were first acquired.

- **Incremental costs**: Those costs which are directly caused by the provision of that service in addition to the other services which the firm also produces. Another way of expressing this is that the incremental costs of a service are the difference between the total costs in a situation where the service is provided and the costs in another situation where the service is not provided.

- **Local loop**: The access network connection between the customer's premises and the local serving exchange, usually comprised of two copper wires twisted together.

- **Local loop unbundling (LLU)**: A process by which a dominant provider's local loops are physically disconnected from its network and connected to a competing provider's networks. This enables operators other than the incumbent to use the local loop to provide services directly to customers.

- **Long run incremental cost (LRIC)**: The cost caused by the provision of a defined increment of output given that costs can, if necessary, be varied in the long-run and that some level of output is already produced.

- **Main distribution frame (MDF)**: An internal wiring frame where copper access network cables are terminated and cross connected to exchange equipment by flexible wire jumpers.

- **Metallic path facilities (MPF)**: The provision of access to the copper wires from the customer premises to a BT MDF that covers the full available frequency range, including both narrowband and broadband channels, allowing a competing provider to provide the customer with both voice and/or data services over such copper wires.

- **Net replacement cost (NRC)**: Gross replacement cost less accumulated depreciation based on gross replacement cost.

- **Operating capability maintenance (OCM depreciation)**: The maintenance of an entity's operational capability (i.e. the capacity to produce goods and services) when determining the profitability of an entity. OCM depreciation is calculated as the sum of CCA depreciation and HCA depreciation.

- **Ofcom**: The Office of Communications.

- **ONS**: The Office for National Statistics.

- **Openreach**: The access division of BT established by Undertakings in 2005.

- **PSTN switch**: A public switched telephone network switch that terminates a customer's telephone line and connects a customer's telephone call to other PSTN switches so that the telephone call reaches the intended destination.

- **Public switched telecommunications network (PSTN)**: The conventional telephony network used to provide telephone calls using circuit-switching.

- **RAV adjustment**: An adjustment to the regulatory asset valuation of the pre-1997 assets to historic cost accounting.

- **RAV model**: This model calculates the forecast asset values and depreciation, for Copper and Duct. The model also applies a regulatory adjustment (the RAV adjustment) previously applied by Ofcom.

- **Regulatory asset value (RAV)**: The value ascribed by Ofcom to the copper and duct capital employed in the relevant licensed business.

- **Regulatory financial statements (RFS)**: The financial statements that BT is required to prepare and publish by Ofcom.

- **Return on capital employed (ROCE)**: The ratio of accounting profit to capital employed. The measure of capital employed can be either Historic Cost Accounting (HCA) or Current Cost Accounting (CCA).

- **Retail price index (RPI)**: A measure of inflation published monthly by the ONS. It measures the change in the cost of a basket of retail goods and services.

- **Shared metallic path facility (SMPF)/shared access**: The provision of access to the copper wires from the customer's premises to a BT MDF that allows a competing provider to provide the customer with broadband services, while narrowband communications continue to be carried on BT's PSTN (access to which is provided by WLR) .

- **Significant market power (SMP)**: The significant market power test is set out in European Directives. It is used by National Regulatory Authorities (NRAs), such as Ofcom, to identify those CPs who must meet additional obligations under the relevant Directives.

- **Weighted average cost of capital (WACC)**: The rate that a company is expected to pay on average to all its security holders to finance its assets.

- **Wholesale fixed analogue exchange line (WFAEL)**: The provision of wholesale analogue voice services using BT or KCOM's existing voice infrastructure.

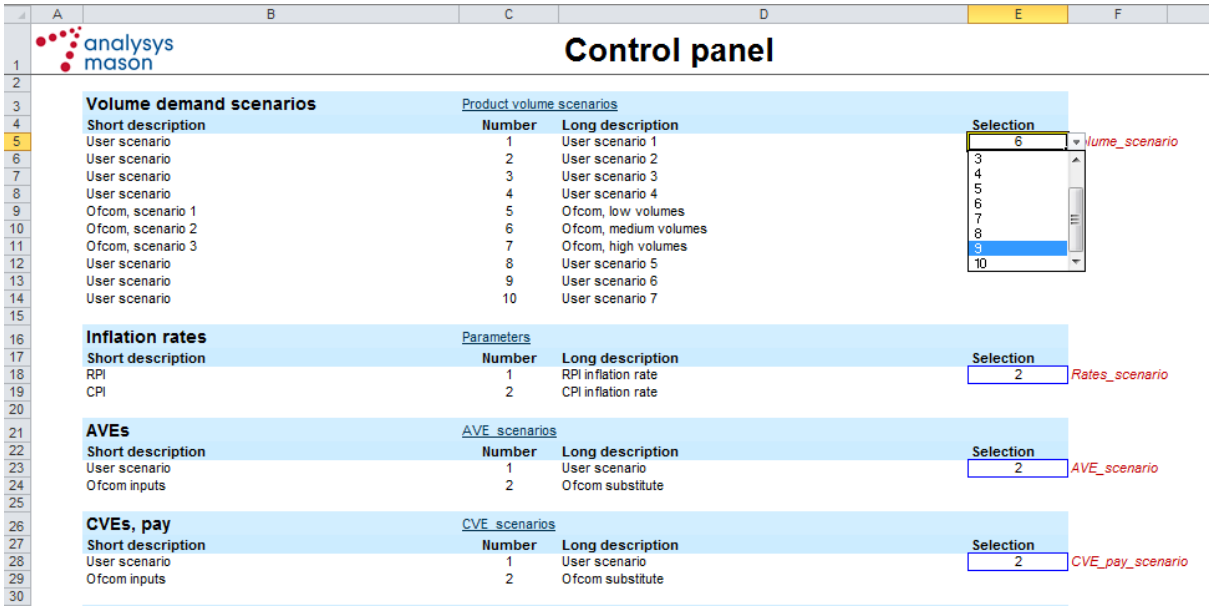
- **Wholesale line rental (WLR)**: The service offered by BT to other UK communications providers to enable them to offer retail line rental services in competition with BT's own retail services.

Annex B Modelling examples

The purpose of this annex is to provide illustrated examples of some of the functions and inputs of the Cost Model that may be adjusted and altered by the user.

B.1 Control panel

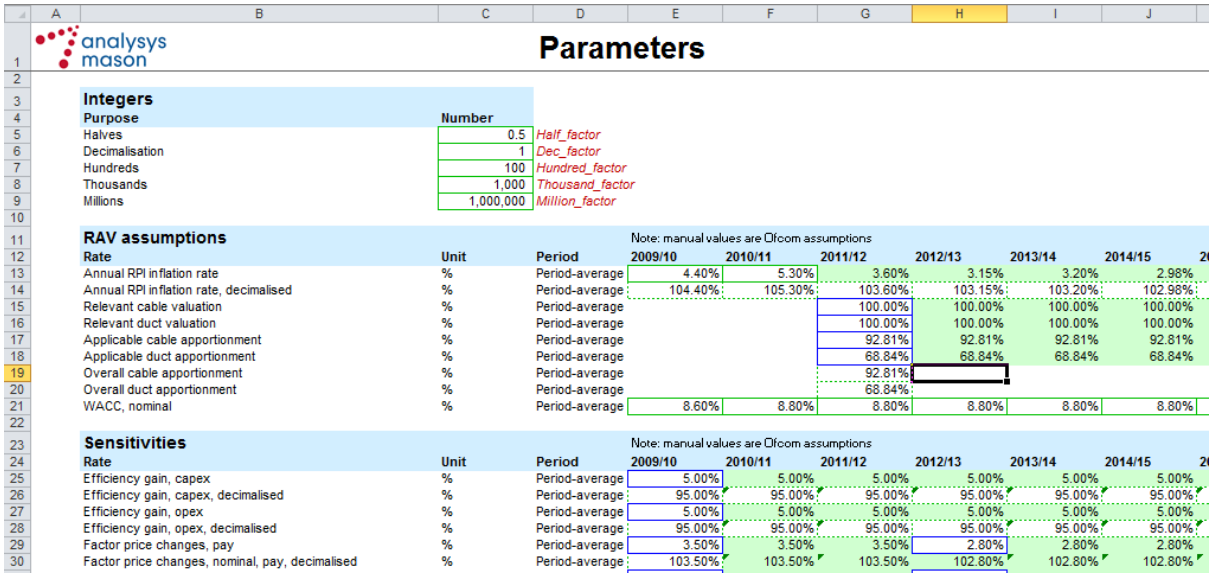
Figure 5.1: The 'Control panel' worksheet, showing the selection of scenarios [Source: Analysys Mason, 2013]



The screen shot in Figure 5.1 has been captured from the 'Control panel' worksheet. The blue-bordered cells in column E house the selection criteria employed by the Cost Model. These numbers correspond to the scenario lists in column C and are chosen using a drop-down menu, e.g., selecting '5' instead of '6' in the 'Volume demand scenarios' selection cell, will switch the volume input data for the Cost Model from 'Ofcom, medium volumes', to 'Ofcom, low volumes'.

B.2 Parameters

Figure 5.2: The 'Parameters' worksheet, showing adjustable sensitivities [Source: Analysys Mason, 2013]



analysys mason

Parameters

Integers

Purpose	Number	
Halves	0.5	*Half_factor*
Decimalisation	1	*Dec_factor*
Hundreds	100	*Hundred_factor*
Thousands	1,000	*Thousand_factor*
Millions	1,000,000	*Million_factor*

RAV assumptions

Note: manual values are Ofcom assumptions

Rate	Unit	Period	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15
Annual RPI inflation rate	%	Period-average	4.40%	5.30%	3.60%	3.15%	3.20%	2.98%
Annual RPI inflation rate, decimalised	%	Period-average	104.40%	105.30%	103.60%	103.15%	103.20%	102.98%
Relevant cable valuation	%	Period-average			100.00%	100.00%	100.00%	100.00%
Relevant duct valuation	%	Period-average			100.00%	100.00%	100.00%	100.00%
Applicable cable apportionment	%	Period-average			92.81%	92.81%	92.81%	92.81%
Applicable duct apportionment	%	Period-average			68.84%	68.84%	68.84%	68.84%
Overall cable apportionment	%	Period-average			92.81%			
Overall duct apportionment	%	Period-average			68.84%			
WACC, nominal	%	Period-average	8.60%	8.80%	8.80%	8.80%	8.80%	8.80%

Sensitivities

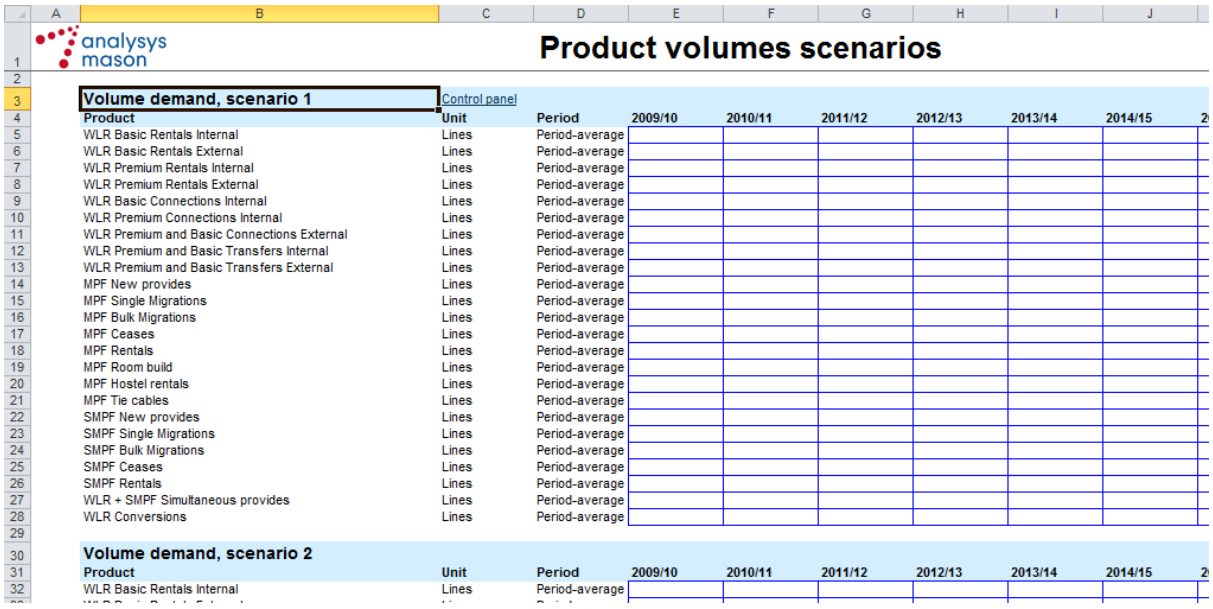
Note: manual values are Ofcom assumptions

Rate	Unit	Period	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15
Efficiency gain, capex	%	Period-average	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%
Efficiency gain, capex, decimalised	%	Period-average	95.00%	95.00%	95.00%	95.00%	95.00%	95.00%
Efficiency gain, opex	%	Period-average	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%
Efficiency gain, opex, decimalised	%	Period-average	95.00%	95.00%	95.00%	95.00%	95.00%	95.00%
Factor price changes, pay	%	Period-average	3.50%	3.50%	3.50%	2.80%	2.80%	2.80%
Factor price changes, nominal, pay, decimalised	%	Period-average	103.50%	103.50%	103.50%	102.80%	102.80%	102.80%

The screenshot in Figure 5.2 has been captured from the 'Parameters' worksheet. The blue-bordered cells indicate where users may input their own alternate values for certain sensitivities in order to vary the resultant outputs of the Cost Model. As all calculations throughout the model that employ these calculations refer back to the named ranges on this worksheet, applying a change to these cells will run that change throughout the model.

B.3 Product volumes

Figure 5.3: The 'Product volume' sheet, showing space for alternative volumes [Source: Analysys Mason, 2013]



analysys mason

Product volumes scenarios

Volume demand, scenario 1 Control panel

Product	Unit	Period	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15
WLR Basic Rentals Internal	Lines	Period-average						
WLR Basic Rentals External	Lines	Period-average						
WLR Premium Rentals Internal	Lines	Period-average						
WLR Premium Rentals External	Lines	Period-average						
WLR Basic Connections Internal	Lines	Period-average						
WLR Premium Connections Internal	Lines	Period-average						
WLR Premium and Basic Connections External	Lines	Period-average						
WLR Premium and Basic Transfers Internal	Lines	Period-average						
WLR Premium and Basic Transfers External	Lines	Period-average						
MPF New provides	Lines	Period-average						
MPF Single Migrations	Lines	Period-average						
MPF Bulk Migrations	Lines	Period-average						
MPF Ceases	Lines	Period-average						
MPF Rentals	Lines	Period-average						
MPF Room build	Lines	Period-average						
MPF Hostel rentals	Lines	Period-average						
MPF Tie cables	Lines	Period-average						
SMPF New provides	Lines	Period-average						
SMPF Single Migrations	Lines	Period-average						
SMPF Bulk Migrations	Lines	Period-average						
SMPF Ceases	Lines	Period-average						
SMPF Rentals	Lines	Period-average						
WLR + SMPF Simultaneous provides	Lines	Period-average						
WLR Conversions	Lines	Period-average						

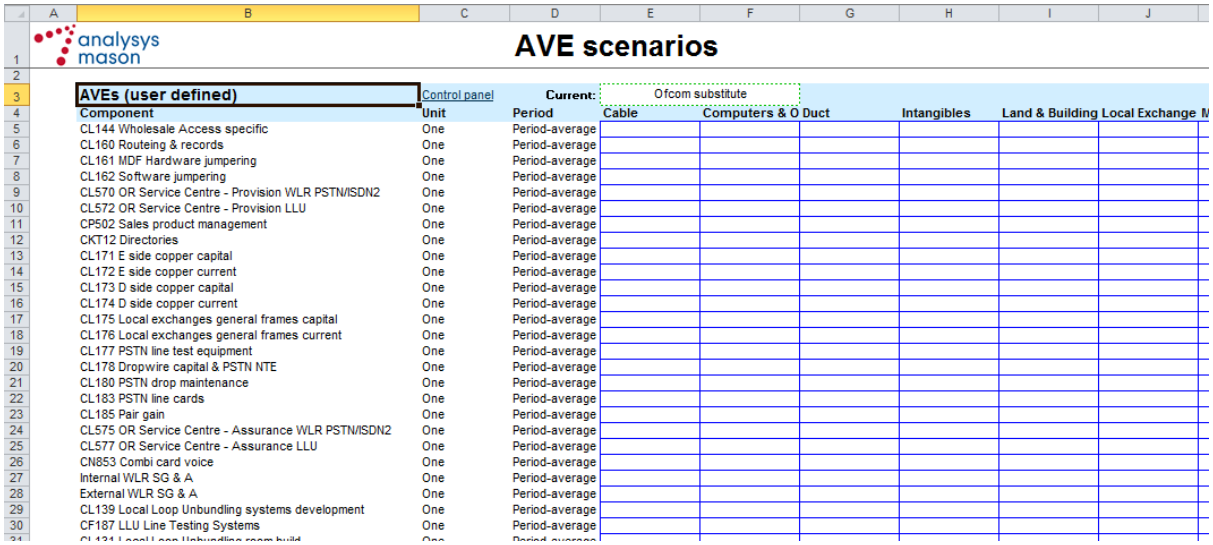
Volume demand, scenario 2

Product	Unit	Period	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15
WLR Basic Rentals Internal	Lines	Period-average						

The screenshot in Figure 5.3 above has been captured from the ‘Product volume scenarios’ sheet. The blank blue-bordered cells indicate where users may enter alternative values for product volume forecasts as data inputs to the Cost Model. There are seven such spaces on the sheet and once data have been entered, the ‘Control panel’ sheet is used to make it the effective input to the Cost Model calculations (see paragraph B.1).

B.4 AVE scenarios

Figure 5.4: The ‘AVE scenarios’ sheet, showing space for alternative AVE values [Source: Analysys Mason, 2013]



analysys mason

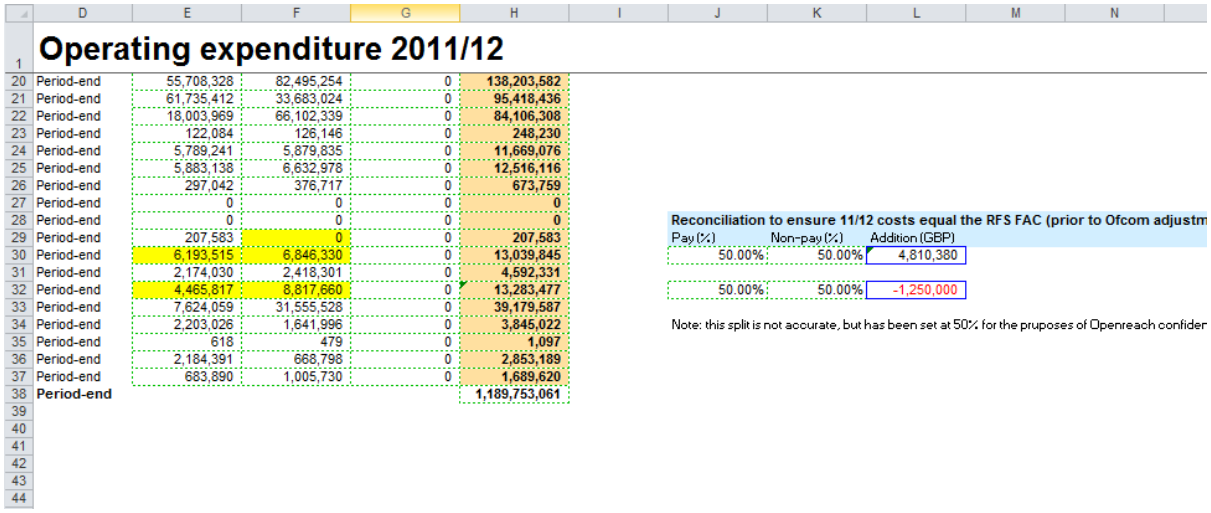
AVE scenarios

AVEs (user defined)	Control panel	Current:	Ofcom substitute						
Component	Unit	Period	Cable	Computers & O	Duct	Intangibles	Land & Building	Local Exchange	M
CL144 Wholesale Access specific	One	Period-average							
CL160 Routeing & records	One	Period-average							
CL161 MDF Hardware jumpering	One	Period-average							
CL162 Software jumpering	One	Period-average							
CL570 OR Service Centre - Provision WLR PSTN/ISDN2	One	Period-average							
CL572 OR Service Centre - Provision LLU	One	Period-average							
CP502 Sales product management	One	Period-average							
CKT12 Directories	One	Period-average							
CL171 E side copper capital	One	Period-average							
CL172 E side copper current	One	Period-average							
CL173 D side copper capital	One	Period-average							
CL174 D side copper current	One	Period-average							
CL175 Local exchanges general frames capital	One	Period-average							
CL176 Local exchanges general frames current	One	Period-average							
CL177 PSTN line test equipment	One	Period-average							
CL178 Dropwire capital & PSTN NTE	One	Period-average							
CL180 PSTN drop maintenance	One	Period-average							
CL183 PSTN line cards	One	Period-average							
CL185 Pair gain	One	Period-average							
CL575 OR Service Centre - Assurance WLR PSTN/ISDN2	One	Period-average							
CL577 OR Service Centre - Assurance LLU	One	Period-average							
CN853 Combi card voice	One	Period-average							
Internal WLR SG & A	One	Period-average							
External WLR SG & A	One	Period-average							
CL139 Local Loop Unbundling systems development	One	Period-average							
CF187 LLU Line Testing Systems	One	Period-average							

The screenshot in Figure 5.4 has been captured from the ‘AVE scenarios’ sheet. The empty blue-bordered cells can be used should the user wish to enter alternative AVEs to the Ofcom values in situ. If such changes are made, the ‘Control panel’ sheet can then be used to make the substitute AVEs effective inputs to the Cost Model calculations (see paragraph B.1).

B.5 2011/12 Opex adjustment for CF187 LLU Line Testing Systems and CL132 Local Loop Unbundling hostel rentals

Figure 5.5: The 'Opex 11-12' sheet value adjustments for CF187 and CL132 [Source: Analysys Mason, 2013]



Operating expenditure 2011/12

20	Period-end	55,708,328	82,495,254	0	**138,203,582**	
21	Period-end	61,735,412	33,683,024	0	**95,418,436**	
22	Period-end	18,003,969	66,102,339	0	**84,106,308**	
23	Period-end	122,084	126,146	0	**248,230**	
24	Period-end	5,789,241	5,879,835	0	**11,669,076**	
25	Period-end	5,883,138	6,632,978	0	**12,516,116**	
26	Period-end	297,042	376,717	0	**673,759**	
27	Period-end	0	0	0	**0**	
28	Period-end	0	0	0	**0**	
29	Period-end	207,583	0	0	**207,583**	
30	Period-end	6,193,515	6,846,330	0	**13,039,845**	
31	Period-end	2,174,030	2,418,301	0	**4,592,331**	
32	Period-end	4,465,817	8,817,660	0	**13,283,477**	
33	Period-end	7,624,059	31,555,528	0	**39,179,587**	
34	Period-end	2,203,026	1,641,996	0	**3,845,022**	
35	Period-end	618	479	0	**1,097**	
36	Period-end	2,184,391	668,798	0	**2,853,189**	
37	Period-end	683,890	1,005,730	0	**1,689,620**	
38	**Period-end**				**1,189,753,061**	

Reconciliation to ensure 11/12 costs equal the RFS FAC (prior to Ofcom adjustm

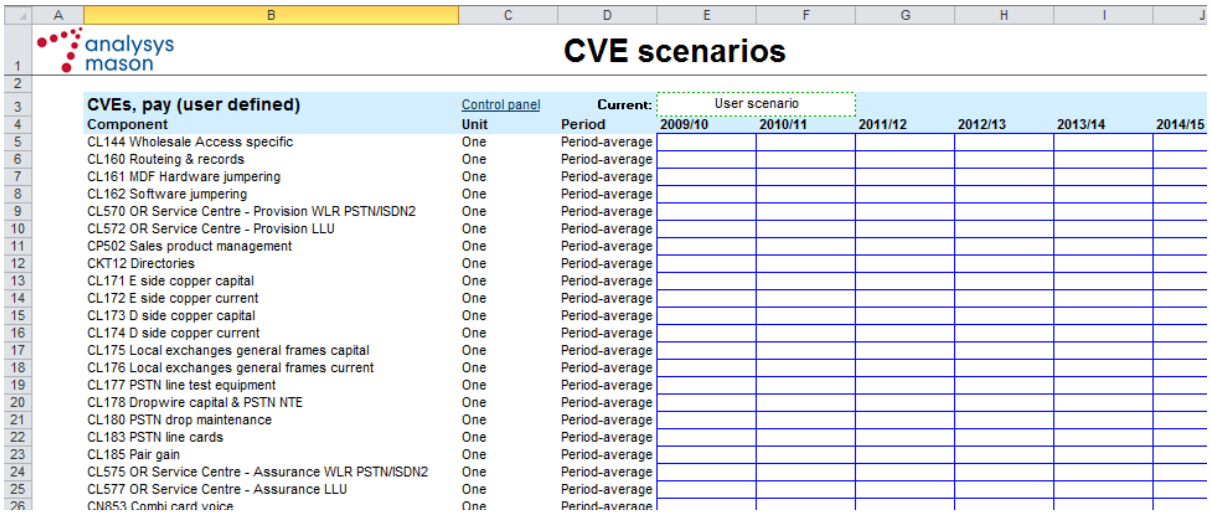
Pay (%)	Non-pay (%)	Addition (GBP)
50.00%	50.00%	4,810,380
50.00%	50.00%	-1,250,000

Note: this split is not accurate, but has been set at 50% for the pruposes of Openreach confider

The screenshot in Figure 5.5 has been captured from the 'Opex 11-12' worksheet. Ofcom has made adjustments to the pay and non-pay opex values for 2011/12 for the network components CF187 LLU Line Testing Systems and CL132 LLU hostel rentals. Although not designed as adjustable sensitivities for the Cost Model, the user may – if they wish – change the values for these adjustments by altering the contents of the blue-bordered cells.

B.6 CVE scenarios

Figure 5.6: The 'CVE scenarios' sheet, showing space for alternate CVE values [Source: Analysys Mason, 2013]



analysys mason

CVE scenarios

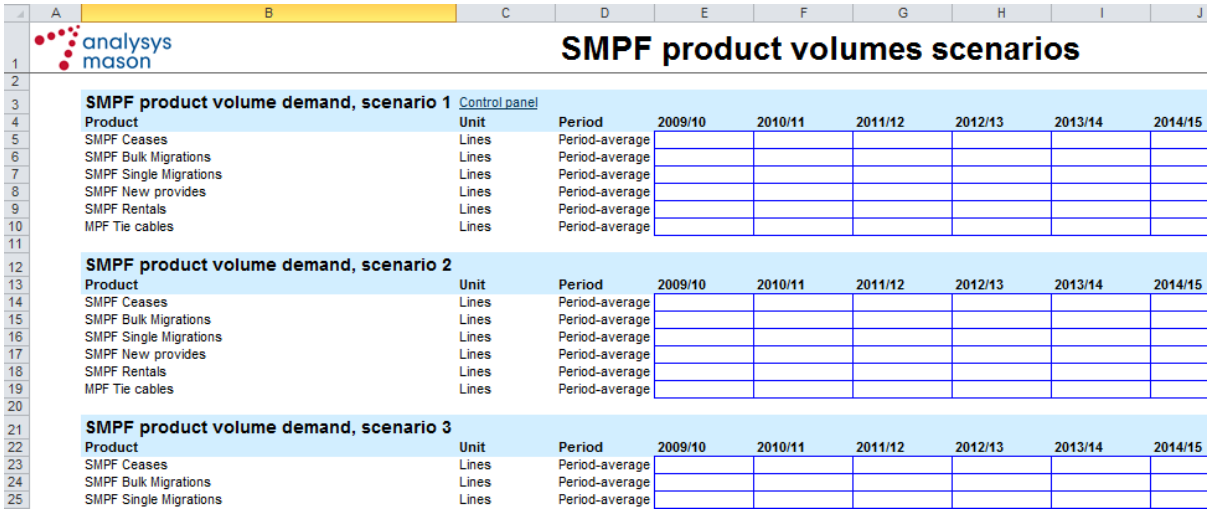
CVEs, pay (user defined)	Control panel	**Current:**	User scenario						
Component	**Unit**	**Period**	**2009/10**	**2010/11**	**2011/12**	**2012/13**	**2013/14**	**2014/15**
CL144 Wholesale Access specific	One	Period-average						
CL160 Routeing & records	One	Period-average						
CL161 MDF Hardware jumpering	One	Period-average						
CL162 Software jumpering	One	Period-average						
CL570 OR Service Centre - Provision WLR PSTN/ISDN2	One	Period-average						
CL572 OR Service Centre - Provision LLU	One	Period-average						
CP502 Sales product management	One	Period-average						
CKT12 Directories	One	Period-average						
CL171 E side copper capital	One	Period-average						
CL172 E side copper current	One	Period-average						
CL173 D side copper capital	One	Period-average						
CL174 D side copper current	One	Period-average						
CL175 Local exchanges general frames capital	One	Period-average						
CL176 Local exchanges general frames current	One	Period-average						
CL177 PSTN line test equipment	One	Period-average						
CL178 Dropwire capital & PSTN NTE	One	Period-average						
CL180 PSTN drop maintenance	One	Period-average						
CL183 PSTN line cards	One	Period-average						
CL185 Pair gain	One	Period-average						
CL575 OR Service Centre - Assurance WLR PSTN/ISDN2	One	Period-average						
CL577 OR Service Centre - Assurance LLU	One	Period-average						
CN853 Combi card voice	One	Period-average						

The screenshot in Figure 5.6 has been captured from the 'CVE scenarios' worksheet. The empty blue-bordered cells can be used should the user wish to enter alternative CVEs to the Ofcom values in situ.

If such changes are made, the 'Control panel' sheet can then be used to make the substitute CVEs effective inputs to the Cost Model calculations (see paragraph B.1).

B.7 Total SMPF volume scenarios

Figure 5.7: The 'Total SMPF volume scenarios' sheet, showing space for alternate SMPF volumes [Source: Analysys Mason, 2013]



analysys mason

SMPF product volumes scenarios

SMPF product volume demand, scenario 1	Control panel							
Product	Unit	Period	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15
SMPF Ceases	Lines	Period-average						
SMPF Bulk Migrations	Lines	Period-average						
SMPF Single Migrations	Lines	Period-average						
SMPF New provides	Lines	Period-average						
SMPF Rentals	Lines	Period-average						
MPF Tie cables	Lines	Period-average						

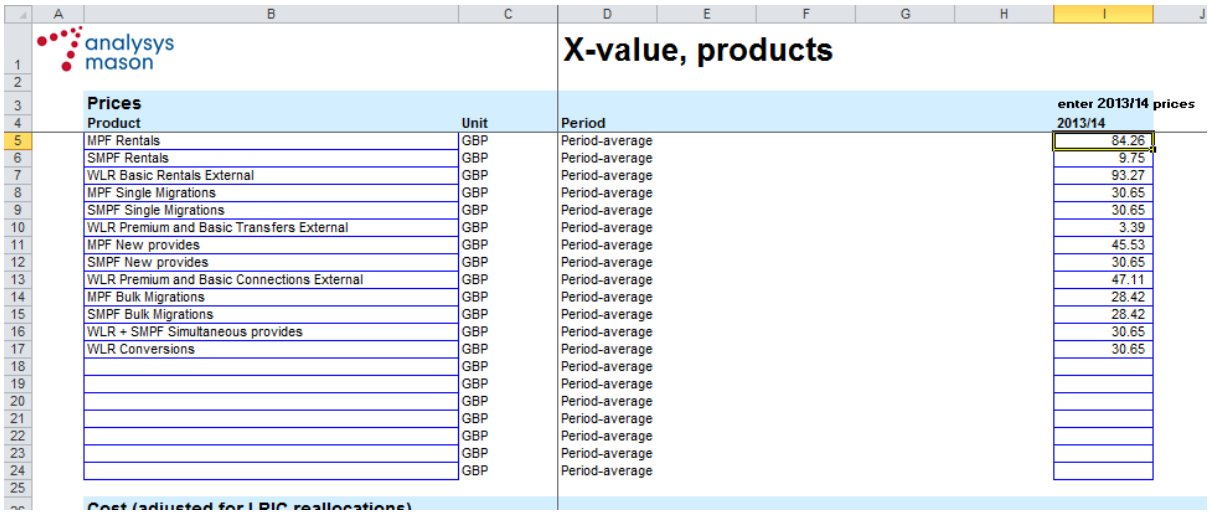
SMPF product volume demand, scenario 2								
Product	Unit	Period	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15
SMPF Ceases	Lines	Period-average						
SMPF Bulk Migrations	Lines	Period-average						
SMPF Single Migrations	Lines	Period-average						
SMPF New provides	Lines	Period-average						
SMPF Rentals	Lines	Period-average						
MPF Tie cables	Lines	Period-average						

SMPF product volume demand, scenario 3								
Product	Unit	Period	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15
SMPF Ceases	Lines	Period-average						
SMPF Bulk Migrations	Lines	Period-average						
SMPF Single Migrations	Lines	Period-average						

The screenshot in Figure 5.6 has been captured from the 'Total SMPF volume scenarios' worksheet. The empty blue-bordered cells can be used should the user wish to enter alternative volumes to the Ofcom values in situ.

B.8 Outputs

Figure 5.8: The X (products) sheet [Source: Analysys Mason, 2013]



analysys mason

X-value, products

Prices			enter 2013/14 prices
Product	Unit	Period	2013/14
MPF Rentals	GBP	Period-average	84.26
SMPF Rentals	GBP	Period-average	9.75
WLR Basic Rentals External	GBP	Period-average	93.27
MPF Single Migrations	GBP	Period-average	30.65
SMPF Single Migrations	GBP	Period-average	30.65
WLR Premium and Basic Transfers External	GBP	Period-average	3.39
MPF New provides	GBP	Period-average	45.53
SMPF New provides	GBP	Period-average	30.65
WLR Premium and Basic Connections External	GBP	Period-average	47.11
MPF Bulk Migrations	GBP	Period-average	28.42
SMPF Bulk Migrations	GBP	Period-average	28.42
WLR + SMPF Simultaneous provides	GBP	Period-average	30.65
WLR Conversions	GBP	Period-average	30.65
	GBP	Period-average	
	GBP	Period-average	
	GBP	Period-average	
	GBP	Period-average	
	GBP	Period-average	
	GBP	Period-average	
	GBP	Period-average	

Cost (adjusted for LRIC reallocations)

The final outputs of the model can be seen in the X (products) sheet. This sheet provides RPI-X forecast prices for the three year period. Prices for the MPF and SMPF anciliary baskets and for the co-mingling ancilliary baskets can also be found in the two sheets to the far right hand side of the model.