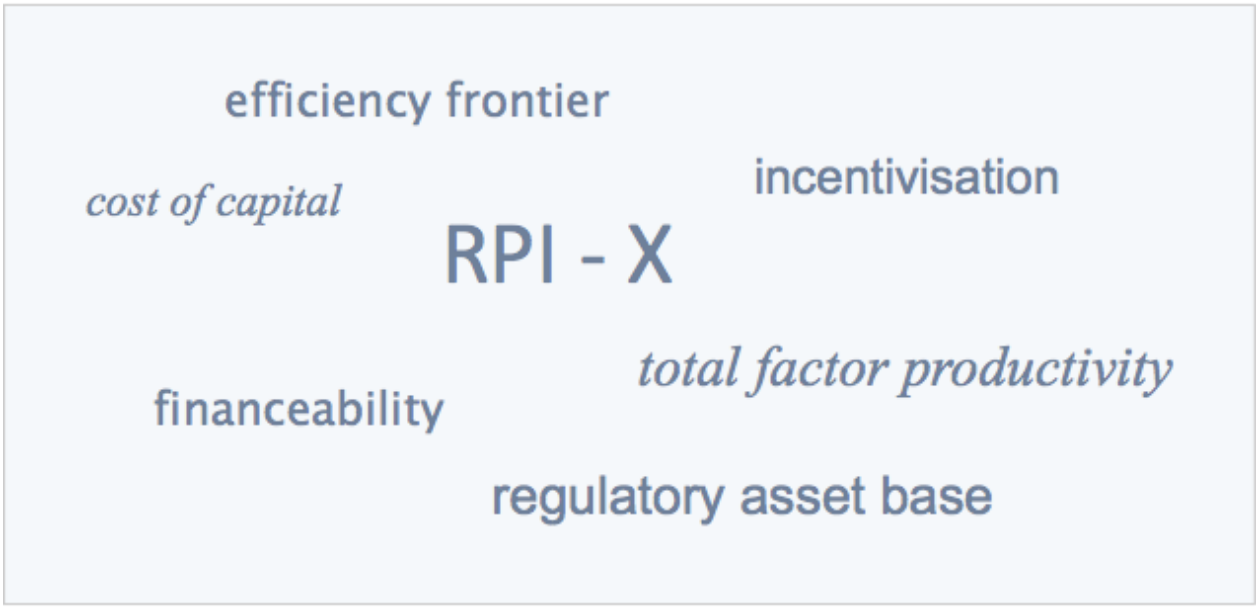
GUIDE TO ECONOMIC REGULATION



Part 2: How Regulators Calculate Price Controls

John Earwaker

Foreword

This is Part 2 in a series of booklets which aim to provide individuals working in the regulated aviation, communications, energy, rail and water sectors with an introductory guide to the principles and practices of economic regulation.

The focus in this booklet is price regulation. Specifically: how do regulators calculate the price controls which many of the UK's regulated firms have to adhere to? In this Part we will see that there is a standard and conceptually quite simple methodology that the UK regulators apply in most of the price reviews they carry out (even if on a first read the terminology and jargon in a regulator's decision documents can seem a little intimidating). We will also see that different regulators have, over time, adapted the basic price-setting model in different ways, creating subtle but important differences in approaches between the sectors.

The best way of navigating through the material that follows is to work first of all through chapter 1. This lays the foundation for layers of additional, industry-specific detail in chapters 2 to 9, which readers can pick and choose from depending on their areas of interest.

1. How do regulators calculate price controls?

1.1 The 'building block' model of a firm's revenue requirement

At the heart of every price review is a fundamental, overarching question:

> "How much revenue will a firm need in order to cover the efficient costs of providing the regulated service or services?"

Before explaining how regulators go about answering this question, it is important to make three preliminary observations.

First, the exercise is deliberately forward-looking. The question is not how much revenue the firm might have needed last year, or how much income does the firm require this year, but how much revenue is the firm going to need in each of the year's covered by the regulator's new price control (typically a period of between three and six years, depending on the sector). This requires the regulator to look ahead and consider the challenges that the firm is going to face and to tailor its calculation of costs and revenues to the circumstances at hand.

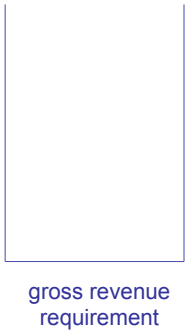
Second, as part of this forward look, there needs to be a good sense from the outset of the services that the firm is to provide to customers, especially in relation to the breadth and quality of the services it will offer. This acts as an anchor for the costing exercise that follows, albeit with scope for the regulator and the company to debate whether it might be in customers' interests to enhance (or possibly reduce) service from the initial base case after seeing how the costs and benefits of a move to new service levels stack up.

Third, the word 'efficient' is important. Price regulation is designed to stop firms with monopoly or substantial market power from setting prices that are unnecessarily high. One aspect of this is that companies are only allowed to pass costs on to customers that are efficiently incurred, with the corollary that any inefficient costs are for the firm's shareholders to deal with out of their own pockets. This serves to make the calculation of allowed revenues a thought experiment rather than a purely empirical exercise – i.e. the question is how much *should* a firm spend, if it deploys good management and cost control, not how much will a firm spend.

With these important pieces of context, we can show how a regulator builds up a calculation of the efficient firm's annual revenue requirement piece by piece.

We start with the empty pot drawn in figure 1 overleaf.

Figure 1



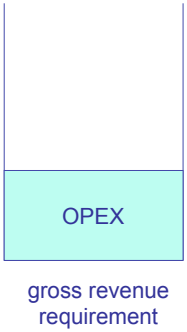
We are now going to see how a regulator fills this pot up with four main revenue 'building blocks'.

Step 1: opex

The first item that a regulator will place in the pot is a £m allowance for operating expenditure (or "opex"). Opex includes all costs that a company pays on a regular monthly or annual basis as part of the day-to-day job of keeping a service running. In a typical regulated firm, it might include a wage bill, national insurance contributions, pension costs, supplier/contractor costs, utility bills, business rates, and other cost items of a similar, recurring character.

The rule that regulators apply is that efficient opex is to be matched pound-for-pound with revenue as cost is incurred. This makes for a fairly straight-forward first building block in the allowed revenue calculation, depicted by the amount of money in green in figure 2.

Figure 2



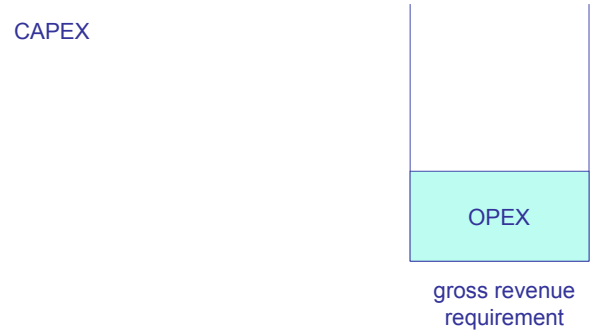
The principal challenges for the regulator when sizing this opex building block are to work out what the efficient cost base will be at the start of the regulatory period and then to consider how costs are likely to change over time. This might necessitate various pieces of benchmarking and cost forecasting work (topics that we cover in detail in Part 5 of the series). These are by no means trivial tasks, but for the purposes of describing in conceptual terms how a regulator calculates a firm's revenue entitlement, we can keep matters very simple: customers pay for the forecast efficient level of operating costs on a pay-as-you-go basis.

Step 2: capex

The other type of cost that a firm may incur is capital expenditure (or "capex"). These costs will typically involve the creation of new physical assets and, as such, will be distinct and separable from the opex that is involved in keeping existing assets running.

Regulators do not add efficient capex directly into the pot of allowed revenue.

Figure 3

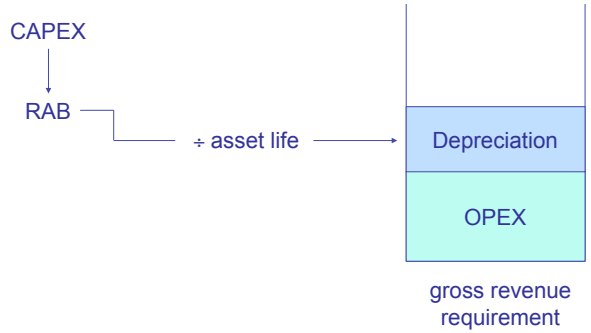


To see why this is the case, think about the nature of investment expenditure. The first thing to note is that capex can be quite lumpy – i.e. there can be years in which a firm invests large amounts of money but other years in which capex is relatively small. A second observation is that once an investment is complete the firm will have a physical asset which will provide service to customers for a period of many years to come.

These two things mean that it would be unfair to expect the customers that just happen to be around when an investment is being made to pay for that investment in full. The benefits resulting from capital expenditures will usually extend over several generations and it would be wrong to expect only current customers to pay for projects knowing that the services will be enjoyed by other users over a period of maybe 30, 40 or 50 years.

The equitable way of organising the pay-back of investment is to allow for costs to be paid for by customers in instalments over the life of the built asset (e.g. if a £100m investment is expected to last 40 years, customers should pay in 40 annual instalments of £2.5m). From the perspective of our allowed revenue calculation, this means that the firm's revenue entitlement in any one year should include an allowance for a set of annual instalments in the payback of all historical capex. These instalments are labelled "depreciation".

Figure 4



An aside: the regulatory asset base

This is the point at which we need to introduce the concept of a regulatory asset base (or "RAB"). In a system where firms get paid by customers for capex in instalments over a period of many years, it is important that a record is kept to show how much investment has been made by the firm but not yet paid for by customers. This is what the RAB does. The RAB acts as a running account or a constantly updating I.O.U. The value of the RAB will go up every time a firm invests more money in its business, and it will be written down each year as the regulator factors depreciation payments into the firm's allowed revenues and discharges, in part, customers' obligation to pay for historical investments.

In most of the UK's regulated sectors, the process for calculating the RAB is as mechanistic and as simple as that.

Sometimes people get confused by the A in RAB and think that the RAB is some sort of asset register and accompanying valuation of the stock of working assets at any given point in time. This isn't correct. The RAB is a completely financial construct and there is no ongoing link to the physical side of a business. (It might, therefore, be more logical to use the terminology 'regulatory base' and drop the A.) To emphasise this point, there can often be old, but functioning assets on a network that have been fully depreciated from the RAB for regulatory purposes but which still provide services to customers. Such assets would not be revalued. Conversely, in some companies' RABs there may be allowances for investments made several years ago, and which customers are yet to pay for in full, where the built physical asset has long been decommissioned. The deal from a regulatory point of view will usually be that customers are to pay for all investments that the regulator has allowed into the RAB, and that there will be no write-up or write-down of past capex except through the payment by the process of payment by instalments by customers that we outline above.

In this respect, the frameworks for remunerating opex and capex are more similar than they are different. The regulator makes a forward-looking assessment of the expenditure that an efficient firm would incur and commits customers to paying for those efficient costs. The only difference is that payment for opex comes immediately, while payment for capex in bite-size chunks based on the RAB's running record of historical expenditures.

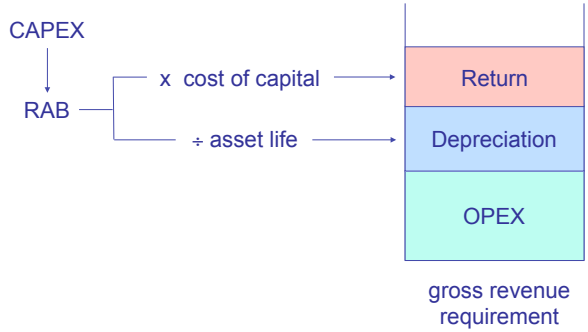
Step 3: rate of return

As described so far, the story is incomplete. To be able to proceed with projects, if funding from customers is coming over time in instalments, the regulated firm is going to need to ask someone to stump up the monies

that it needs to pay for labour, materials, contractors, etc. (with a promise to pay that money back when revenues come in from customers). That someone is: investors.

It should be obvious at this point that investors are only going to make funds available if there is something else in it for them – i.e. something that reimburses them in a fair and calibrated way for locking their money up for a non-trivial period of time. This is the concept of the cost of capital. When calculating allowed revenues, a regulator must make allowance for some level of return to compensate investors for the cost of the capital that they make available to the regulated company.

Figure 5



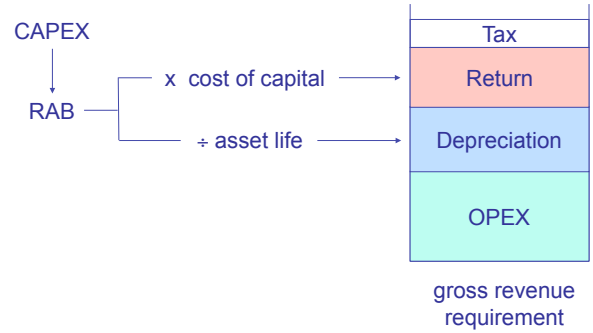
The return in £m is calculated as a percentage rate of return on the value of the RAB, as a measure at any given point in time of the money that a firm will have taken from investors for capex but not yet received payment for from customers. It can be seen that the size of a regulated firm's profit varies, therefore, in proportion to the size of the accumulated RAB. Firms with small RABs need to make only small profits, while firms with large RABs need to make large profits. (If anyone ever asks "why should my utility company make a profit?", the answer is as set out above: profit is, in effect, a cost that a firm has to cover when it takes capital from investors for investment, as part of a deal in which customers pay for that investment in instalments over the life of the built assets.)

The difficult bit for the regulator is sizing the percentage cost of capital. The return should not be too high as to give the firm profits that it does not need, but neither should it be so small as to undermine the firm's attempts to raise and maintain the capital that it requires for its investments. The process that regulators go through when they estimate a firm's cost of capital, which can be complex, is described in detail in Part 4 of this series. For now it is enough to note that allowed revenues should make provision for investors to be paid for the capital that they make available to a regulated firm at a rate that is not dissimilar to the returns that are available on other, similar investments (hence why one sometimes encounters the terminology "opportunity cost of capital").

Step four: tax

Together, the allowances for opex, depreciation and an allowed return constitute the three key building blocks that justify the levying of prices for regulated services. To complete the story, there is then a fourth and final building block, albeit of a smaller scale and of slightly lesser importance, to cover the corporation tax payments that most regulated firms have to make to HMRC.

Figure 6



A regulator's allowance for tax is made in exactly the same way as allowances for opex, capex and the cost of capital. That is to say that a regulator looks ahead and forecasts how much an efficient firm is likely to have to pay in corporation tax, based on the way that it has sized the other building blocks in the allowed revenue calculation. All other things being equal, the lower the forecast tax bill, the lower prices can be (something that may not be instantly apparent to the average person on the street when they read newspaper headlines about the amounts of tax that regulated companies pay).

Summary

This final computation completes the first part of the price control calculation. By summing together the allowances for opex, depreciation, return and tax, a regulator will know the total amount of revenue that a regulated company needs to bring in.

1.2 Net revenue requirement

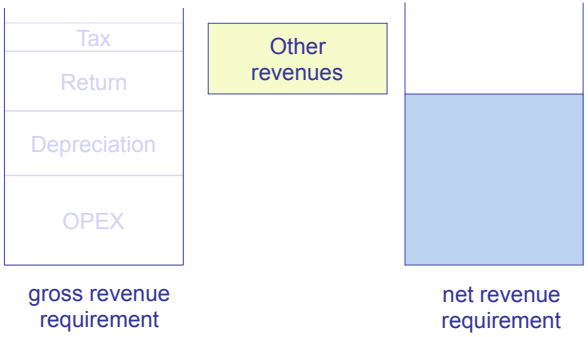
The next task is to think about where that revenue will come from.

The diagrams that we drew throughout the previous section are all deliberately drawn to show a firm's gross revenue requirement. This matters because in a number of the regulated sectors the regulated firm may be able to generate revenue from ancillary, non-regulated services alongside its core price-regulated activities. The most obvious example of this would be the way in which airports and railway stations make money from retail and other commercial activities, in addition to the charges that they levy on planes and trains. But in most industries there will be sources of extra revenue outside of the monthly bills levied on regulated customers.

The availability of such revenues needs to be considered during the regulator's calculations.

The most common approach is to draw up a 'single till', in which the regulator makes allowance for the revenues that an efficient firm can generate from its non-regulated activities before fixing the revenues that the firm is to be allowed to collect for its regulated services. We can show this allowance as a deduction from the gross revenue requirement – i.e. a downsizing of the net amount of revenue that the firm needs to collect via charges for its regulated services.

Figure 7



In practical terms, a single till approach requires a regulator to look at the entirety of a regulated firm's costs on the left-hand side, and the entirety of the firm's revenues on the right-hand side, with a view to bringing the two sides of the ledger into balance. Within this set-up, some of the costs that go into the building block calculation of the gross revenue entitlement may not strictly speaking be incurred in the course of delivering the price controlled services, but so long as all sources of income are accounted in the 'other revenues' building block, customers can be assured that they will not suffer any over-charging.

(Note that the alternative to single till regulation is for the regulator to establish 'dual tills' – one for the regulated services and one for unregulated activities. This approach will usually only be deemed appropriate when (a) there is no way for the regulated company to use its dominant position in the regulated market to make supernormal profits in the unregulated market and/or (b) the regulator feels comfortable allocating joint and common costs between the two pots.)

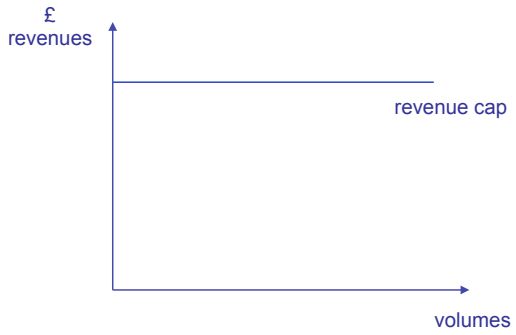
1.3 Revenue cap or price cap?

It is the net revenue in figure 7 that will become the subject of a formal, binding price control. Once the regulator has its year-by-year calculation of the net £m regulated revenues that a firm needs in order to cover the efficient costs of the services it provides, the last big decision that a regulator needs to make concerns how exactly to frame the formal restriction on the regulated firm's prices.

There are two main options: a revenue cap; and a price cap.

A *revenue cap* is a limit on the aggregate amount of revenue that a company can collect from customers over a 12-month period. The value of such a cap can come directly from the building block calculations we have just described, meaning that the regulator's job in this way of doing things is as easy as to write the final £m figures into a licence condition that permits the firm to collect no more than the calculated amounts each year.

Figure 8

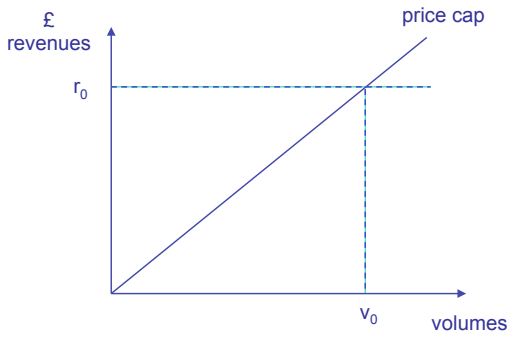


A firm that faces a revenue cap will have to keep a watch on its prices and react to changes in demand. That is, if a firm finds that it has more customers than was anticipated or is selling a higher-than-expected number of units, it will need to adjust its unit prices down in order to stay within its revenue cap.

Conversely, a firm may wish to move its unit price up in a situation where its volume of sales is falling short of initial expectations. In either case, the regulatory restriction is the same: the firm has a fixed entitlement to a given amount of revenue irrespective of volumes.

The alternative to a revenue cap is a *price cap*. This is depicted in figure 9. A regulator that chooses this option will take the £m amount of building block revenue entitlement for a 12-month period (r_0) and divide through by the expected volume of sales (v_0). This will give a unit price or an average revenue amount. The regulator will then write a licence condition that restricts the firm from charging its customers no more than this average price.

Figure 9



As the diagram shows, where average revenue/prices are fixed, the total amount of

revenue that the firm actually goes on to collect from customers will depend very directly on out-turn volumes. If, for instance, volumes double, the firm's revenues will double. Similarly, if volumes come in at half the forecast level, revenues will also halve.

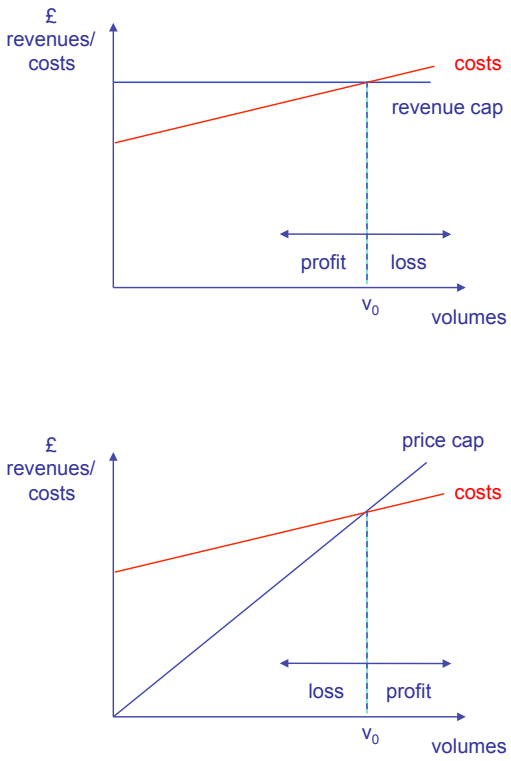
Why then might a regulator prefer a revenue cap and when might a regulator prefer a price cap? The key here is whether volume growth in an industry is a good thing.

In sectors where there is a sense that volumes ought to be minimised as much as possible – say, energy consumption or water consumption – regulators tend to set revenue caps. If a firm knows that it is going to obtain the same amount of revenue regardless of the volumes it sees on its network, it loses all incentive to grow demand. Indeed, insofar as it can influence customers' consumption, it is likely to benefit when customers use less (because the firm will still collect the same amount of revenue, but will save on certain volume-driven expenditures) and will have an incentive to promote volume-reducing initiatives.

In other industries, it may be that volume growth is seen as a good thing. Firms that have price caps see their revenues move one-for-one with changes in out-turn volumes will benefit from increases in volumes and suffer when there is unexpected volume decline. This will give the firm an incentive to grow its market and serves more generally to align its interests with its customer base.

This contrast between the incentive properties of a revenue cap and the incentive properties created by a price cap are illustrated graphically in figure 10. In each case we show a firm that has a certain amount of fixed cost and sees an additional amount of incremental, volume-driven cost.

Figure 10



The charts show that the link between profits and volumes reverses if a regulator switches from a revenue cap to a price cap.

In reality, the regulator does not have to choose between a pure revenue cap and a pure price cap. Historically, the UK's regulators have experimented with a variety of price cap designs which mix together both fixed revenue entitlements and volume-driven elements. These hybrid caps enable the regulator to position the slope of the blue line in the above chart anywhere between the extremes of a pure revenue cap and a pure price cap, which can be particularly useful to a regulator who wants to set up a very cost-reflective price control framework.

1.4 RPI – X regulation

The UK's system of price cap regulation sometimes goes by the name of RPI – X regulation. How does the revenue requirements that we have described thus far come to take on an RPI – X form?

First let us take X. In figure 11, we bring together the results of the regulator's building-block calculations and put five years of revenue entitlement side by side. The X-factor is nothing more than a simple description of the way that the value of the revenue cap changes from one year to the next. In this particular case, it turns out that the company is looking at a revenue cap with an RPI – 3% formulation. By contrast, the company in figure 12 has a different set of circumstances and ends up with an RPI + 3% cap.

Figure 11

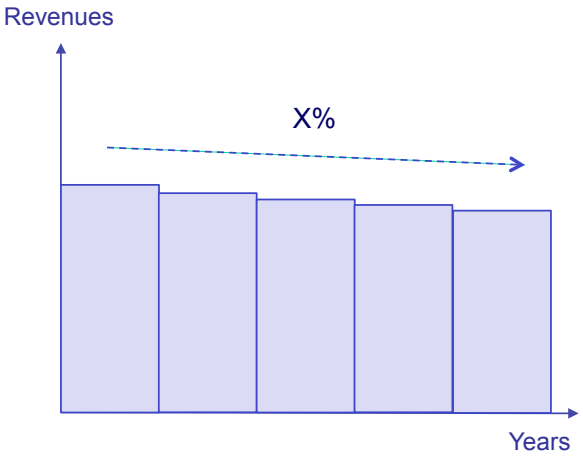
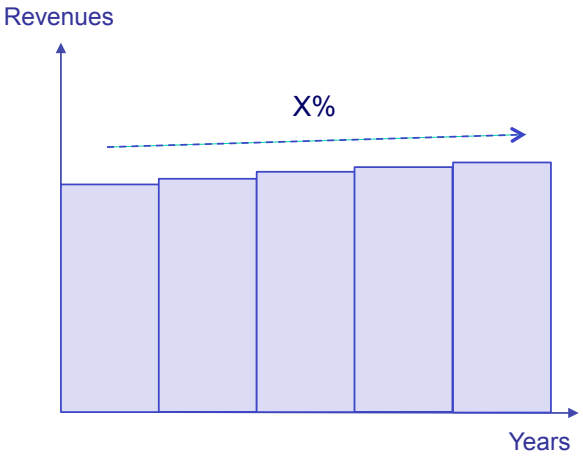


Figure 12



In each case the values of X within the RPI ± X formula have no particular meaning other than as a function of expansion or reductions in the sizing of the underlying building blocks (i.e. the opex, depreciation, return, etc.) and, hence, in the sum total of the firm's annual revenue requirement.

(As an aside, newcomers to regulation sometimes have the impression that X factors are a measure of the productivity growth that a firm is being challenged to achieve. This is not correct. Assumptions of this kind may well be feeding into the regulator's calculations of opex and capex allowances, but the values of X depict the net change in the level of the *final* revenue cap or the final price cap, not what is happening one stage earlier to the opex and capex building blocks.)

What about RPI?

The convention during price reviews is that all of the calculations that we described thus far are made in the money of the day (i.e. in constant real prices) and ignoring any future economy-wide inflation. This is designed to simplify the analysis and makes what is already a complex set of computations just that little bit more tractable.

Of course, a regulator cannot just assume inflation away. If the building blocks in the allowed revenue calculations are all calculated in constant real prices, the regulator must allow somewhere for the escalation in costs that the presence of inflation in the economy will bring. It does this by providing for the final revenue cap or the final price cap to index each year in line with recorded RPI inflation.

The worked example below shows how the process works. Suppose that in 2022 a regulator calculated a firm's revenue requirement for the year 2026 and determined that the firm needs to collect £100m in 2022 prices. The amount of money that the firm is entitled to collect in 2026 will be £100m uplifted for the inflation that crystallises between 2022 and 2026. If, for example, out-turn inflation runs at 3% per annum, the firm's final revenue entitlement will be £112.6m.

Figure 12

Because inflation indexation tracks *out-turn* inflation, the regulated firm's revenue entitlement automatically grows more when inflation is high and grows less when inflation is low, giving a real-time link between costs and the general level of prices in the economy

and protecting the firm from the effects of inflation.

Note that, in practice, most regulators nowadays use CPI or CPIH as their measure of inflation, rather than the old-fashioned RPI series. However, for good reason or bad, the name RPI – X label has stuck even though we should strictly speaking now be talking about CPI – X or CPIH – X.

1.5 Concluding remarks

For the purposes of an introductory guide to regulation like this, we now have a complete description of the most important steps in a typical price control calculation.

One of the features of modern-day regulation, however, is that regulators can always make small improvements to the 'standard' model and in doing so make matters just a little bit more sophisticated. We pick up some of this additional detail in the next eight chapters which look in turn at the current set of price control arrangements for the UK's regulated:

- airports;
- air traffic control provider;
- energy networks;
- rail infrastructure company;
- telecoms networks; and
- water companies

2. Aviation – Airports

The Civil Aviation Authority's (CAA's) methodology for calculating airport price controls is one of the more orthodox regulatory frameworks in the UK.

The building blocks in the CAA's calculation of Heathrow Airport's revenue requirement are shown below. There are only two small departures from the methodology that we outlined in chapter 1. The first is the bundling together of the cost of capital and tax into a single line item which is sufficient to cover both the return to investors and payments to HMRC as one composite amount. The second is the inclusion of an "asymmetric risk allowance". This is a new building block which has been inserted into Heathrow Airport's regulatory framework for the first time in the H7 review (for the period 2022 to 2026) after the recent experience of COVID. Its purpose is to act as a kind of annual downpayment to compensate Heathrow for bearing the downside financial risks around future pandemic-scale events.

Otherwise, the table below, which we reproduce from the CAA's June 2022 final proposals for Heathrow Airport's H7 price cap, shows that the CAA calculates an airport's revenue requirement as the sum of an opex allowance, depreciation and a return, less the amount of revenue that the airport is able to generate from other activities like its shops and car parks.

The CAA's calculation of Heathrow Airport's price cap

£m, 2020 prices	2022	2023	2024	2025	2026
Opex	1,127	1,143	1,192	1,227	1,210
Depreciation	841	879	918	970	1,022
Allowed return including tax	644	658	663	663	667
Asymmetric risk allowance	-	6	18	28	27
Incentive payments	-	4	-	-	-
Gross revenue requirement	2,611	2,690	2,791	2,888	2,925
Other revenues	(897)	(983)	(1,060)	(1,126)	(1,133)
Net revenue requirement	1,714	1,707	1,721	1,762	1,792

The CAA's calculation of Heathrow Airport's price cap (cont'd)

2020 prices	2022	2023	2024	2025	2026
Net revenue requirement, £m	1,714	1,707	1,721	1,762	1,792
Passengers, millions	54.9	67.3	75.4	81	81.6
Unsmoothed yield per passenger, £	31.22	25.37	22.82	21.75	21.96
Smoothed yield per passenger, £	27.39	25.88	24.42	23.04	21.75

Reference: CAA (2022), Economic regulation of Heathrow Airport Ltd: H7 final proposals, available at https://www.caa.co.uk/commercial-industry/airports/economic-regulation/h7/consultations/final-and-initial-proposals-for-h7-price-control/

The second part of the table, above, shows how the CAA transforms its calculated revenue requirement into a price cap. The CAA's airport price cap is defined in terms of a maximum amount of revenue per passenger passing through the airport. To calculate the value of the price cap for each 12-month period, the CAA divides the calculated net revenue requirement by forecast passenger volumes, giving a per passenger revenue entitlement.

The formal licence condition ultimately takes a CPI – X form.

The X value is calculated by the CAA to give an even trajectory of prices, smoothing out some of the ups and downs that can be seen in the tables, but leaving the airport with exactly its calculated revenue entitlement over the full five-year regulatory period.

The X in this case is 5.74%.

The smoothed yield per passenger caps shown in the final row of the table are then uprated by out-turn CPI inflation on an annual basis.

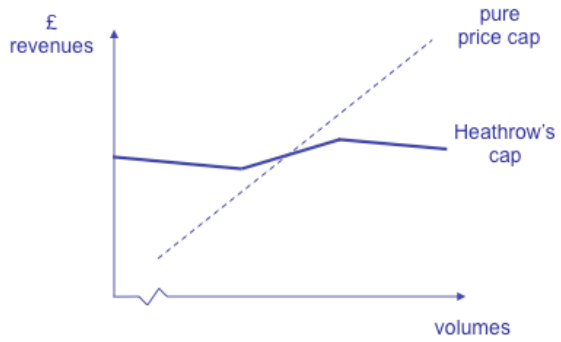
Note that one important new add-on to this form of control that will take effect from 2022 is a traffic risk-sharing mechanism. The CAA's new H7 risk-sharing rules specify that:

- if passenger numbers are within ±10% of the forecasts shown in the table, HAL will keep only 50% of the gain or loss in regulated revenues; and
- if passenger numbers are more than ±10% away from the CAA's forecasts, Heathrow will additionally give back or receive from customers 105% of the incremental increase or decrease in regulated revenues.

Monies to be returned to or recouped from customers in respect of traffic risk-sharing in year t will be trued-up over a ten-year period from year t+2 to year t+11.

This has the effect of turning a pure price cap into a hybrid cap as show in figure A below.

Figure A



3. Aviation – Air Traffic Control

The price control arrangements for NATS are broadly comparable to the CAA's airport price control framework (see chapter 2).

The CAA first calculates a gross revenue requirement as the sum of allowances for opex, depreciation and an allowed return. As in the case of airports, the allowed return is a pre-tax return which combines the cost of capital and corporation tax payments to HMRC into a single line item. The CAA deducts from the gross revenue requirement a forecast of the income that NATS can obtain from its commercial activities to leave a net revenue requirement. This is then transformed into a maximum permitted amount of revenue per flight (or "service unit") that NATS handles using projections of future volumes.

There are three separate controls, covering NATS' UK en route services, its London approach services and its Oceanic services. An example calculation of the en route price cap is set out in the tables below.

The CAA's calculation of NATS' en route price cap

£m, 2017 prices	2020	2021	2022	2023	2024
Opex	514	511	527	483	466
Depreciation	184	150	132	136	145
Pre-tax return	27	30	32	32	31
Gross revenue requirement	725	691	691	565	642
Other revenues	(96)	(89)	(88)	(86)	(87)
Net revenue requirement	630	603	604	564	555

The CAA's calculation of NATS' en route cap (cont'd)

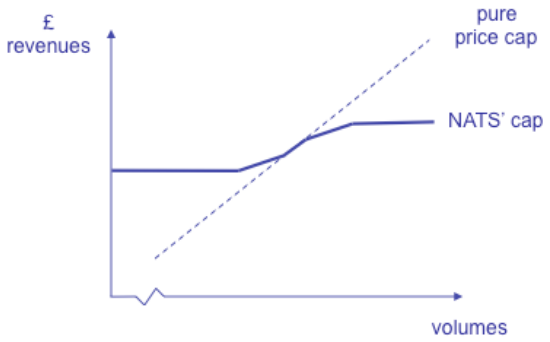
2017 prices	2020	2021	2022	2023	2024
Net revenue requirement, £m	630	603	604	564	555
No. of service units (000s)	12,504	12,747	13,040	13,263	13,472
Maximum permitted average charge per service unit, £	50.39	47.30	46.29	42.51	41.23

The formal licence conditions ultimately take a CPI – X form. This means that the caps shown in the final line of the table are uprated every year in line with out-turn CPI inflation.

In the cases of NATS' Eurocontrol and London Approach caps, the price control formula contains a traffic risk-sharing mechanism. If actual traffic volumes turn out to be more than 2% above or below the CAA's original forecast, NATS retains only 30% of the incremental gain or loss in revenues with the remaining 70% being carried forward into an adjustment down or up to a subsequent year's price cap. If actual traffic volumes come out more than 10% above or below the CAA's original forecast, NATS retains none of the incremental revenue gain or loss.

This transforms the form of control from what would otherwise be a pure price cap into a hybrid price / revenue cap, as shown in the chart opposite.

Figure B

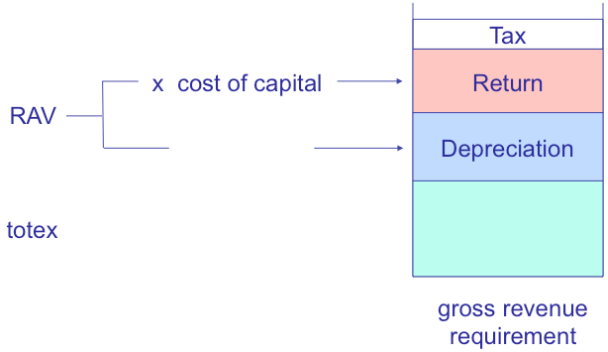


The effect of this arrangement during the years in which traffic was affected by the COVID pandemic was to create a significant deferred payment from customers to NATS in respect of revenue entitlement not recovered during 2020-22. The CAA is currently assessing how this deferred income should be factored into NATS's future price controls as part of the ongoing NR23 price review.

Reference: CAA (2019), UK RP3 CAA decision document, available at https://publicapps.caa.co.uk/docs/33/CAP%201830%20CAA%20Decision%20Doc.pdf

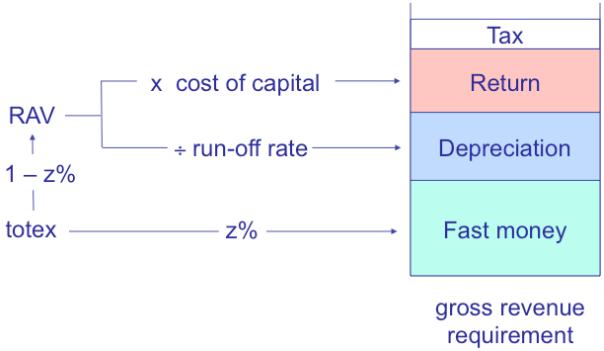
4. Energy Networks – Great Britain

Ofgem's methodology for calculating energy network price controls underwent a major revamp in 2010 following the completion of the regulator's RPI – X @ 20 review. One of the main innovations that the resulting 'RIIO' price controls brought in involves a deliberate blurring of the boundary between opex and capex and a consequent focus on total expenditure (or "totex").



Under RIIO, energy network price controls no longer provide rigidly for opex to be paid for pound-for-pound as it is incurred or for capex to be paid for over the life of the built asset. Instead, the regulator splits all controllable totex in fixed proportions between 'fast money' and additions to a company's RAB.

(Non-controllable opex is dealt with separately and is paid for by customers on a pay-as-you-go-basis.)



The so-called fast money provides for a proportion of a regulated firm's expenditure to be matched by revenue immediately. The remaining totex is then paid by customers in instalments. The RAB (or regulatory asset value / RAV in Ofgem's labelling) is still a running account of the expenditures that firms have incurred but not yet been paid for, only now, strictly speaking, RABs can contain an element of day-to-day operating spend as well as physical investment. Despite this change in character, additions to the RAB are still depreciated over a period that aligns to the life of a typical network asset and thus contribute an amount of 'slow money' to a firm's calculated revenue requirement.

An example of one of Ofgem's allowed revenue calculations is provided overleaf.

Ofgem's calculation of ENW's RIIO-ED2 revenue cap

£m, 2020/21 prices	2023/24	2024/25	2025/26	2026/27	2027/28
Non-controllable opex	56	50	50	49	49
Fast money	110	113	112	104	102
Depreciation	153	149	146	141	140
Return	79	82	86	89	92
Other allowances	8	3	2	2	2
Tax	27	23	19	13	11
Revenue requirement	433	421	415	398	395

Reference: Ofgem (2022), RIIO-ED2 final determinations, available at https://www.ofgem.gov.uk/publications/riio-ed2-final-determinations

The intention behind this design of the allowed revenue calculation is that firms should worry less than under the standard model about whether expenditure they are contemplating is classified as opex or capex and should focus more narrowly on minimising total costs. Until recently, there was a perception that firms had been trying to maximise capex and minimise opex, perhaps in part because Ofgem had a habit of over-estimating the true cost of capital (thus presenting the regulated networks with an incentive to grow their RABs by as much as possible). Now that totex is split in pre-determined proportions between fast money and RAB additions, this should not happen. Note that the percentage split (labelled z in the building block diagram on the previous page) is fixed in advance. The precise figure varies from firm to firm, but is chosen so that allowed revenues are not materially different from the amounts that would have been calculated via the more conventional price review methodology outlined in chapter 1.

For completeness, note that:

- the entitlements shown in the final line of the table are converted by Ofgem into an annual revenue cap; and

- Ofgem's revenue caps index in line with CPIH inflation.

5. Northern Ireland

The NI Utility Regulator's price controls for NI Water and for Northern Ireland Electricity's distribution and transmission networks are based on a standard opex plus depreciation plus return plus tax building block calculation. Examples of the UR's calculations from its most recent periodic reviews are shown below.

The UR's calculation of NI Water's revenue entitlement

£m, 2018/19 prices	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27
Opex (incl. PPP costs)	214	218	222	225	231	240
Depreciation	96	138	159	173	176	162
Return	56	63	59	58	58	62
Tax	-	-	4	2	0	-
Revenue requirement	365	419	444	458	465	464

Reference: UR (2021), Water and sewerage services price control 2021-27 – PC21 final determination, available at https://www.uregni.gov.uk/news-centre/pc21-price-control-determination-published

The UR's calculation of NIE's distribution network revenue entitlement

£m, 2015/16 prices	2018/19	2019/20	2020/21	2021/22	2022/23	2023/24
Opex	69	69	68	68	67	67
Depreciation	70	71	72	73	70	70
Return	35	35	35	36	36	36
Tax	7	7	6	7	6	6
Revenue cap	180	181	181	182	179	179

Reference: UR (2017), Northern Ireland Electricity Limited, transmission and distribution 6th price control, final determination, available at
https://www.uregni.gov.uk/publications/nie-networks-td-6th-price-control-final-determination-rp6

The UR's price controls for the NI gas distribution networks are slightly different in that the UR seeks to smooth the charges paid by customers in Northern Ireland into a flat profile over a 20-plus year period.

The calculations work as follows:

i) the UR makes a fixed determination of the three gas distribution networks' revenue entitlements for a six-year price control period using a standard building block methodology (e.g. the UR's most recent decision was for 2023-28);

ii) the regulator then makes indicative assumptions out to 2045 in the case of Firmus Energy, 2046 in the case of Phoenix Natural Gas and 2057 in the case of SGN's network;

iii) finally, the UR models the flat charges that the networks will need to levy in £ per therm in order to obtain exactly the forecast required amount of revenue in NPV terms by the above-mentioned cut-off dates.

The effect this approach has is that the revenue that a licensee actually recovers in any given price control period can be higher or lower than the calculated revenue requirement for those six years in isolation. Monies that are under- or over-recovered are recorded as an addition to or a deduction from the companies' Total Regulatory Values (TRVs) so that they can be appropriately recognised when the UR conducts its next price review.

The UR's calculation of Firmus Energy's revenue entitlement

£m, 2020 prices	2023	2024	2025	2026	2027	2028
Opex	9	9	9	10	10	10
Depreciation	8	9	9	9	9	9
Return	4	8	12	14	14	14
Revenue requirement	21	26	31	32	33	33
Volumes (therms 000s)	63,984	68,443	72,642	76,513	78,713	80,776
Allowed revenues (flat £/therm)	25	27	29	31	32	33
TRV addition / deduction	-5	-1	+1	+2	+1	-0

Reference: UR (2022), GD23 gas distribution price control 2023-28 final determination, available at: https://www.uregni.gov.uk/news-centre/final-determination-gas-distribution-price-control-gd23-published

Note that the UR's price controls are mix of revenue caps and price caps and use different inflation indices, as follows:

NI Water – price cap, RPI indexation

NIE – revenue cap, RPI indexation

Firmus, Phoenix – revenue cap, CPIH indexation

SGN – price cap, CPIH indexation

6. Rail

ORR used to cap the income that Network Rail collects in access charges levied on franchised train operators via a conventional building block calculation of allowed revenues.

ORR's calculations for the 2014/15 to 2018/19 control period (CP5) are set out in the table below.

Opex covers expenditure on network operations, support costs, traction electricity, maintenance, and anticipated compensation payments for delay and track possessions.

Amortisation is ORR's terminology for the depreciation of the RAB.

Other income includes revenues from property and other commercial activities, as well as income from charges levied on non-franchised operators.

Network Rail's revenue entitlement requirement was the sum of allowances for opex, amortisation, return and tax, plus a small true-up for a number of incentives that were in place during the previous control period, less a forecast of Network Rail's commercial income.

ORR's calculation of Network Rail's total GB revenue requirement, CP5

£m, 2012/13 prices	2014/15	2015/16	2016/17	2017/18	2018/19
Opex	2,687	2,735	2,672	2,640	2,633
Amortisation	2,282	2,282	2,382	2,482	2,482
Return	1,093	1,151	1,255	1,369	1,451
Incentive payments	34	34	34	34	34
Tax	4	-	-	-	3
Gross revenue requirement	6,100	6,203	6,344	6,525	6,604
Other income	(764)	(813)	(862)	(911)	(960)
Net revenue requirement	5,336	5,390	5,482	5,614	5,643

Reference: ORR (2013), Periodic review 2013: final determination of Network Rail's outputs and funding for 2014-19
http://orr.gov.uk/__data/assets/pdf_file/0011/452/pr13-final-determination.pdf

Following Network Rail's reclassification as a central government body, ORR switched from a building block methodology to a much more simple cash out = cash in calculation. Under its revised approach, ORR nowadays simply calculates how much cash Network Rail will pay out over a five-year period and seeks to ensure that the combination of government grants and income from train companies will exactly cover these outlays.

The table below shows the build up of Network Rail's revenue requirement for the 2019/20 to 2023/24 control period (CP6).

As we noted in Book 1, ORR concludes its price reviews by rewriting the charges listed in Network Rail's contracts with franchised train operators.

These charges index annual in line with CPI inflation.

ORR's calculation of Network Rail's total GB revenue requirement, CP6

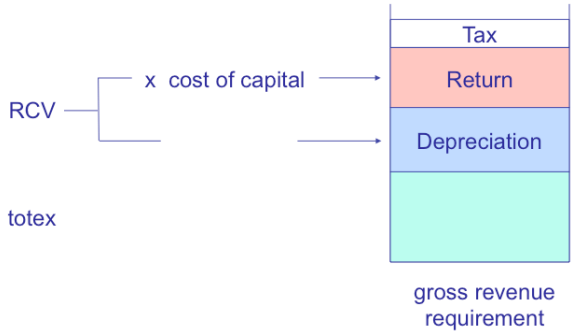
£m, 2017/18 prices	2019/20	2020/21	2021/22	2022/23	2023/24
Operations	689	686	686	684	681
Support	533	539	527	502	507
Maintenance	1,554	1,579	1,531	1,518	1,509
Renewals	3,052	3,657	3,687	3,423	2,823
Other costs	1,100	1,095	1,084	1,260	1,238
Risk allowances	250	390	530	651	774
RPI/CPI conversion item	123	210	289	358	403
Gross revenue requirement	7,301	8,155	8,434	8,396	7,937
Other income	(545)	(558)	(547)	(554)	(564)
Net revenue requirement	6,757	7,597	7,887	7,842	7,374

Reference: ORR (2018), PR18 final determination, available at https://www.orr.gov.uk/monitoring-regulation/rail/networks/network-rail/price-controls/pr18/publications/final-determination

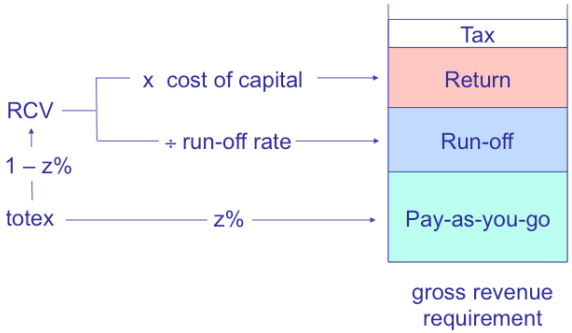
8. Water and Sewerage – England & Wales

Ofwat uses a similar methodology to Ofgem when calculating firms' revenue entitlements (see chapter 4) in preference to the more standard calculation that it deployed at price reviews prior to 2015.

The Ofgem/Ofwat methodology does away with a rigid opex/capex classification and focuses on the total expenditure or totex that a regulated firm will incur.



In place of a rule in which efficient opex is paid pound-for-pound as it is incurred and efficient capex is paid in instalments, Ofwat provides for a proportion of efficient totex to be paid for on a pay-as-you-go basis and adds the remainder to the RAB (or RCV / regulatory capital value in Ofwat's terminology). The so-called pay-as-you-go money provides for some of a regulated firm's forecast expenditure to be matched by revenue immediately. The remaining totex is then paid by customers in instalments.



The intention behind this design is that firms will worry less than in the past about whether expenditure they are contemplating is classified as opex or capex and focus more narrowly on minimising total costs. Until recently, there was a perception that firms had been trying to maximise capex and minimise opex, perhaps in part because Ofwat had a habit of over-estimating the true cost of capital (thus presenting the regulated networks with an incentive to grow their RABs by as much as possible). Now that totex is split in pre-determined proportions between fast money and RCV additions, this should not happen – i.e. the regulated firm should choose whichever solution has the lowest whole-life cost, regardless of the opex / capex classification.

The RCV is still a running account that keeps track of the expenditure that customers are to

pay for via future prices, but now, strictly speaking, it can contain elements of both opex and capex. In recognition of the RCV's slightly different character, Ofwat no longer provides rigidly for additions to the RAB to be depreciated over the life of built assets. Instead, the RAB is 'run down' by a chosen percentage amount each year and Ofwat includes a 'run-off' amount in allowed revenues.

Both the run-off rate and the split between pay-as-you-go money and RAB additions are calibrated so that the revenues that the firm is entitled to collect is not noticeably different from the prices that would emerge from the more conventional building block model.

An example of Ofwat's allowed revenue calculation is given in the table below.

Ofwat's calculation of Wessex Water's wastewater network plus control

£m, 2017/18 prices	2020/21	2021/22	2022/23	2023/24	2024/25
Pay-as-you-go	101	102	104	105	107
Run-off	73	79	86	90	92
Return	46	50	52	54	56
Tax	5	3	2	1	0
PR14 reconciliations	13	-	-	-	-
Innovation funding	1	1	1	1	1
Grants and contributions	9	9	9	9	9
Gross revenue requirement	248	244	255	260	265
Other income	(1)	(1)	(1)	(1)	(1)
Net revenue entitlement	248	243	254	259	264
Smoothing	4	10	(0)	(5)	(10)
Revenue cap	252	253	254	254	255

Reference: Ofwat (2019), PR19 final determinations, available at: https://www.ofwat.gov.uk/regulated-companies/price-review/2019-price-review/final-determinations/

Ofwat sets five main price controls for each regulated water and sewerage firm covering: water resources; water network plus activities; wastewater network plus activities; bioresources; and household retail. The first three controls are revenue caps. The bioresources price control is a modified average revenue control in which most but not all of a company's revenue entitlement is fixed, and the household retail control is a cap on average revenue per customers.

The wholesale revenue entitlements index in line with CPIH, and Ofwat formally issues an CPIH + K% formula to each firm, in which K describes the permitted percentage change in revenues (before allowing for inflation) from year to year.

9. Water and Sewerage – Scotland

The WIC has in the past issued publicly owned Scottish Water with price controls based on the standard building blocks that are used in other regulatory regimes. However, in recent reviews, the WIC has adopted a simpler cash out = cash in methodology.

The WIC's SR21 calculation of Scottish Water's revenue requirement for the period 2021/22 to 2022/27 is summarised in the table below.

The WIC's calculation of Scottish Water's revenue requirement,

£ billion, 2017/18 prices	2021-27
Recurring expenditure	5.2
Capital expenditure	3.4
Ring-fenced allowance	0.1
Cash requirement	8.8
Borrowing	(0.9)
Other income	(0.2)
Revenue requirement	7.8

The WIC's final SR21 price control determination translated the revenue requirement in the last line of this table into a CPI + 2% restriction on the average annual increase in Scottish Water's charges.

Reference:
https://wics.scot/publications/price-setting/strategic-review-charges-2021-27/determinations/2021-27-final-determination