

Monopoly Money

How consumers overpaid by
billions



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Summary

Essential services have been the subject of a liberalising experiment over the past 40 years. Our water, energy transportation, sewers, airports, railways and broadband and telephone infrastructure have all been placed into private hands.¹ Where competition was possible, usually at the retail, customer-facing side of these businesses, it was introduced. Where it was not, the new companies who owned the underlying private monopolies were subject to (theoretically) tight price regulation.

This experiment has partially been a consumer success story. The very best energy deals on the market track underlying costs well and the margins providers can make on the most active consumers are low or non-existent. A 35% increase in household internet access in the past decade has been accompanied by falling prices.²

But these successes are marred by two major failures. One is deep, structural price discrimination: low prices for active consumers that are only sustained by unjustifiably high costs for loyal ones. This loyalty penalty led the government to intervene directly in the energy market and led us to make a super-complaint to the Competition and Markets Authority about the £4.1bn penalty in 5 other essential markets, to tackle this once and for all.

A second failure is just as fundamental but less remarked on: consumers have overpaid for the natural monopolies and other networks underpinning many of these markets for at least the past 15 years. Because of patchy reporting from regulators, it's impossible to document the full extent of these overpayments. However, this research finds that regulators have systematically set prices too high, leading to consumers facing unnecessarily high bills - that is, bills well in excess of what is required to deliver the necessary investment in these essential services.

We're able to put concrete figures on these overpayments for water, energy, telephone and broadband infrastructure. Our conservative estimate is that that excess figure is £24.1bn. We find that the errors in energy and water have cost consumers £11bn and £13bn respectively.

More competition exists in broadband and telephony infrastructure, as new entrants compete to lay down new networks in large cities. However, BT - the regulated owner of Openreach - still holds around 80% of the wholesale broadband market. This gives it a position of significant market power, which leads Ofcom to regulate its prices for broadband and (historically) for the telephone network. We find that consumers overpaid for this broadband and telephone infrastructure - we estimate £100m in the period 2014-2018.³

¹ Temporarily, in the case of rail infrastructure.

² [Internet access – households and individuals, Great Britain: 2018](#), ONS

³ We have rounded figures to the nearest billion in energy and water and the nearest hundred million in broadband.

The story of why this happened is at once technical and simple. On the technical side, one of the central tasks that regulators face is trying to estimate the cost of capital: the revenue necessary to attract investment in these essential infrastructures. This report documents mistakes, errors in judgement and poor forecasts that have led regulators to put the wrong values into their financial models, which in turn has led to unjustifiably high consumer bills.

But just focusing on the technicalities would neglect a simpler explanation: regulators have been out-resourced and outgunned. If this was just a story of errors in financial modelling, the errors would sometimes fall in consumers' and sometimes in investors' favour. But this is not what we see: instead, the errors are *biased*. Indeed, as we show below, this has sometimes been a conscious strategy from regulators: fearing under-investment, they have 'aimed up' on capital costs, choosing higher values than their estimates indicated they should.

The political debate on this question is dominated by whether monopolies should be publicly or privately owned. But the driving force underpinning public concern is, in great part, the cost burden that people bear just to meet essential bills and other important costs. For many of these utilities, it is the poorest who are hit hardest - who pay 14% of their incomes on energy⁴ and water bills⁵ alone. Companies and regulators must do a better job of demonstrating the virtues of our current model of ownership, or people will lose faith in it.

There have been welcome signs that regulators are getting tougher on companies: in both water and energy, they have signaled their *intent* for the lowest baseline rewards for companies in the history of British economic regulation. Following the publication of Citizens Advice's *Missing Billions* report, Ofgem has now acted in line with Citizens Advice's key recommendations in their recent RII0-2 decision. Ofgem has acted on debt indexation and on equity indexation and lower equity beta in RII0-2, all of which should lead to lower customer bills. In its recent decision Ofgem has indicated a cost of capital of 1.8%⁶ - far lower than they have reached in previous decisions, and Ofwat has indicated a provisional cost of capital of 2.4%.⁷ In Ofgem's case it predicts this will lead to £6bn in lower bills from 2021.⁸ But, while the language is stronger, it's vital that regulators deliver.

⁴ [Energy spend as a percentage of total household expenditure](#), Ofgem, June 2018

⁵ [Water bills affordability and support for household customers](#), House of Commons Library, 2016

⁶

https://www.ofgem.gov.uk/system/files/docs/2019/05/riio-2_sector_specific_methodology_decision_-_core.pdf (The Baseline Allowed Return on capital (WACC) therefore increases by 24bps (0.24%) relative to the assumption Ofgem presented in December which was 1.6%)

⁷ [Delivering Water 2020: Our final methodology for the 2019 price review. Appendix 12: Aligning risk and return](#), Ofwat, 2017

⁸ Other regulators are acting to reduce capital costs as well - the Civil Aviation Authority published draft proposals for air traffic control that indicated a capital cost of 2.6%: [Draft UK Reference Period 3 Performance Plan proposals](#), Civil Aviation Authority, 2019

Summary of recommendations

Recommendation 1: Firms should voluntarily return money to consumers through a rebate on their bills. Three energy network companies returned £287m to consumers when we highlighted these concerns in the energy sector and other companies have also acted to reduce bills. The following energy companies have not so far returned money to consumers:

- Electricity North West
- Northern Powergrid
- UK Power Networks
- Northern Gas Networks
- Wales and West Utilities

Scottish Power Energy Networks haven't returned money to consumers or directly reduced bills, although they did set up a £15m green economy fund after our report.⁹

These energy companies and all regulated monopoly or dominant companies in other sectors should now return money to consumers.

If firms do not act, the government must act to make sure consumers get their money back. Clear precedent for such government action exists, as when the 2013 Budget mandated a rebate on households' electricity bills.¹⁰

Recommendation 2: Where possible, regulators should index costs, rather than try to forecast them. Regulators' forecasts have led to serious over-estimates of the relevant costs. For debt costs and the return on Government bonds (2 key determinants of overall costs), regulators should use real market data to more accurately track costs. When choosing a cost of capital, regulators should not 'aim up': they should choose the value that the evidence suggests.

Recommendation 3: Ofgem and Ofwat should adjust the equity beta, a financial measure of risk, to those observed for low risk publicly listed monopoly companies. These regulators have typically assumed that these monopolies are far riskier than the empirical evidence suggests, which has huge consequences for overall returns. For future price controls, beta should be reduced significantly.

Recommendation 4: Regulators should review the opportunities to use competition to deliver monopoly services, rather than rely only on incumbents. Recent evidence in energy and water suggests that companies bidding for delivery contracts reveal far lower costs than existing monopoly providers. Competition should

⁹ [SP Energy Networks launches green economy fund to support Scotland's communities](#), Scottish Power, 2018

¹⁰ Ofgem, [Government Electricity Rebate \(GER\)](#)

be explored as a way of allowing a more diverse range of companies, not-for-profits and trusts to bid for these services.

Recommendation 5: The government should review what has gone wrong. Our findings merit serious review and investigation. The National Audit Office should review our findings and identify lessons learned. The National Infrastructure Commission should incorporate our recommendations into their review of infrastructure regulation.

Introduction

Monopolies and certain other dominant firms in water, energy transportation, sewers, major airports, broadband and telephone infrastructure and rail underpin our economy and provide us with essential services. Modern life is unimaginable without them.

Consumers exert no influence over these costs in many of these sectors: they have no way of rewarding or punishing these companies for value for money or service quality. They have to rely on regulators to set the costs and control the quality of these businesses.

With the exception of rail, all of these services are privatised, so a significant amount of revenue is returned to investors as profit. Baseline allowed financial returns for the services we have studied has been £92bn since 2004.¹¹

It's possible that this level of revenue, earmarked for returns to creditors and investors, is appropriate for investment-heavy businesses. It takes a lot of investment to build pylons and sewers and airports. To finance current and future investment, regulators need to promise investors a reasonable rate of return.

This research provides estimates of consumer overpayments in the water, broadband and energy sectors, who have received baseline returns of £81.1bn. For these sectors, we demonstrate that the level of capital revenue regulators have allowed is not justified. Across these sectors, we estimate what level of return - and therefore how much of consumers' money - is actually needed to ensure investment. We compare this to the returns that companies have been allowed.

We find that the sum consumers have overpaid for water and energy is colossal: in our conservative estimate, £24bn in total. And, while we find that overpayments in broadband and telephone infrastructure are significantly less, they're still material: £100m in the years 2014-2018.

This paper follows our previous research, *Energy Consumers' Missing Billions* and our subsequent analyses of the equity beta, which applied many of the insights below to monopolies in the energy sector. This paper updates and extends an updated version of the model used there to other sectors. However, unlike that forward-looking research, this paper only covers the recent past: the amount we overpaid for these services across the economy from 2004 to 2019.

It also is indebted to a groundbreaking paper sponsored by the UK Regulators' Network on *Estimating the cost of capital* by Wright et al. - in particular, the arguments advanced

¹¹ All figures calculated using our financial model of regulated returns; for certain sectors - particularly broadband and telephone networks - we only have a partial record during the study period.

by Wright, Mason and Pickford.¹² This report implements many - though not all - of their assumptions and recommendations.

While we have endeavoured to paint as full picture as possible, it has not been possible to examine *every* price control across *every* industry - particularly in broadband and telephone networks. This is because regulators have not always done as good a job as they might have done in ensuring that this data is published in a full and transparent way. As a consequence, this study likely undercounts the total level of consumer detriment.

This research covers:

- England, Wales, Scotland and Northern Ireland for broadband
- England, Wales and Scotland for energy
- England and Wales for water. Scottish Water is publicly owned and regulated separately.

The structure of this report

Chapter 2 shows that regulators have persistently set prices too high by overestimating the cost of capital. It compares regulatory estimates for the cost of capital to what we find the cost of capital should have been during the period 2004-2019. It then considers each relevant sector in snapshot, estimating the overall costs to consumers where possible.

Chapter 3 explains the key features of estimating the cost of capital, and sets out the mistakes, errors in forecast and reasoning across regulators that led to such consequential consumer overpayments.

Chapter 4 sets out how to put this right. It recommends that regulators take themselves out of decision-making where possible, committing themselves to following available data. And it proposes a mechanism for incorporating evidence of past bias into future decision making.

¹² [Estimating the cost of capital for implementation of price controls by UK Regulators](#), Wright et al, 2018

Chapter 2: How we overpaid by billions

2.1 Why do regulators set price controls?

Seven regulators - the Civil Aviation Authority, Ofcom, Ofgem, Ofwat, the Office of Rail and Road, the Water Industry Commission for Scotland and the Northern Ireland Utility Regulator - set price controls for major infrastructure in the UK. Between them they set 21 current price controls for 8 industries: airports, air traffic control, telecoms, gas, electricity, water, wastewater and the rail network.¹³

They set price *controls* because competition can't or doesn't work effectively for these services. While competition can increase choice and decrease price for many goods and services, this is much less so for natural monopolies. It wouldn't be profitable for companies to build rival water pipes or electricity pylons, so we're left with single owners and operators for them. And a monopoly company would typically set a monopoly price to maximise their revenue. While this is good for shareholders, it's obviously bad for consumers - particularly if they ended up overpaying for such essential services.

Even for sectors where the monopoly is a little less obvious, it can sometimes be prudent to set a price control. Heathrow and Gatwick airports both have their prices regulated - not because there's *no* competition between airports, but because that competition isn't always effective. If you live in a certain part of the country or you need to go to a particular location, often you *effectively* have no choice; 43% of all passenger journeys are taken at these 2 airports.¹⁴

This study looks at a selection of 18 historic and current price controls and is able to demonstrate consumer overpayments in 13 of them. We have disregarded price controls which do not affect domestic consumers (for example, the controls on ISDN office lines) or ones that do not have a significant impact on consumer prices (such as mobile call termination charges). For analytic purposes, we have also grouped certain price controls together (e.g., wholesale water and wholesale wastewater). Table 1 details the price controls studied.

¹³ [Cost of capital - Annual Update Report](#), UKRN, 2018

¹⁴ [Transport Statistics Great Britain 2018](#), Department for Transport, 2018

Table 1: Timeline of price controls examined in study

Sector	Price Control	Start	End
Electricity Distribution	DPCR4	01/04/2005	31/03/2010
	DPCR5	01/04/2010	31/03/2015
	RIIO-ED1	01/04/2015	31/03/2019
Gas and Electricity Transmission	TPCR3 (NGC)	01/04/2004	31/03/2007
	TPCR3 (Transco)	01/04/2004	31/03/2007
	TPCR4	01/04/2007	31/03/2013
	RIIO-T1	01/04/2013	31/03/2019
Gas Distribution	GDPRC4	01/04/2008	31/03/2013
	RIIO-GD1	01/04/2013	31/03/2019
Water	PR04	01/04/2005	31/03/2010
	PR09	01/04/2010	31/03/2015
	PR14	01/04/2015	31/03/2019
Aviation	HAL09	01/04/2008	31/03/2014
	GAL09	01/04/2008	31/03/2014
	HAL14	01/04/2014	31/03/2019
	GAL14	01/04/2014	31/03/2019
Broadband & telephone	FAMR 2014	01/04/2014	31/03/2017 (03/2018 for Openreach)
Rail	PR13	01/04/2014	31/03/2019

We reached conclusions on consumer overpayments in energy, water, telephone and broadband (both of the latter covered by a single price control). In rail and in aviation, our modelling is more circumspect and is not included in our total figures, due to greater difficulties in estimating consumer over-payments which we describe in the sections below.

2.2 How do regulators set prices?

A price control is meant to achieve a few things. Most importantly, it controls the amount of revenue that companies can collect from customers. But it's also designed to set incentives for companies to do certain things: whether reducing costs or innovating to meet environmental objectives. The intent is to artificially reproduce a competitive context: companies should be acting under the same incentives and pressures as a company in a highly competitive market would, as well as deliver any wider social or environmental benefits it's decided they should meet.

What unites the sectors and businesses described below is that competition is sufficiently constrained that regulators feel it's necessary to regulate the prices they're permitted to set. But there are important differences between them, which we discuss in the sector specific sections below. Most importantly, a contrast can be drawn between natural monopolies where no, or almost no, competition exists: energy and water networks are the clearest case here; they also form the vast majority of the overpayments we identify.

However, broadband and airports are somewhat less clear cut: there is competition in much of the country for both these services - for example, Virgin Media runs a rival broadband network; there are commercial alternatives for many routes to Heathrow and Gatwick. However, BT, Heathrow and Gatwick still have the power to set prices above the competitive rate (as regulators put it, they have significant market power to raise prices). This is because, while there is greater competition among providers here, it is not great enough; price regulation is still needed to protect consumers.

Rail is more unusual still. It was regulated *as if* it were a private enterprise¹⁵ - its regulator sets a cost of capital and Network Rail is run as a company. But it's owned by the government and its financing costs are lower as a consequence. Various adjustments are made by the regulator to reflect this difference in ownership structure for the study period.

While these sectors are different in many respects, they still use the same cost of capital model to estimate the revenue that firms will need to collect from customers in order to attract investment. They are therefore all included in the subsequent analysis (though we're unable to reach firm conclusions on aviation or rail, as we discuss below).

Within this framework, one of the big decisions regulators make is about the **cost of capital**: how much lenders and investors need to earn in order to persuade them to invest in these services. Our model of delivering this infrastructure is built on this: these services were privatised to deliver cost efficiencies and greater investment. Investors and lenders to these companies require a return on their investment. Under our existing model, it's therefore in current and future consumers' interests that these companies earn an appropriate return - both to incentivise companies to run their businesses more cheaply and to guarantee investment that will deliver better returns in future.

Because these businesses require a lot of investment - it's not cheap to build sprawling, long-lived assets like pylons and water pipes - it's both one of the most critical decisions regulators make and where mistakes can be most costly. What might seem trivial in percentage terms - often these mistakes are as little as 1% or 2% off the correct figure - are hugely consequential: in a given year, across price regulated businesses, a mistake of just 0.5% about the cost of capital could cost consumers £1bn in a year.

¹⁵ This has grown more complex since its reclassification as a public service in 2014.

Companies raise finance for investing in their business in 2 ways: through debt and through equity. Debt provides a guaranteed, pre-agreed level of return, so it's cheaper as a way of raising finance, but at the cost of increasing investors' assessment of risk (otherwise willing investors might think to themselves: can this company survive a shock with this level of risk?).

Equity investors, on the other hand, take a direct stake in the business. Every profit the business earns is one they're entitled to a share of. But that also means they aren't guaranteed a level of return (as businesses don't always make profits), so they expect a higher level of return to account for this greater risk. Equity also has less protection in bankruptcy situations than debt does, meaning shareholders are less likely to get their investment back if the company fails. They therefore expect a higher return.

Almost all large businesses use a combination of debt and equity financing to fund investments in their businesses. The proportion of capital funded by debt is called the company's *gearing*.

In a competitive setting, companies would raise the amount of debt and equity they believed they needed as their shareholders and managers saw fit. If they get this right, they'd succeed; if they didn't, a competitor would take their place. But natural monopolies and dominant firms *don't* work like that - because regulators set the price, they take a view about what a company's cost of capital should be.

The cost of capital is the percentage return that an investor or a creditor expects on their investment each year. Regulators, in turn, set a baseline percentage return that businesses can collect from consumers to pay their investors and lenders. This money doesn't necessarily *automatically* transfer from consumers to investors: firms have some freedom about when, how and if they pay it out in dividends. Indeed, Welsh Water are a not-for-profit, and have used some of their capital allowances primarily to improve financial resilience. But regulators allow firms to collect these revenues from consumers on the expectation that it will be used to pay debt and reward investors.

2.3 Have regulators got it wrong?

In short, yes: across the 13 price controls where we're able to estimate a concrete figure, ¹⁶ we find that consumers overpaid £24bn for water and energy and £100 million for broadband and telephone infrastructure. Regulators allowed revenue for baseline returns for these services of £81.1bn, based on their expectation of what the cost of capital would be over the period they were forecasting and their judgement of how risky the businesses were. We also provide indicative figures for airports and hypothetical modelling for rail below.

To estimate the cost of capital allowances regulators should have set, we used the standard model used by regulators, populating them with actual market data during the

¹⁶ 18 including rail, which is excluded from total savings due to the hypothetical nature of the modelling.

period we studied. This estimates the 2 principal components of the cost of capital:

- The cost of debt - as given by the 10 year average returns on traded highly-rated corporate bonds.
- The cost of equity, as predicted by the Capital Asset Pricing Model, which estimates what investor expectations would be for a stock, given a certain level of risk.

The model then takes a weighted average of these 2 components, based on the regulators' assessment of what proportions of capital funding should be funded by debt and equity. We use this model to provide a daily estimate of the cost of capital throughout the study period. This model and approach is widely accepted as the default method for estimating capital costs in the financial literature.

Below, we provide 2 versions of the model. The first, more conservative, model uses the measure of risk based on Ofgem's latest study's estimate of risk, which finds that energy and water networks are roughly 60% as risky as the average business.¹⁷ This is the principal figure we use throughout the report.

This model finds that the level regulators should have set the cost of capital at is £57bn in that period - £24.1bn less than regulators allowed, coming directly out of consumers' pockets.

The second version of the model is based on the study completed by the UK Regulators Network which suggested that water and energy companies may be roughly 40% as risky as the average business.¹⁸

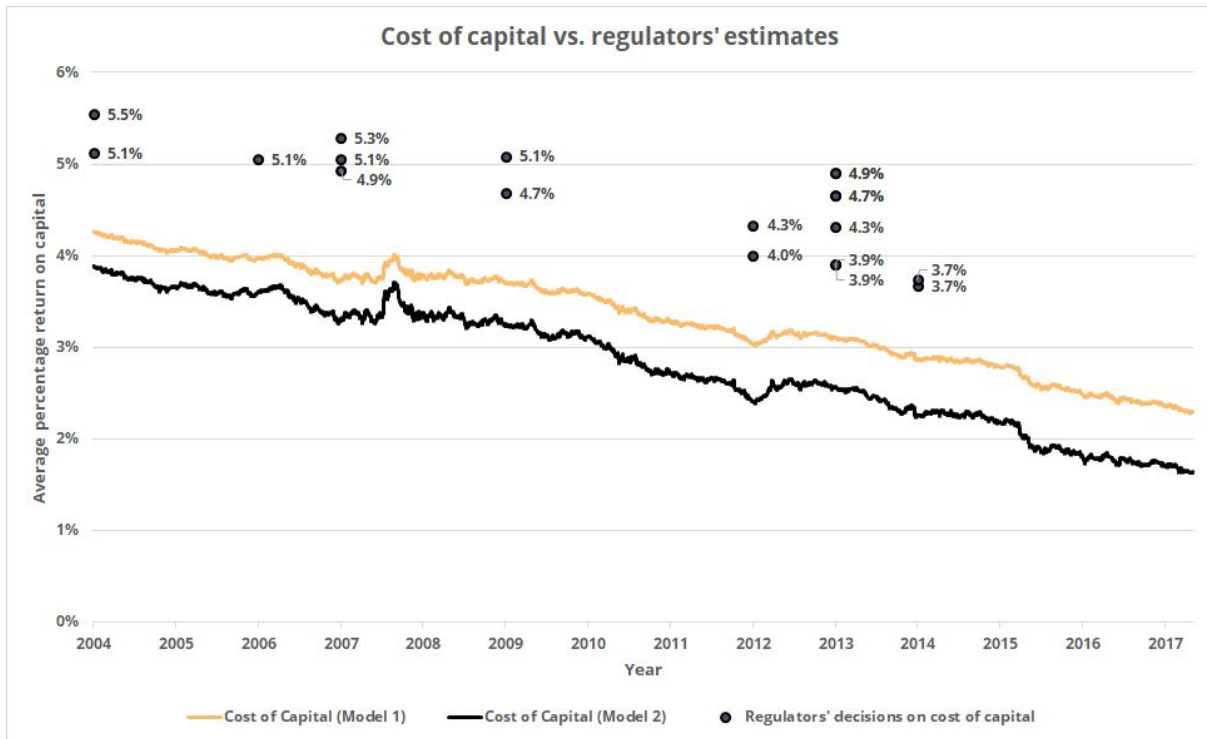
This version of the model finds a cost of capital of £48bn in that period - for water and energy companies, a full £33bn less than regulators in fact allowed.

Whichever option is justified (and we think both can be justified econometrically), the sums are extraordinary, coming directly and unnecessarily out of consumers' pockets. In the following sector specific discussions, however, we use our more conservative estimate.

¹⁷ This is the value we use for water and energy. We use a slightly higher value for broadband and telephony, to reflect different risks. For airports and rail we use a higher value, based on international comparators.

¹⁸ They suggest figures of between 0.3-0.5, from which we use the midpoint. This adjusted model is only applied to water & energy. Adjustments are not made to broadband, airports and rail.

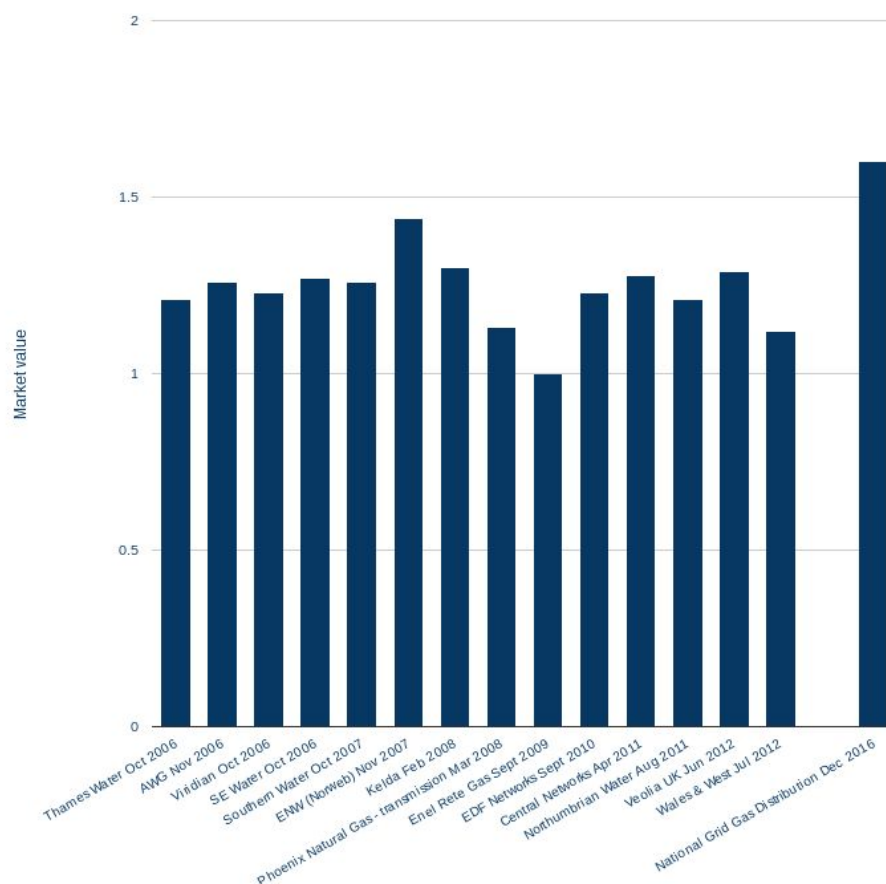
Figure 1: Cost of capital vs regulators' estimates



The cost of capital has always been lower than regulators set it. Regulators have now begun to reduce capital costs for future price controls - but the level of unnecessary costs for consumers they allowed in prior periods is extraordinary.

This view is not supported by modelling alone: market data on the private sales of these businesses concurs. Figure 2 shows that whenever these businesses have been sold, they almost always sell for more than regulators have said they are worth. The most recent sale, of a 61% stake National Grid Gas Distribution, sold at 53% higher than regulators said it was worth, indicating that its buyer expected high returns to persist into the future.

Figure 2: Sale price multiple over regulatory asset value¹⁹



2.4 Water and sewerage

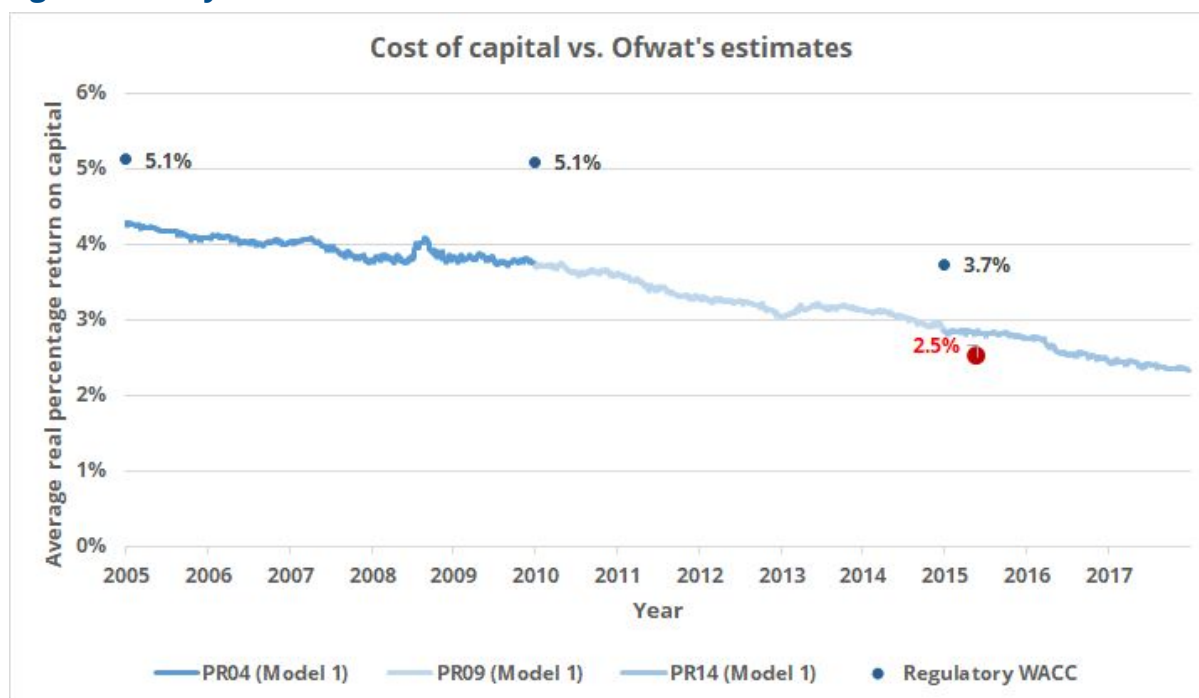
*"The fact of the matter is that if we have learned one thing from the last twenty years it is that in the world of financing costs, trying to predict the next five years simply by looking backwards is likely to result in getting it wrong. Over the past twenty years, the direction of error has been consistently in favour of companies rather than customers."*²⁰

Cathryn Ross, former Ofwat Chief Executive

¹⁹ [Profits in the Pipeline](#), Simon Moore, 2016

²⁰ [Ofwat : direction of error on financing in last 20 years consistently favoured water firms - not customers](#), Water Briefing, 2017

Figure 3: Analysis of water sector



The water industry is perhaps the most price controlled service in the UK. While occasional flirtations have been made with introducing competition, it looks likely to remain so.²¹ The cost of water and sewerage per household is £405 a year²² in England and Wales and it makes up around 5% of the poorest 10% of households' expenditure.²³

Water has the highest consumer overpayments in revenue terms. This is partly because, over the period studied, water has the highest asset values across the sectors.²⁴

Our analysis in water covers 3 price control periods: PR04, PR09 and the first four years of PR14, which collectively run from 2005 to 2019 (the last control runs to 2020).

Thames Tideway Tunnel: a way forward?

The major outlier in cost of capital decisions is a decision by Ofwat for the construction of the Thames Tideway Tunnel, a £4.3bn 'super sewer' in London. This cost of capital decision (the red dot in Figure 3) was **just below** what our model suggests it should have been at that point in time. What happened?

One difference is that the project benefits from government support, including on cost overruns. It could also raise its debt at current levels.

But we think the main difference was a competitive tender. Rather than relying on existing monopoly businesses to deliver the project, Ofwat opened it out to rival bidders. The successful bidder knew they could do it a lot cheaper - and the agreed cost of capital plummeted as a result. We return to this later on.

²¹ When Ofwat last investigated this, their most optimistic estimate of household benefits was a somewhat feeble £8 a year: [Costs and benefits of introducing competition to residential customers in England](#), Ofwat, 2016

²² [How much is the average water bill per month?](#), Money Advice Service, 2018

²³ [Water bills affordability and support for household customers](#), House of Commons Library, 2016

²⁴ Competition has been introduced for businesses, but has so far been slow to take off.

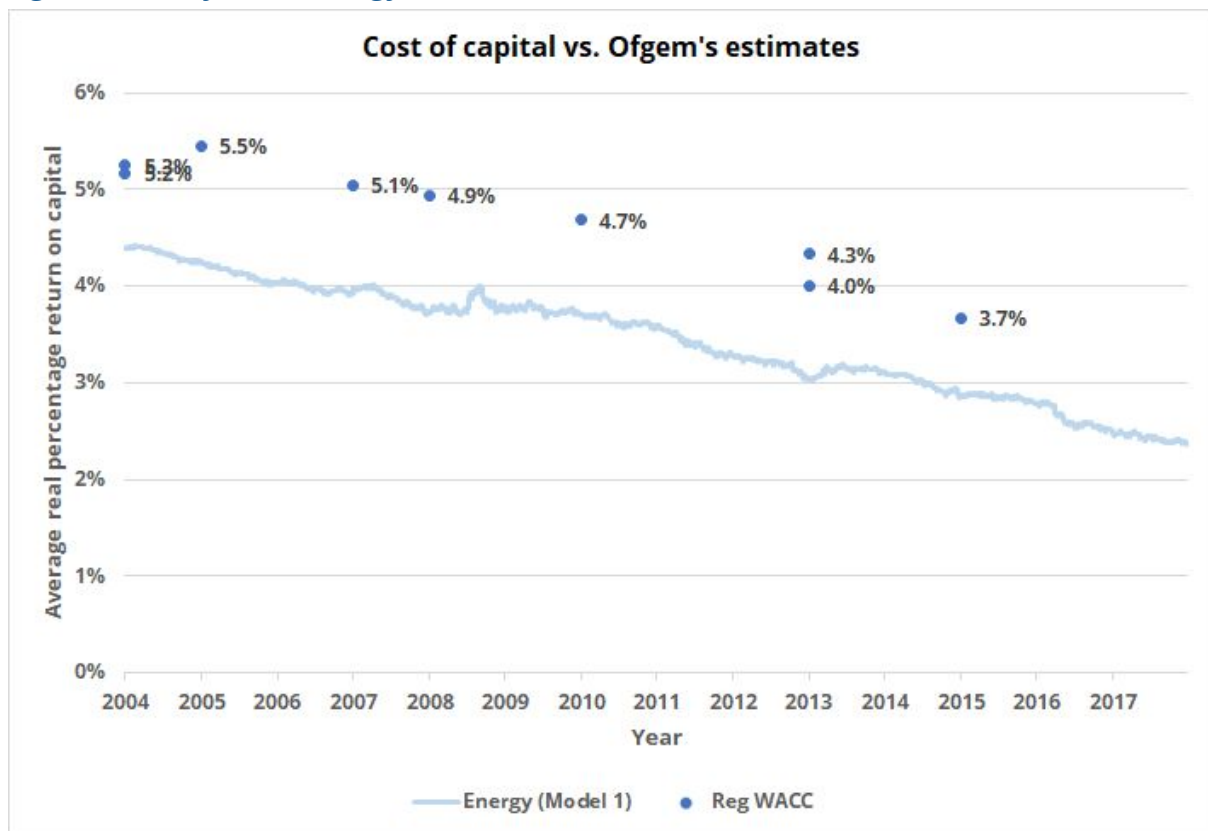
The current value of the businesses that provide water is £73bn, and they earned £2.8bn in baseline returns on average each year. We calculate that in this period, consumers should have paid £13bn less to companies - or about £920m less a year.

2.5 Energy

“The energy sector is being closely watched and I'm sure it cannot escape your attention that the cost of energy has become a highly political and highly discussed issue...Network companies need a licence to operate not just from the regulator but from society at large and the money they make must be seen as legitimate.”²⁵

Jonathan Brearley, Executive Director of Systems and Networks

Figure 4: Analysis of energy sector



The average household energy dual fuel bill is around £1,100 a year and represents about 8% of the poorest households' expenditure.²⁶ Of this, around £275 a year covers the cost of transportation through energy networks, from the point of generation to people's homes. The current value of the businesses that transport energy is £70bn.

Energy transportation only represents a proportion of consumers' final energy bill - around £275 a year for the standard household.

²⁵ [Ofgem reinforces tougher price control warning to network companies](#), Current News, December 2017

²⁶ [Energy spend as a percentage of total household expenditure](#), Ofgem, June 2018

Energy transportation was the focus of our previous research in this area - we found that over an 8 year period, consumers were overpaying £7.5bn in the current price control period.

This analysis extends that research back to 2004 and finds - across 9 price controls - consumers have overpaid by £11bn in the period from 2004-2019.²⁷ This works out as £730m a year. Our previous studies of the energy sector provide further details of our concerns.²⁸

2.6 Broadband and telephony

*'Prices overall have been set at a higher level than that required to provide investors in BT with an appropriate rate of return: in other words, prices could have been lower and BT's investors would have still been adequately compensated.'*²⁹

Frontier Economics

Households spend an average of £182 on broadband a year.³⁰ At the retail end, there is competition among 5 large providers who hold 91% of the market.³¹ BT is the main business whose price is regulated in this market³², with its provision of certain underlying infrastructure being regulated by Ofcom. Alongside this it provides the local network that underlines much telephone infrastructure. The value of these parts of its business is £9.4bn.³³

Broadband is a little different from water and energy. In many areas of the country, broadband providers are genuinely competing with each other to lay down infrastructure; there are several different networks capable of providing broadband in many areas of the country, although BT's infrastructure supports most services. Much of this infrastructure does not need price controls - competition is succeeding in bringing prices down for consumers. BT also provides telephone infrastructure, which until 2017 was considered under the same price control.³⁴ Meanwhile, the regulator is actively permitting companies (mainly BT) to charge high prices on legacy infrastructure, because it wants to encourage migration to newer, better services.³⁵

²⁷ Note: there is some overlap between this and the £7.5bn figure, as the current price control is 3-4 years into operation. We are missing data for gas distribution in years 2004-2009 and only have data for electricity distribution to 2005.

²⁸ [Energy Consumers Missing Billions](#), 2017; [The postcode lottery in energy profits](#), 2018; [Things can only get beta](#), 2018

²⁹ [The Profitability of BT's Regulated Services](#), Frontier Economics, 2013

³⁰ Citizens Advice analysis of ONS, [Living Costs and Food Survey](#), January 2018.

³¹ Ofcom, [The Communications Market Report](#), 2016. This is the share of residential and SME broadband services. The providers are Virgin Media, EE, BT, TalkTalk and Sky.

³² Excepting Hull, where a local privatised monopoly is in place (KCOM Group), which is excluded from this analysis.

³³ Based on Mean Capital Employed taken from Regulatory Accounts.

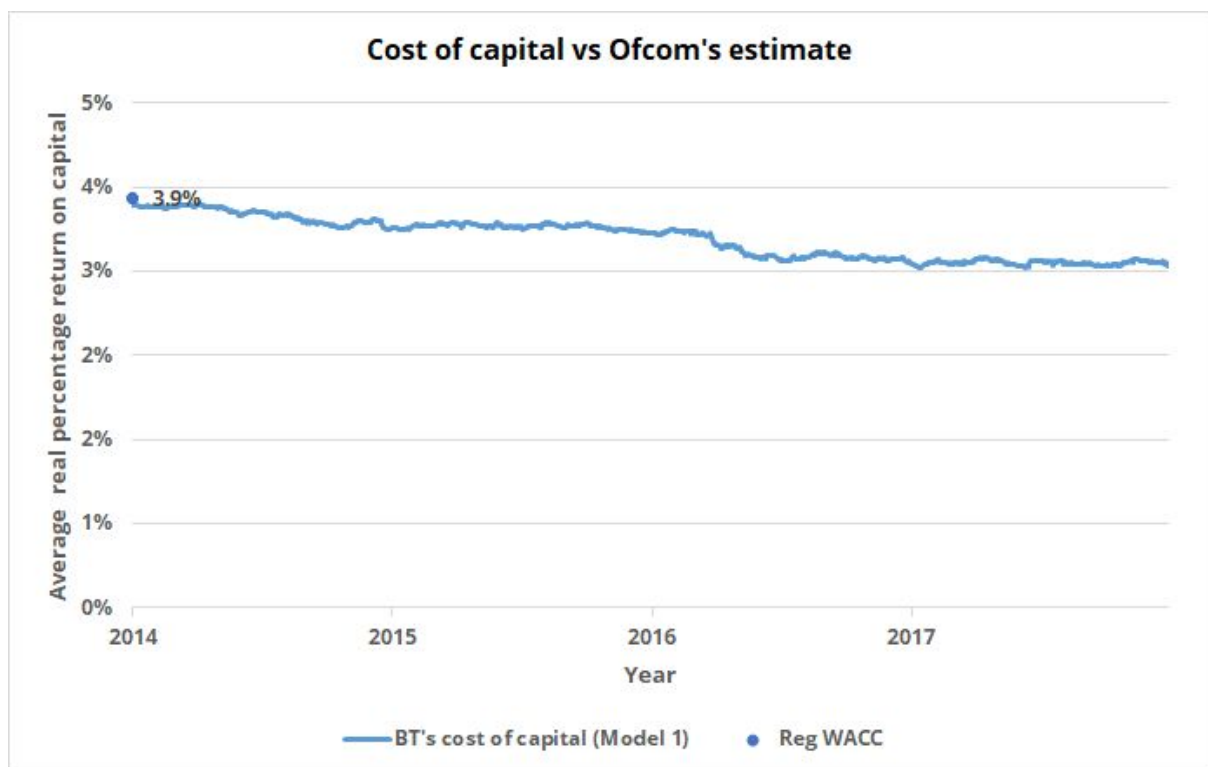
³⁴ This has now been replaced by an obligation to charge a fair and reasonable price.

³⁵ See, for example, paragraph 4.36, [Wholesale ISDN30 price control](#), 2011

So broadband is somewhat less straightforward than the 'classic' monopoly cases of water and energy. However, BT is still subject to significant price regulation. Until recently, the infrastructure required to deliver fixed line telephone calls was price controlled, so we can examine the historic assessment of capital costs with our modeled costs. And the infrastructure that underpins much of our broadband - the fixed connections between a telephone exchange and our homes - allows BT to maintain a dominant position and is regulated by Ofcom as such.

Data on historic price controls has been harder to come by in telecoms; this analysis only dates back to 2014 and up to 2018 for broadband and 2017 for the analogue telephone exchange lines. Still, even with this proviso, Ofcom's decisions on the cost of capital do not appear to have erred to the same degree as other sectors, as Figure 5 shows. According to our model, in those years, for broadband and telephone infrastructure, consumers have been overcharged by £100m.

Figure 5: Analysis of the broadband and telephony sector



Two factors likely contribute to this lower figure:

- 1) Compared to other regulators, Ofcom assumes that BT is funded much more by equity than by debt - 32% debt funded rather than up to 65% for other companies. Because Ofcom uses a cost of equity much closer to our model, this reduces the overall consumer overpayments. For example, Ofcom assumes an equity beta (described below) of 0.69; far closer to the figure of 0.6 that we use to model energy and water (though we follow Ofcom's figure for broadband and telephone).

- 2) BT earns much of its capital returns through other incentives set by Ofcom. A 2013 Frontier Economics report³⁶ found that BT had earned £4.8bn in excess of its allowed cost of capital in 2006-2013. Our model does not account for these effects, so it is possible that returns should be reduced further.

Overall, our findings suggest that Ofcom have matched what capital costs should have been set at much more closely than regulators in energy or water. Yet even so - consumers have still overpaid by £100m.

2.7 Airports

*'BAA was acquired at a share price of 940p, compared with a pre-bid price of around 650p. For what are supposed to be relatively dull and boring industries, these premia are simply extraordinary, and provide prima facie evidence that consumers have not had a good deal. It is very unlikely that such premia - and the returns to shareholders - could be justified by extraordinary efficiency gains.'*³⁷

Dieter Helm

Airports might not seem like a natural monopoly in the first instance: in principle, you can choose to fly from any one of more than 40 commercial airports. But, because of constrained airport capacity in the southeast of England, choice is effectively limited. Airlines often have to take the routes where they can find them, which would give airports the power to charge higher than competitive prices, which in turn are passed directly to consumers. In practice, the Civil Aviation Authority (CAA) has found that both Heathrow and Gatwick airports have this type of monopoly or significant market power.

Heathrow's and Gatwick's regulatory value is £16bn and £3bn. In their most recent price controls, the CAA allowed them to earn a return of just under 5%.

The regulatory arrangements for each airport are somewhat different. Heathrow is subject to traditional price control arrangements, where the revenue it can collect from airlines (who in turn collect it from passengers) is in part based on capital costs.

This was true of Gatwick until 2014 as well, but the CAA then decided to liberalise arrangements. Gatwick now makes price commitments to the CAA, but that is also based on the CAA's assessment of the cost of capital.

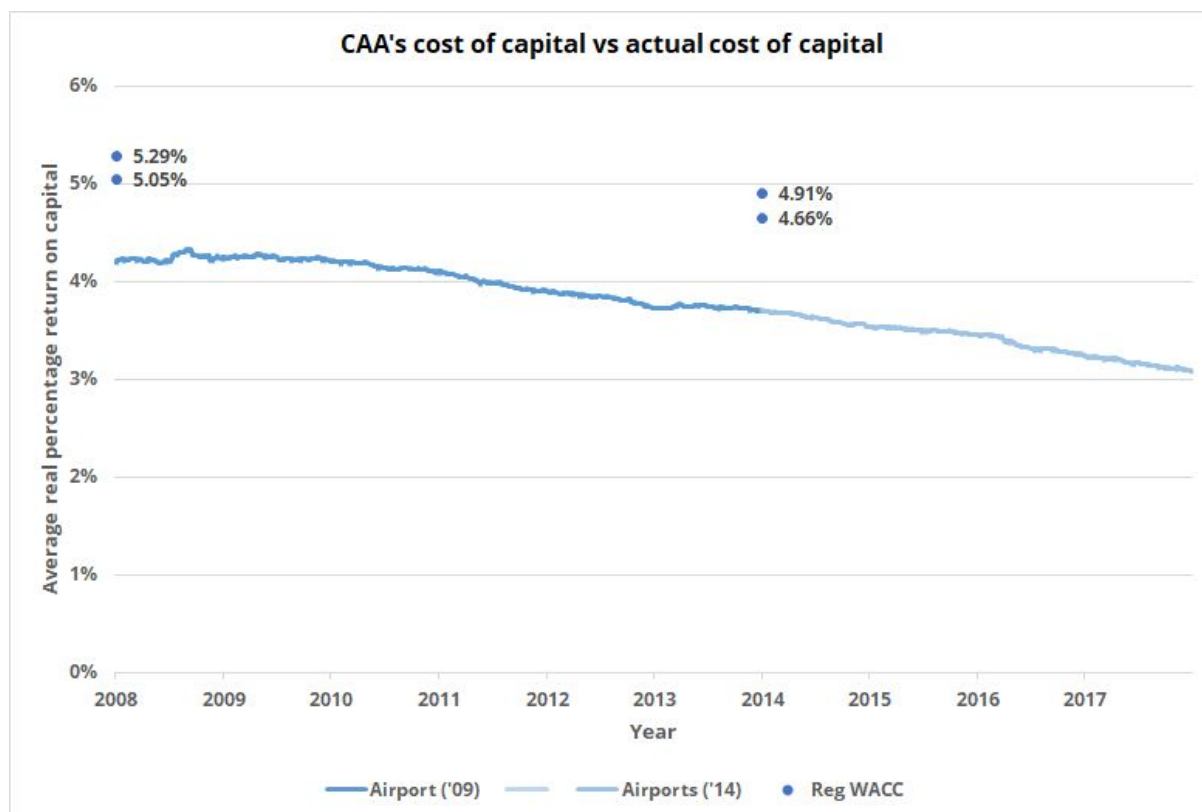
We offer an estimate of potential consumer overpayments but it is not a firm one and we do not include it in our total figure. This is because of the difficulty in estimating the cost of equity, due to there being no UK comparator listed companies. This is an issue we return to later.

³⁶ [The Profitability of BT's Regulated Services](#), Frontier Economics, 2013

³⁷ [The Split Cost of Capital and Utility Regulation with Particular Reference to Airports](#), Dieter Helm, 2011

However, the graph below, using data from an international comparator set of airports, estimates a cost of capital significantly lower than the CAA's regulatory estimates, which we estimate would lead to a £2bn reduction in consumers' bills. The CAA has since set its price control NATS En Route, the air traffic control operator, which indicates a cost of capital of 2.6% - significantly lower than indicated in our model for airports.

Figure 6: Analysis of the airport sector



2.8 Railways

Network Rail spends £6bn a year on maintaining and investing in our rail network.³⁸ Of this, £2bn³⁹ is spent on meeting 'capital costs'.

The rail network's 'capital costs' are different, because it isn't in private hands - it's therefore also excluded from our overall numbers, due to the hypothetical nature of this modelling. The government owns Network Rail. As there are no shareholders, there is no equity: Network Rail is *solely* financed by debt, which is guaranteed by the UK government. Before 2014, Network Rail issued that debt itself; following the ONS's reclassification of it as a public service, it started borrowing money directly from the government.

³⁸ [Periodic Review 2013: Final determination of Network Rail CP5, Financial Framework](#), ORR; Table 14.2, average annual expenditure in Great Britain (today's prices).

³⁹ [Periodic Review 2013: Final determination of Network Rail CP5, Financial Framework](#), ORR; original figure £8.1bn in 2013 prices. This includes the £2bn amortisation adjustment the ORR makes to ensure Network Rail's financial stability.

However, in the last price control, it was regulated *as if* it were a private business. The Office for Rail and Road (ORR) followed a 3-step process:

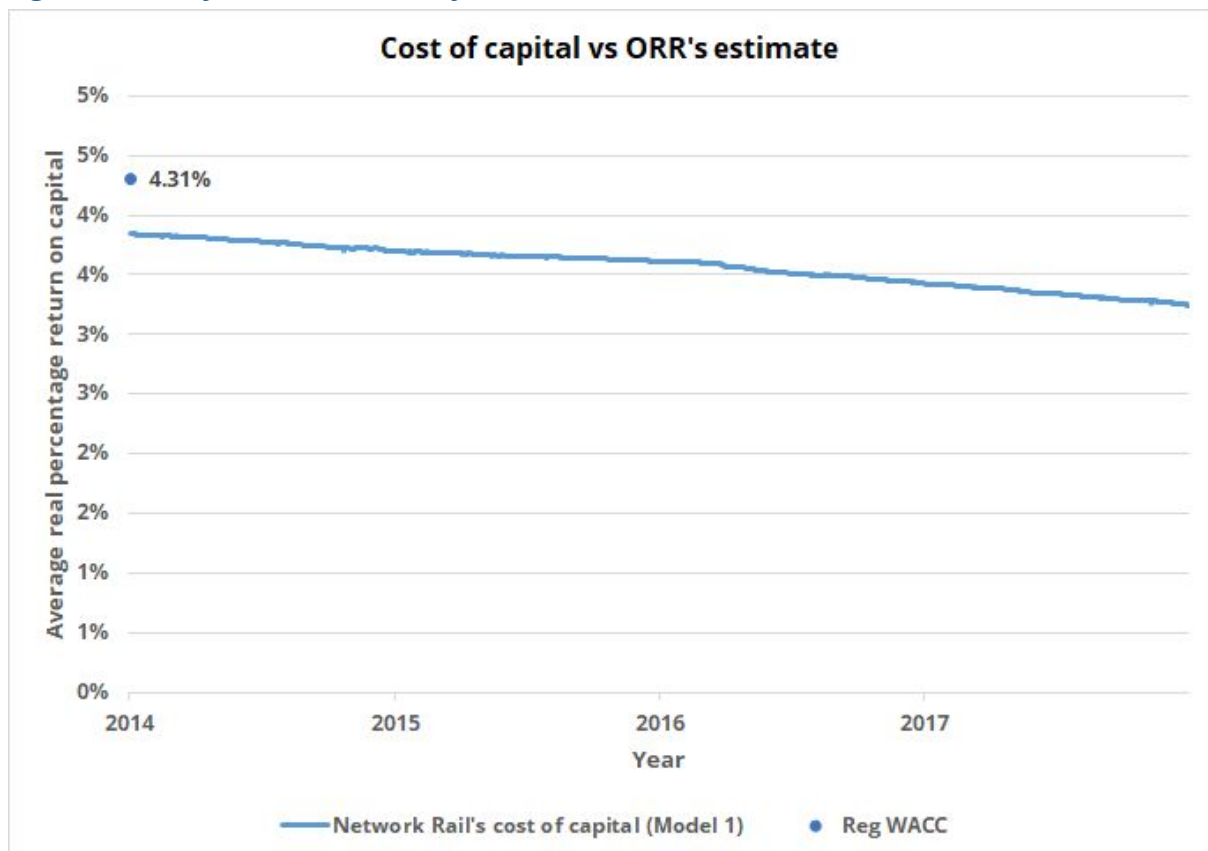
- 1) They estimate the cost of capital *as if* it were a private business;
- 2) They then deduct the additional funding that would go to equity holders and a further reduction in recognition that government backed debt will be cheaper than other forms of debt - this halves their capital allowance.
- 3) As this reduces their capital funding significantly, the ORR add funding for financial sustainability (through an increased 'amortisation adjustment').

In the latest price control, due to its reclassification as a public service, none of the above now makes a difference to Network Rail's overall budget.

However, the cost of capital decision the ORR makes still has relevance if the government were to ever place the business in private hands. The mistakes made by other regulators, if replicated by the ORR, would then have implications for future consumers.

We therefore estimate the excess cost of capital due to the assumptions the ORR make *if* Network Rail were a private business - i.e. if the equity reduction and additional funding adjustments were not made.

Figure 7: Analysis of the railway sector



If Network Rail were in private hands, the ORR's cost of capital assumptions for 2014-19 would allow it to earn £15bn in returns - or £3bn a year. This would increase Network Rail's costs from £6bn to £7bn a year. Over the period, that implies a £5.6bn higher capital cost for consumers than the current arrangement. This paper doesn't seek to adjudicate on the competing merits of each model - the consumer benefits of private capital could exceed an additional £1bn annual cost.

What if Network Rail were privatised and ORR estimated the cost of capital according to our proposed approach? We find that allowed capital costs would be £12bn. This leads to lower costs of £3bn, or £580m a year.

That means that the cost difference is as much about correct regulation as it is about ownership, given that over-estimating the cost of capital accounts for well over half the difference between private and public ownership of Network Rail (again, abstracting away from the other potential benefits and costs of private ownership). If this result transfers across monopoly industries, it indicates we are spending too much time thinking about ownership, and not enough time thinking about getting regulatory decisions right in the first place.

2.9 Next steps for the cost of capital

In their deliberations for setting the next price controls for water and energy, Ofwat and Ofgem have gone some way to correct the mistakes of the past. Following the publication of Citizens Advice's Missing Billions report, Ofgem has now acted in line with Citizens Advice's key recommendations in their recent RIIO-2 decision. Ofgem has acted on debt indexation and on equity indexation and lower equity beta in RIIO-2. Both Ofgem and Ofwat are proposing the lowest costs of capital in the history of British economic regulation: 2.4% in the case of Ofwat and 1.8% in the case of Ofgem.⁴⁰ Similarly, the CAA are intending to set a far lower cost of capital for air traffic control at 2.6% and the ORR have decided on a notional cost of capital of 2.6%.

However, both Ofgem and Ofwat need to hold their nerve and implement these changes, as well as commit to reforms that will stop these problems happening again.

⁴⁰ Implied cost of capital when deflated using RPI.
https://www.ofgem.gov.uk/system/files/docs/2019/05/rriio-2_sector_specific_methodology_decision_core.pdf (The Baseline Allowed Return on capital (WACC) therefore increases by 24bps (0.24%) relative to the assumption Ofgem presented in December which was 1.6%)

Chapter 3: How were these mistakes made?

To understand how regulators rewarded companies with £24.1bn they shouldn't have earned, we need to examine both of the components that underpin the cost of capital and the errors that regulators made along the way.

Throughout, there are 2 common themes:

- 1) **Reliance on forecasts.** Rather than trust available and objective market data, regulators assumed that their judgement about what capital costs would be were superior.
- 2) **Bias.** As shown above, whenever a decision could go companies' way, it has done. There could be many causes to this bias - from misjudging the risks of underinvestment to hearing industry's perspective more often than consumers' - but the data clearly shows systematic bias in decision-making.

This in turn points to our principal solutions, discussed in more detail in Chapter 4.

3.1 The building blocks of capital

As explained in Chapter 1, the cost of capital is determined by assessing how much funding should come from debt, how much from equity and then assessing the cost of each funding source. Regulators typically do this by calculating a weighted average of these costs - or the Weighted Average Cost of Capital (WACC) given by the formula:

$$\text{WACC} = (\text{cost of debt} * \text{gearing}) + (\text{cost of equity} * (1 - \text{gearing}))$$

This formula expresses the average percentage return that capital earns on its investment in the business. Take the example of Heathrow. In its most recent capital decision, the CAA decided that their cost of debt was 3.2%, its cost of equity 6.84%⁴¹ and that it would finance 60% of its capital through debt. If we plug that into the formula above we get:

$$\text{Heathrow's WACC} = (3.2\% * 0.6) + (6.84\% * 0.4) = 4.66\%$$

This cost of capital is earned *on* the regulated value of Heathrow's assets (the value of the company described in Chapter 2) - the monetary value that regulators (in this case, the CAA) assign to the regulated part of Heathrow's business. For its price control, its asset base is £15.8bn. So, for example, last year a WACC of 4.66% will allow Heathrow to earn a baseline of £730m.

⁴¹ Adjusted from nominal to real values.

3.2 The cost of equity and the capital asset pricing model

A *minority* of most of these companies' capital is financed by equity (35%-45%, excepting BT which is 68% equity based), but it typically forms a majority of the cost of capital. To estimate it, regulators have typically turned to a standard tool of finance theory — the Capital Asset Pricing Model. Two aspects of this model are particularly important:

- 1) It assumes that the *only* reason for differences in rate of returns should be a investment's risk (or volatility) when compared to the market's risk (or volatility). An investor should be *indifferent* between investments of equal risk.
- 2) It's trying to estimate *expectations* of what returns will be, rather than returns themselves.

When applied to the cost of equity, it's defined as:

Cost of equity = risk-free rate + (equity risk premium * equity beta)

1. **The risk-free rate** - this is the hypothetical return on an entirely safe investment. In principle, an investor wants some return to put their money even in the safest investment, to compensate them for foregoing the opportunity to spend that money today. The proxy usually used for estimating this is the return on government bonds (the closest to risk free you can usually get).
2. **The equity premium** - this is the average market return on investment, over and above the risk free rate. This makes sure that investors are getting sufficient return compared to what else they could invest their money in. If they don't, investors may cut investment or seek to exit from the industry.
3. **The equity beta** - The equity beta is intended to capture the riskiness of an investment, relative to the whole market. The higher the risk, the more you want the expected return to be - after all, there's a higher chance that you end up with nothing.

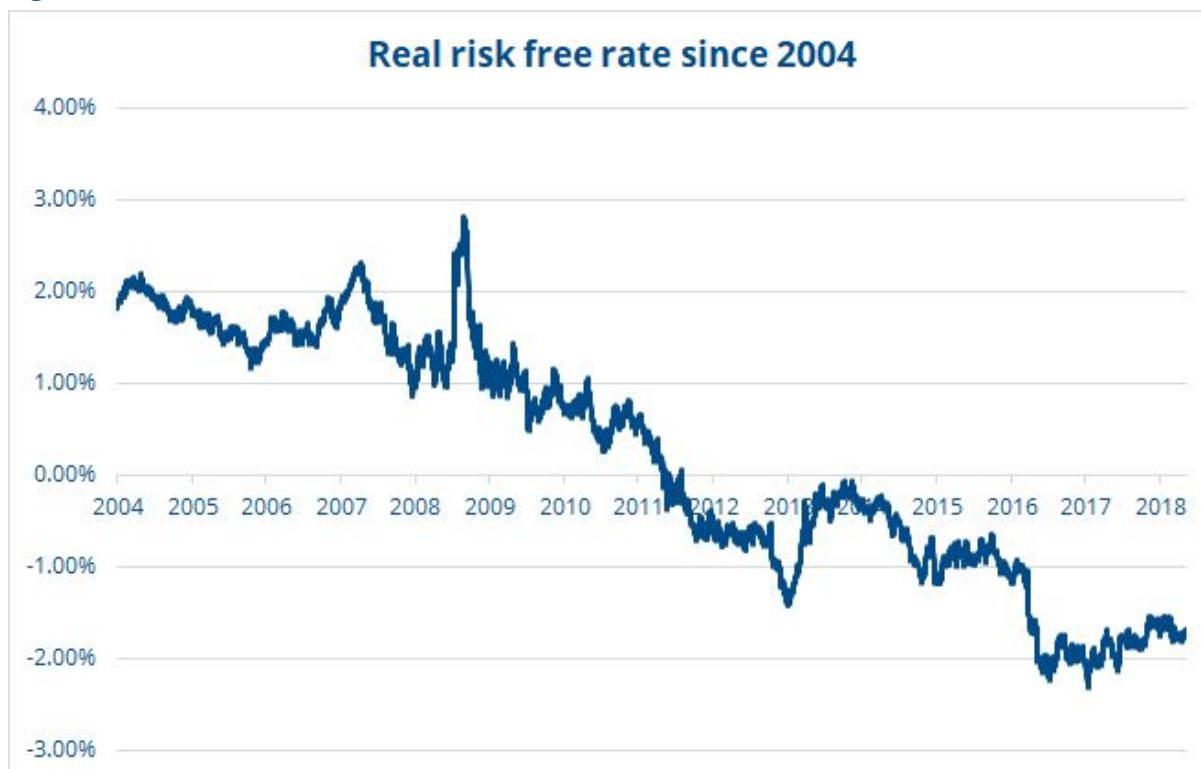
The equity beta is a numerical measure of this risk: specifically it compares a stock's volatility to the volatility of the whole market.⁴² You multiply the beta by the equity premium to arrive at the risk-adjusted return. If the beta is higher than 1, then the investment is riskier than the average market investment. If it's lower than 1, it's lower than average risk.

Regulators have to estimate each of these components. In making these estimations, regulators have made questionable judgements that have cost consumers. We review the approach taken for each of these estimates and examine what has gone wrong in estimating the cost of capital.

⁴² More precisely, it measures the correlation of an investment return relative to a diversified portfolio, so that investors are compensated for investment risk that cannot be diversified away.

3.3 What's the problem with the risk-free rate?

Figure 8: The real risk free rate



Regulators have typically assumed a risk-free rate of around 1.7-2% in real terms. In earlier years, this was justifiable. However, one of the persistent oddities of the post-financial crash economy is the negative real rate of return for government bonds. For many years, investors have been paying the government to (effectively) hold their money in real terms. That's an unusual place for an economy to be, but it's where the UK economy has been for some time and shows no indication of abating.

In recent years, some have recognised the contemporary market evidence (particularly the Civil Aviation Authority; and forthcoming determinations from Ofgem and Ofwat are expected to follow suit) and started to set rates markedly closer to zero.

Regulators set the risk-free rate too high because this has been the long-run average they expected 'depressed' rates to return to. In one sense - a narrow one - regulators' error here is excusable: nobody predicted the peculiar conditions of the financial crash would persist for this long. This could explain why regulators have felt comfortable agreeing rates of around 2%.

There are 2 problems with this justification. Firstly, the risk-free rate has always been volatile. Its standard deviation from its average is almost 2% since 1985. So while there is a long-run mean of close to 2%, it's not a good guide to expectations when it deviates so significantly.

That wouldn't necessarily be a reason to abandon using an average - if the average is the only predictor you have. But regulators needn't do any predicting here at all - the Bank of England publishes the daily data for the real return on 10 year Government bonds, the proxy that all regulators use. There's no good reason to not use this data. As we propose later, there's also no reason not to use it on a regularly updated basis. Regulatory judgement can be replaced.

3.4 Measuring the equity risk premium and the total market return

The equity risk premium is the return investors expect on a well diversified portfolio, over and above the risk-free rate. In practice, we never actually observe it: it's *inferred* by subtracting the risk-free rate from the market return.

The first thing that needs to be estimated, therefore, is the total market return: this is the daily return (both in changes to price of a stock and dividends paid from a stock). But in practice the daily return to the stock market is *too* volatile to be of much use. So regulators have relied on historic averages of the market return, stretching back to the 19th century, and subtracted their estimate of the risk-free rate from that return to arrive at their estimate of the equity risk premium.

This has weaknesses: in particular, it will take a long time (by definition) for that average to update to reflect current conditions. For example, if the secular stagnation hypothesis is true (that we are now in a persistent period of low economic growth), using the long run average return to stocks will lead to higher allowances than is needed to attract investment.

In light of this, some regulators have concluded that a forward looking model such as a Dividend Discount Model is appropriate, which attempts to measure the market return by reference to forecast future dividend payments.⁴³ While we regard such an approach as meriting further investigation, it appears too volatile. The Bank of England's DDM model, for example, implied dramatic increases in consumers' bills during the financial crash, as the Bank of England's model would indicate equity costs of 12%.⁴⁴ It therefore would not be implementable.

While using long-run averages has weaknesses, therefore, it should be the preferred approach. However, it is unclear that the appropriate starting point for an average should go back to the beginning of the stock market's dataset. It's reasonable to doubt whether returns for the year 1900 have much to tell us about future returns today; there has been considerable volatility in returns after that point.

⁴³ [Delivering Water 2020: Our methodology for the 2019 price review Appendix 12: Aligning risk and return](#), Ofwat, 2018

⁴⁴ [Section 4.4.4, Estimating the cost of capital for implementation of price controls by UK Regulators](#), Wright et al. (2018)

The UKRN cost of capital report suggests a range of between 6-7%, which they conclude is remarkably stable across time. We use the mid-point of 6.5%. We then estimate the risk premium by subtracting the risk-free rate from this figure.

3.4. The equity beta

Finally, for the cost of equity, we consider the equity beta: the systematic risk associated with a particular investment. Getting the beta right matters: across the price controls we studied, a shift of 0.1 in beta estimate leads to a roughly £4bn difference in costs to consumers over the study period.

The raw data for calculating beta is only available from listed companies - companies whose stock is traded every day on the stock exchange - so regulators have typically used the equity betas from publicly listed comparator companies, assuming that private companies face similar risks to these listed companies. This isn't *necessarily* a safe inference as listed companies only account for 25% of the total value of monopoly businesses. However, it's the only reasonable approach to take, given the ownership structure of these businesses.⁴⁵

The latest evidence, commissioned by Ofgem, on this subject finds that the average equity beta for water and energy companies is 0.6, which we use in our first model.⁴⁶ Their estimate covers the period 2008-2018. If they estimate over the longer time period 2000-2018, they find an even lower beta of 0.54.⁴⁷

In general, this market evidence has always fit a little better with an intuitive sense of how risky we should think these businesses are.

Instead of following the available market data, Ofgem and Ofcom have typically used values far in excess of what is observed in the financial data - usually assuming a risk *equal* to the average company, rather than what can be justified on its merits.

Here, Ofcom has done better. BT is similar in some ways to the other utilities - it has a very significant, price-controlled business much like the energy and water networks. However, it also has a much bigger unregulated, retail business which is riskier. The market prices both together; it therefore has a higher observed beta overall. Ofcom's task is to identify the beta of the underlying infrastructure business. Because, as the Indepen study notes, the data for BT is much noisier and looks less like the traditional utilities, we have used Ofcom's estimate that BT's infrastructure is 69% as risky as other companies to inform our findings there - a figure close to the overall mean for utilities.

⁴⁵ There's been a flight away from public to private ownership of these businesses in recent years. It's an open question as to how sustainable beta estimation will be if this persists.

⁴⁶ [Indepen](#), Beta Study RIIO-2, 2018; central value

⁴⁷ [Indepen](#), Beta Study RIIO-2, 2018; average of OLS single whole period estimates excluding BT, Table 5.3

This is an area where regulators can't avoid using some judgement: unlike the risk-free rate or the cost of debt (discussed below), betas have to be estimated over a longer-time period and some judgement is inevitably involved in the methodology selection.

Part of this is made difficult by the size of the sample: there are only 5 or 6 businesses (depending on how we treat BT) in the UK that feature significant price regulation as monopolists. Indeed, it has made our modelling of - for example - airports and railways much more difficult, because there are no UK listed businesses of this type to derive an effective beta from. As we later recommend, no more regulated monopoly businesses should be allowed to exit public markets, or regulation will become extremely difficult.

But how did Ofgem and Ofwat justify choosing betas close to or equal to 1 when the sample does not indicate this is correct? One reason is they re-engineered the beta to a hypothetical company. Rather than look at the *actual* risks of the company, they look at the risks that a hypothetical company would face *if* they had the same level of debt financing as regulators assume. This has led to higher beta assessments than can be justified by the evidence.

But this gets what the cost of capital estimation is trying to do wrong. The purpose is to determine the marginal cost of equity firms *actually face* for their regulated activities as the UKRN report argues:

'MPW argue that re-gearing does not constitute a valid argument for assuming values of equity beta outside the range of econometric estimates. Furthermore, MPW argue that since it seems clear that re-gearing assumed asset betas using notional leverage values is inappropriate for listed companies, it is hard to argue that it is an appropriate technique for unlisted companies.'

In that research, we also highlighted a methodology proposed by Wright et al., that would lead to even lower beta values for monopoly businesses - as low as 0.3-0.5. This is justified by estimating over a longer period - rather than estimate the beta over a sample period going back (say) 5 years, they look at the whole sample period for 2 listed utilities back to 2000 - and by using lower frequency data. To illustrate the potential further savings to consumers that such an approach could yield, we use a beta value of 0.4 in our second model for energy and water.

3.4. The cost of debt

The cost of firms' debt is largely determined by their credit rating, which is in turn determined by how likely rating agencies think the company is to default on its debt. When firms with a certain rating issue debt, this debt can be traded. Indexes are then developed to aggregate the prices of debts of a certain rating, and these indices can be used to estimate what any firm with that credit rating's debt will cost.

Regulators have used these indices to help inform what cost of debt they should allow, but they have also (with the exception of Ofgem since RIIO-1) relied on their own forecasting judgement, over-estimating what the true cost would be.

Ofgem has creditably moved to a rolling cost of debt index⁴⁸, where they take the average cost of debt over a 10 or 20 year period. This has successfully reduced the cost of debt compared to other regulators. However, it still includes debt costs from when Gordon Brown was Prime Minister, when debt was substantially more expensive.

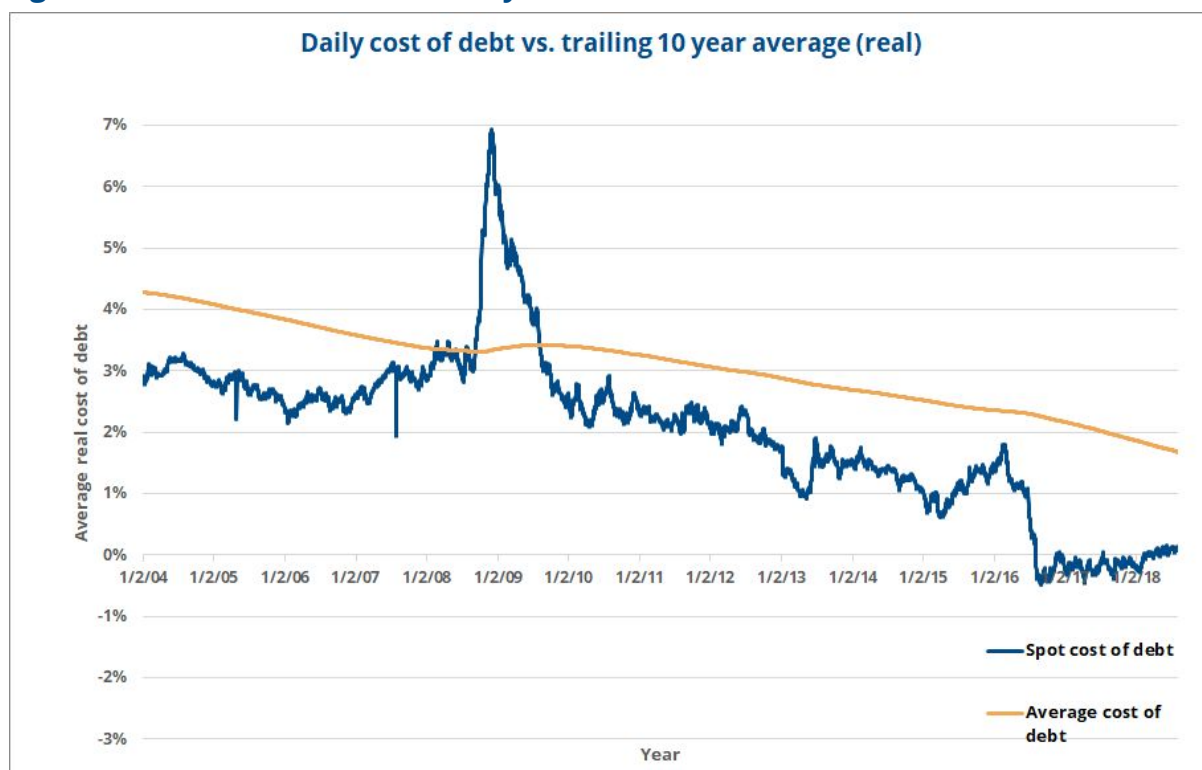
A second reason why regulators have persistently over-estimated the cost of debt is because of their treatment of historic debt. Monopoly companies are typically investing in long-term assets, so will have borrowed large amounts at different time periods, when debt was more or less expensive. If they borrowed when debt costs were high, the argument goes, they shouldn't be punished when rates are low. This could, in principle, undermine the financeability of the company.

This argument has some merit, but we should note it isn't what would happen in a competitive market. Firms aren't guaranteed future income for current debts in normal markets: they're expected to be disciplined and prudent in ensuring that their best estimate of future cash flows will pay for their current debts. And, while regulators have a duty to make sure these companies are financeable, it shouldn't be at any price.

Because debt costs are currently so low, using *any* average that includes past debt prices leads to higher current costs to consumers. While our model uses a 10 year average for debt, Figure 9 below shows that this still overstates the recent daily debt costs.

⁴⁸ [Cost of Debt Model](#), Ofgem, 2018

Figure 9: Cost of debt index vs daily cost of debt



Such higher costs - particularly at a time of unprecedented stagnation in incomes - need to be justified. The typical justification is that, just as current consumers pay for a portion of past higher prices, so future consumers will be compensated by paying on an average that includes today's lower costs.

Putting intergenerational issues to one side, that works - but only if the regulator credibly commits to using a single moving average. The precedent from Ofgem (the only regulator so far to implement this) is yet to be fully implemented. After its first 10 year index for electricity transmission, gas transmission and gas distribution, it adopted an index for electricity distribution that will extend to 20 years, keeping old debt costs in for considerably longer. In its latest price control decisions, it is yet to make a decision on iBoxx length.⁴⁹ If regulators cannot commit to the same mechanism, then there is no guarantee that future customers will be recompensed with lower costs.

Ofgem should stick to a 10 year cost of debt index and all other regulators should follow suit. Ofwat intends to introduce partial indexation in its 2020 price control; it should commit to using full indexation instead, as should other regulators.

This isn't perfect and current consumers will still be paying at a higher rate than they current debt costs indicate; there is no reason in principle not to use the daily rate for debt. Dieter Helm, the regulatory economist, has argued that *'any index less than five years will improve...arrangements. It could be an annual adjustment...it could be monthly, or even weekly or daily.'*⁵⁰ The UKRN cost of capital report concurs.⁵¹ But if regulators can

⁴⁹ Paragraph 12.16, [RIIO-2 Sector Specific Methodology Decision](#), Ofgem, 2019

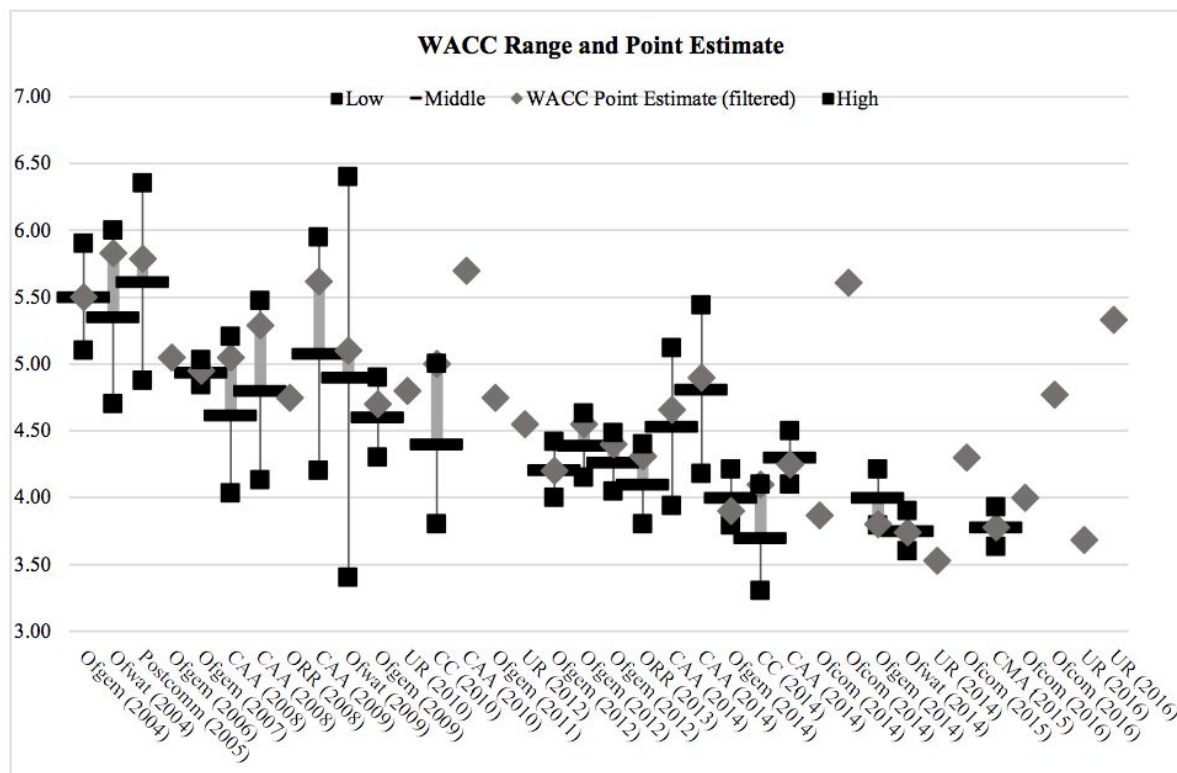
⁵⁰ Utility Regulation, the RAB and the cost of capital, Dieter Helm, 2009

credibly commit to the same 10 year index, debt allowances should, at an overall level, match spot debt costs over time - which is what is critical for consumers' interests.

3.5 Aiming up

Another error that regulators have made is their approach to setting the cost of capital once they have all the preceding pieces in place. Estimates of all these components lead to a range of possible values and regulators have to choose what the cost of capital will actually be. And they typically choose at the top end of that range.

Figure 10: UK WACC decisions (Source: UKRN Cost of Capital report)



The argument for doing this is that regulators face asymmetric risks in setting the cost of capital. At the margin, a small error in companies' favour adds a pound or two to everyone's bill. But a small error in favour of current consumers could jeopardise future investment: if companies can't raise capital, then investment we all need, for example in reducing environmental pollution in the water industry or decarbonising the grid in energy, might not take place.

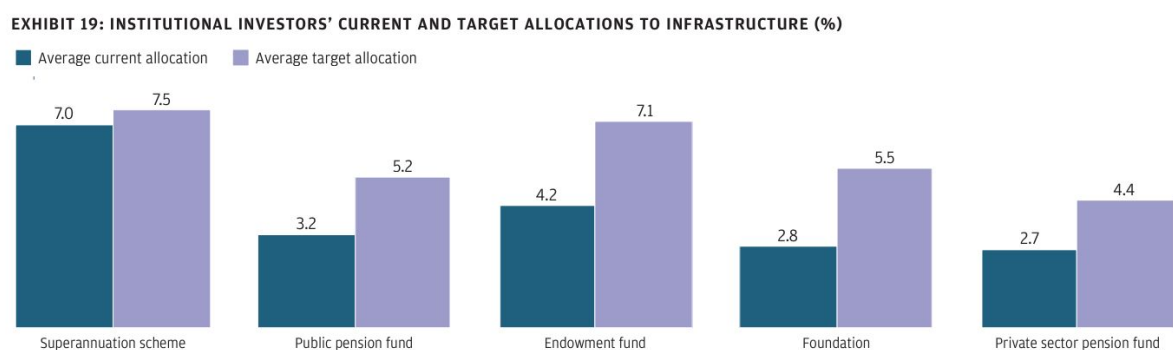
One's first reflection on this should be to look at past decisions: there's no evidence of such a problem. Companies rarely, if ever, have trouble raising necessary investment. Moreover all company owners have license requirements to provide this investment - if the existing owners are not forthcoming, regulators may take enforcement action.

Secondly, the case can only be made at the closest of margins. If it's pennies per consumer, that's one thing - but significant and persistent errors have been made.

⁵¹ See paragraph 8.5.2 of the [UKRN cost of capital report](#)

Thirdly and most importantly, this argument should be placed in the current economic context. If demand for infrastructure assets from investors was reducing, then this really could be a cause for concern: capital flight could lead to serious under-investment in vital essential services. But this is precisely what is not happening: instead, JP Morgan are anticipating that appetite for investment will increase.⁵²

Figure 11: Institutional investors expect to increase investment in infrastructure



3.6 Consistency of decision making and appeals

All of these decisions can currently be appealed to the CMA, who have traditionally placed great store in regulatory precedent and consistency. For example, in their determinations on Bristol Water's appeal against its allowed debt costs, where it allowed Bristol Water a higher debt allowance, the CMA's view was partly reached due to worries about 'the risk of regulatory inconsistency with the overall approach to the cost of capital'.⁵³ Regulators' decisions on cost of capital may in part be informed by a fear that the CMA may disallow new approaches that might better estimate the cost of capital.

This desire for consistency is not without reason - investment may be deterred if investors cannot achieve a degree of predictability in their earnings over time. But it isn't - or shouldn't be - defense against getting the costs wrong in the first place. We think there is enough evidence that suggests these mistakes have been systematic and significant. And our solutions - primarily greater use of indexation that regulators credibly commit to - create their own consistency in decision-making for some of the most significant elements of the cost of capital.

3.7 Conclusion

Taken together, regulators have persistently over-estimated the average cost of capital. Some reasons - like for the risk-free rate and cost of debt - were because of errors in forecasting. Some - like excessive 'aiming up' on the cost of capital - were because of misjudgements. And some - like post-hoc re-engineering of the equity beta - we think were errors in justification. All of these have demonstrably increased consumers' bills over the past 15 years. How can these mistakes be avoided in future?

⁵² JP Morgan. (2019). [Long Term Capital Market Assumptions](#)

⁵³ CMA, [Bristol Water Final Determination](#)

Chapter 4: Conclusion and recommendations

The previous chapter sets out how regulators have previously made mistakes about what the cost of capital should be. As a result, people have overpaid by billions each year. First and foremost, consumers deserve their money back.

The forward looking solutions we propose are, in principle, straightforward: where regulators can rely on real market data rather than their own judgement, they should prefer the former. Where possible, regulators should think about whether competition can bust open these monopolies, with competitive bidding revealing companies' cost of capital.

These decisions also require a more comprehensive review. We conclude with recommendations to the government to examine these problems in more detail and consider what, if any, institutional reforms might be needed.

4.1 What should be done now: give consumers their money back

When we highlighted these concerns in the energy sector, we called on energy network companies to return money through a rebate on customers' bills. Three companies - SGN, Western Power and Scottish and Southern Electricity Networks - acted, returning £287m they could otherwise have collected from customers. Other companies have also taken steps: National Grid announced that they would be deferring £590m of their investment allowance until the next price agreement, £123m of which would have been paid by consumers in the current price agreement. Cadent has also reduced their planned spending by £54m.⁵⁴ However, the following energy companies haven't so far returned money back to consumers:

- Electricity North West
- Northern Powergrid
- UK Power Networks
- Northern Gas Networks
- Wales and West Utilities.

In addition Scottish Power Energy Networks set up a £15m green economy fund after our report. But this didn't return money directly to consumers.⁵⁵

In the water industry, when Ofwat called on firms to recognise the difficulties that customers were facing as a consequence of the financial crash in 2013, amid planned bill increases, some firms voluntarily did not collect revenue from customers, reducing customers' bills by £435m.⁵⁶

⁵⁴ Citizens Advice, [The postcode lottery in energy profits: A regional update of Energy Consumers' Missing Billions](#), 2018

⁵⁵ [SP Energy Networks launches green economy fund to support Scotland's communities](#), Scottish Power, 2018

⁵⁶ Ofwat, [Written evidence to the Public Accounts Committee](#), November 2015

More recently, South West Water proposed in their PR19 business plans that they should return past excess debt costs to consumers - explicitly recognising that these were 'unearned gains' - in the form of offering shares in the business.⁵⁷ We'd like to see all companies, in respect of all years that they have collected too much revenue from consumers for capital costs, return money to consumers. Returning money to consumers is an indication that companies are acting in consumers' interests. When considering business plans for RIIO-2, Ofgem should take this into account when assessing whether they are good value for consumers' money.

While in all cases the money that was returned was far less than consumers had been overcharged, it was a welcome step. But this study demonstrates that consumers have been facing higher costs for a far longer period. It's now time for firms across these industries - energy, water and telecoms - to return money to customers. In energy and telecoms, given that energy and telecoms networks are one stepped removed from the direct consumer, firms may need to work with their regulator to ensure that consumers directly benefit from this reduction.

There's an opportunity here for firms to recognise that the level of revenue they have received was not in consumers' best interests. The political atmosphere is not kind to companies who are judged to be ripping off customers. Returning money is in consumers' best interests: it may be in firms' best interests as well.

If firms do not act, the government must act to ensure that consumers get their money back. One way to do this would be to mandate a reduction in consumers' bills. The government implemented this in the energy industry in 2013 for electricity bills, which provided a total rebate of £620m on consumers' bills.⁵⁸ This approach could be built upon and extended to make sure consumers go their money back, if companies failed to act.

4.2 Improving future decisions

The cost of debt and the risk-free return on investment are known. Regulators don't need to guess it: the data - in the form of 10-year debt index and the spot rate for the risk-free rate - is available. Ofgem have responded to the calls we made in Energy Consumers' Missing Billions, and Ofwat have also made significant progress meaning that are both headed in the right direction for their forthcoming price controls, although it's vital they stick to their guns and deliver lower costs for consumers. This section summarises what we regard as the best implementation of this indexing that would most accurately track underlying debt costs.

4.2.1 The cost of debt

⁵⁷ South West Water, [Business Plan 2020-2025 Empowering customers](#)

⁵⁸ [Government Electricity Rebate scheme](#), Ofgem

For the current price control for electricity transmission, gas transmission and distribution, Ofgem implemented a 10 year cost of debt index to calculate how much consumers should pay towards companies' debt costs. It used the iBoxx debt index, which is a simple average of debt returns on A and BBB corporate bonds. This has been successful and we recommend it sticks to this index in the next round of price controls.

For the electricity distribution price control (RIIO ED1), Ofgem implemented an index that will eventually cover 20 years. This is too long a time span: consumers shouldn't be paying for debts when the real cost was 3% (in 1999) given the current real spot cost of debt rounds to real 0%. This would lead to consumers paying a higher cost of debt.

We recommend:

- **All regulators should use a 10 year average for all price controls.** Ofgem should retain its existing 10 year average. Ofwat should commit to full indexation (rather than allowing a proportion of embedded debt) and the CAA and Ofcom should implement it.
- **Regulators should commit to not changing the length of the average in future decisions.** Particularly as debt costs rise, firms will begin lobbying regulators to increase debt allowances. It's essential that regulators don't do so and stay committed to the indexation approach they have chosen.

4.2.2 The risk-free rate

The risk-free rate is simple to index: the Bank of England publish the spot rate for returns to 10 year Government bonds each day. Regulators should use this as the input for the risk-free rate, to calculate equity capital allowances in each year.

While we accept the argument for using a trailing average for the cost of debt, such an argument does not hold for the risk-free rate. When taking on debt, firms have ongoing financial obligations at the original price for the debt they acquired - the entire case for a trailing average turns on this point.

This is not true for the risk-free rate - what the risk-free rate was in 2008 is irrelevant to current prices and investor expectations; and because equity is not guaranteed a return, there's no need to reflect conditions over a longer period of time.

We therefore recommend:

- **All regulators, in calculating the cost of equity, should index the risk-free rate using the daily spot rate to update capital allowances on an annual basis.**

4.2.3 Other elements of the cost of equity

Not all parts of the cost of capital estimation can be indexed. Regulatory judgement on the total market return and equity beta will still be needed and in making these decisions, regulators should use the best evidence available in estimating them. The first of these is the total market return, where we recommend using the long-run average return to the UK stock market.

The second element of the cost of capital that requires judgement is the equity beta. We argued in *Things can only get beta* that this has been estimated incorrectly by Ofgem, but this argument runs more widely to other regulators - all of whom (apart from Ofcom) have indicated betas of around 1 when the raw data indicates they should be substantially lower.

Our core recommendation from this remains the same:

- **Ofgem and Ofwat should use raw estimates of beta from available listed comparator companies.** These indicate substantially lower betas than currently. They should consider whether the even lower betas indicated by the UKRN study can be justified. We recognise, however, that Ofcom's regulation of BT requires further within-company analysis.
- **Regulators should block any further transactions that would take utilities private.** To estimate betas, we rely on market data from publicly listed companies. If any more are taken private (i.e., off the stock market), it will become increasingly difficult to estimate this figure.
- **Regulators should use a somewhat lower Total Market Return figure of 6.5%,** to reflect the UKRN's cost of capital report's recommendations.

If regulators adopted indexation for both the cost of debt and the risk-free rate, they'd increase the accuracy of capital allowances considerably. When making this recommendation, we're mindful that the risk-free rate and cost of debt can likely only increase from their current lows and therefore that consumer bills will likely be higher in the future under our preferred approach when compared with just taking today's market rate for these variables.

We're comfortable with that conclusion. This isn't (only) an exercise in reducing bills: the cost of capital should be set at the level the market data indicates will attract the necessary investment. Indexation will achieve this. But - because regulators have made decisions that favoured companies for so long - it will also reduce bills compared with relying on ex ante estimation alone.

Our conclusion on beta is simpler: regulators - particularly Ofwat and Ofgem - should use the actual market evidence regarding what the right level is, rather than manipulate the figures in a way that has led to them concluding on higher betas than can otherwise be justified.

4.3 Introducing competition

A second piece of the puzzle is competition: can it help deliver lower costs than relying on the regulator to work out what those costs should be and asking incumbents to deliver them? This is a much broader question than the cost of capital. It goes to the heart of deciding what monopoly infrastructure we need and when we need it, not just the return it earns when we've decided we *do* need to build it. It's only possible to touch briefly on it here.

Competition can help solve some of the fundamental information asymmetries between regulators and the companies that run these services. Regulators can never know the businesses they're regulating as well as companies do. And, while we think the solutions above would go some way to substantively solving cost of capital issues, there will always be opportunities for bias to sneak its way into decision-making.

One way of escaping this trap is to open up more services to competition. As we outlined above, the cost of capital agreed for the Thames Tideway Tunnel was almost exactly what our models suggest it should have been at that point in time (even if capital costs have since declined further still) - though, as we note above - this benefited from certain government guarantees and only forward looking debt. And we know that that reduced cost was a *consequence* of competition - Ofwat had previously indicated it expected a cost of capital 25% higher would be necessary. Ofgem suggests that the competitive tendering process for its offshore electricity lines has delivered up to £470m of consumer savings thus far.⁵⁹

Of course, there are differences in principle between bidding for short-term construction projects versus long-term asset management. We're not suggesting competition for everything - indeed, all we are suggesting at this stage is a greater scope for the role of competition. But a world where more organisations - companies, trusts, not-for-profits - can compete to deliver the monopoly services we need may well deliver more for less.

4.4 Further reviewing what has gone wrong

The mistakes we document deserve serious investigation and review, not just commitments from regulators to make better decisions in future.

Some of these mistakes have been challenging to uncover, because regulators haven't consistently published the data necessary to unpick it. For example, finding historic asset values for certain sectors has been impossible. A concrete and simple measure to improve transparency would be for regulators to publish all decisions about historic price controls, in an easy to discover format.

We recommend:

- **The National Audit Office should review our findings and launch its own investigation into whether consumers have got value for money.**

⁵⁹ [Evaluation of Ofsto Tender Round 2 & 3](#), Ofgem

- **The National Infrastructure Commission, through its current review into utility regulation, should review our recommendations** and help ensure that these mistakes are not made again.

Technical Appendix

This appendix sets out how we calculated how consumers have overpaid for Weighted Average Cost of Capital allowances earned by regulated monopolies over the past thirteen years.

At the high level, we calculate excess capital revenue by:

$$\text{Excess capital revenue} = \text{Allowed cost of capital} - \text{modeled cost of capital}$$

Where **allowed cost of capital** is the revenue that regulators in fact permitted firms to collect from consumers to cover the cost of borrowing debt and attracting equity and the **modeled cost of capital** is what we calculate as the actual revenue required to cover these costs.

Allowed cost of capital

We calculate this by:

$$\text{Allowed cost of capital} = \text{Regulatory Asset Value} * ((\text{cost of debt} * \text{gearing}) + (\text{cost of equity} * (1 - \text{gearing})))$$

To calculate this, we begin with the Regulated Asset Values for each firm, which represent the total value of the assets the firm owns, for each year. We take these from regulatory reports and past values shared by regulators. Where the RAV is not available for a particular year, we have adjusted according to the average percentage change in RAVs for years where we have data.

We have adjusted the Regulated Assets Values from their starting price year to 2018 using RPI, as per existing regulatory practice.

We take the cost of debt, gearing and equity measures from regulators' price control financial models (where available) and from the [UKRN Cost of Capital update 2018](#). We then calculated the allowed cost of capital for each price control. For price controls where the cost of debt changes each year (Ofgem's RIIO controls), we calculated annual allowed cost of capital. All WACCs used are vanilla WACCs. A full list of data sources is included below.

Modeled cost of capital

To calculate the **modeled cost of capital** we use the same headline formula and same inflation-adjusted RAVs as above. We use the same gearing as used by regulators.

For the cost of debt, we use a 10 year trailing average using the iBoxx index published by Ofgem during the last [Annual Iteration Process](#). For dates since 30th November where spot rates are not available, we use the average debt costs for 2018 so far.

The iBoxx index dates back to 1998, meaning some of the years in this study don't have 10 years worth of its average available. For these years, we assume a spread of 150bps between Government gilts and corporate bond yields, based on observed spreads from 1998 to 2008.

For the cost of equity, we use the following formula:

$$\text{Cost of equity} = \text{Risk Free Rate} + ((\text{Total Market Return} - \text{Risk Free Rate}) * \text{Equity Beta})$$

For the risk-free rate, we use daily returns on 10 Year Real Zero Coupon Bond, as published by the Bank of England.

For the total market return, we use 6.5%, at the mid point of the UKRN estimate.

For the equity beta:

- For water and energy, we use Ofgem's consultants' most recent report on water and energy betas, to arrive at a value of 0.6.
- For broadband and telephone networks, we use Ofcom's assumption of 0.69.
- Because there are no listed airports or railways in the UK, we use an international comparator group for these to arrive at 0.82 and 0.9 respectively. These estimates are calculated using data from the Infront Financial Information Terminal, using returns from relevant listed companies.

Additional Data Sources

Regulatory Asset Values:

- [Ofgem Price Control Financial Models](#)
- [Ofwat Regulatory Capital Value Updates](#)
- [Ofwat Legacy populated feeder models at final determination](#)
- [Ofwat Future water and sewerage charges 2005-10](#)
- [Network Rail Financial Statements](#)
- [Heathrow Regulated Asset Base](#)
- [Economic regulation at Gatwick from April 2014: final proposals](#)
- [BT Financial Statements](#) (Mean Capital Employed)

Regulatory WACC sources

- [Ofgem Price Control Financial Models](#)
- [Further estimates from Ofgem on Ofwat, CAA & Ofcom price controls](#)
- [UKRN Cost of Capital updates](#)

Real WACC sources

- Indepen's equity beta report; daily financial returns for relevant listed companies and UK FTSE All Share Index, downloaded from InFront Financial (estimates of beta)
- Ofgem [cost of debt index](#)
- [Real Zero Coupon Bond](#) returns (10 year)

Summary of excess capital revenue and RAVs by price control

The following tables summarise our key findings by price control. All RAVs are adjusted to 2018 prices. The modeled costs of capital are calculated using the model described above. These are average figures during the price control period. Figures will not sum due to rounding. Totals for sectors quoted in this report are rounded to the nearest billion. Years refer to the end of the financial year (e.g. 2005 refers to the financial year 2004/05).

Table 1: Excess capital revenue in the water industry

Price control	Cumulative RAVs	Allowed cost of capital (%)	Modeled cost of capital (%)	Excess revenue
PR04: 2006-2010	£305bn	5.1%	3.9%	£3.5bn
PR09: 2011-2015	£330bn	5.1%	3.2%	£6.1bn
PR14; 2016-present	£285bn	3.7%	2.5%	£3.4bn
Total				£13bn

Table 2: Excess capital revenue in the electricity distribution industry

Price control	Cumulative RAV	Allowed cost of capital (%)	Modeled cost of capital (%)	Excess capital revenues
DPCR4 (2005-2010)	£105bn	5.6%	3.9%	£1.6bn
DPCR5 (2011-2015)	£115bn	4.7%	3.2%	£1.7bn
RIIO ED1 (2016 to present)	£100bn	3.7% ⁶⁰	2.5%	£1.2bn
Total				£4.5bn

⁶⁰ All RIIO WACCs are annually updated due to cost of debt indexation. This is the average WACC over the price control so far.

Table 3: Excess capital revenues in the electricity and gas transmission industry

Price control	Cumulative RAV	Allowed cost of capital (%)	Modeled cost of capital (%)	Excess capital revenues
TPCR3 - NGC (2005-2007)	£30bn	5.2%	4.2%	£300m
TPCR3 - Transco (2005-2007)	£15bn	5.3%	4.2%	£200m
TPCR4 (2008-2013)	£100bn	5.1%	3.6%	£1.4bn
RIIO T1 & GT1 (2013 to present)	£130bn	4.2% ⁶¹	2.7%	£2.0bn
Total				£3.9bn

Table 4: Excess capital revenues in the gas distribution industry

Price control	Cumulative RAVs	Allowed cost of capital (%)	Modeled cost of capital (%)	Excess capital revenues
GD-PRC4 (2009-2013)	£90bn	4.9%	3.5%	£1.2bn
RIIO-GD1 (2013 - present)	£111bn	4.0%	2.6%	£1.5bn
Total				£2.6bn

Table 5: Excess capital revenues in the broadband industry

Price control	Cumulative RAVs	Allowed cost of capital (%)	Modeled cost of capital (%)	Excess capital revenues
FAMR 2014: 2014-2018	£35bn	3.9%	3.6%	£100m
Total				£100m

⁶¹ Different WACCs were calculated for different assets in this price control. This is the average, weighted by RAV for each asset.

Table 6: Hypothetical excess capital revenues in the airport industry

Price control	Cumulative RAVs	Allowed cost of capital (%)	Modeled cost of capital (%)	Excess capital revenues
HAL09: 2009-2014	£95bn	5.1%	4.0%	£1bn
GAL09: 2009-2014	£15bn	5.3%	4.0%	£200m
HAL14: 2015-present	£80bn	4.7%	3.3%	£1bn
GAL14: 2015-present	£15bn	4.9%	3.5%	£200m
Total				£2.4bn

Table 7: Hypothetical excess capital revenues in the rail industry

Price control	Cumulative RAVs	Allowed cost of capital (%)	Modeled cost of capital (%)	Excess capital revenues
Network Rail: 2014-19	£350bn	4.3%	3.5%	£2.8bn
Total				£2.8bn

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