Energy Consumers' Missing Billions

The profits gifted to energy networks

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Contents

List of figures

Summary

Britain's infrastructure has undergone a great liberalisation in the past 40 years. Competition and markets have increasingly replaced state-run monopolies and consumers have more choice as a result. There are many more providers in these markets - energy alone now has over 60 suppliers.

Competition's role is necessarily more limited, however, when it comes to the physical infrastructure itself. It isn't profitable or practical for companies to build competing assets. The companies that own and run this infrastructure are therefore natural monopolies. As a result, the prices these companies charge have to be regulated by government.

This regulation is a negotiation between companies and regulators. Companies seek to maximise revenues while regulators seek to minimise the price consumers pay while guaranteeing efficiency and security of supply. This negotiation is, in many ways, harder for regulators than for industry. Companies know more about their costs and can afford expensive lobbyists and consultants. There is a risk, therefore, that these decisions lean in industry's favour, meaning excess profits and unjustifiably high prices for consumers.

This is exactly what has happened in energy. Energy networks, the companies that run the pipes and wires that carry gas and electricity, are forecast to return over **£25bn** to investors and creditors in the course of the current price agreement.

Our central estimate is that **£7.5bn**[1] of these returns are excess profits - that is, profits that are entirely unjustified, not reflective of performance, and in excess of what is required. The regulator intended the best-performing companies to earn double-digit returns while the worst earn only enough to pay the cost of their debt. Instead, the ***average*** **company profit is 10% and none earn less than 7%.**

Energy networks are enjoying a multi-billion pound windfall, paid for by consumers.

Our modelling is based on revisiting several key decisions Ofgem, the energy regulator, made in its latest price negotiations with energy networks. Our modelling shows how, in each of five key decisions, the numbers went considerably in networks' financial favour. It is hard to see how the companies could have failed to make large profits.

We also explain why this happened. Partly, estimates were made that always seemed generous to industry. Partly, this was a highly uncertain period, in which interest rates and bond returns were unprecedentedly low. Because of the approach used (for example, some forecasts were fixed, rather than being indexed to market conditions), network companies profited from these trends.

[1] Our model finds a low estimate of £3.5bn and a high estimate of £11.1bn.

Recommendations

Most importantly, we propose measures to make sure consumers get their money back:

1. **Network companies should voluntarily return money to consumers through a rebate on their bills.** There is precedent, particularly in the water industry, for returning overpayments to consumers. Companies have a chance to do the right thing and recognise that much of the profit they are earning is not in consumers' best interests. Ofgem should work with network companies to make sure this happens.

2. **If network companies fail to act, the government must act to make sure consumers get their money back.** At a time when many consumers are struggling to pay their bills, it is unacceptable for companies to be gifted billions in excess profits. If companies do not voluntarily return this money, the government should implement a mandatory rebate.

We also propose changes to make sure this never happens again:

3. **Ofgem should, as far as possible, stop trying to forecast costs over a long time period.** This is an impossible task in any context. For key financial metrics, such as the risk-free rate, Ofgem should use real market data to index network companies' costs. It should shorten its cost of debt index. Market prices can go up as well as down - but market prices are always going to be a better, less biased guide to actual costs than long-term regulatory forecasts. For our central figure, we estimate indexation could save consumers £3.4bn over the course of this price control.

4. **Ofgem should adjust the equity beta, a financial measure of risk, to those observed for other utility companies.** Ofgem has assumed that network companies are far riskier than the empirical evidence suggests and this has huge consequences for profits. We estimate consumers could save £3bn over the course of the price control.

5. **Ofgem should set much tougher incentives for network companies.** Rather than providing mostly financial rewards and reputational penalties, companies' capital should be placed at risk. Every reward for the best performer should be matched by a penalty for the poorest performer. If Ofgem had set the incentive package more robustly and symmetrically consumers could save £1.1bn.

6. **Consumer bodies should be given more power to request a review of a price control when financial returns are excessive.** Network companies currently have the power to request a review at any time during the price control, but consumers do not.

1. Introduction

1.1 Why energy networks' returns matter

Energy networks - the wires and pipes that connect electricity and gas supplies to homes and businesses - are among the most important infrastructure in the country. They underpin the vast majority of modern economic activity. They also have a significant impact on consumers - while a consumer's direct relationship is with their energy supplier, it's energy networks that make sure that the lights and heating stay on. Finally, they're a key part of shaping our energy system and are rare - but crucial - sources of direct customer support in the event of power cuts or gas leaks.

They are also expensive: networks' operating revenue run to over £11bn[2] a year (which excludes certain other drivers of cost, such as incentive payments). Most analysts, and Ofgem, expect the role of (particularly electricity) networks to expand and their costs to increase as society meets the challenges of decarbonisation and the transition to a smart energy system.

These costs are incurred in a wider context where average incomes have stagnated for the past decade. It's therefore critical that these costs are interrogated and justified. A major component of these costs are networks' base financial returns - the amount of money they return to creditors or investors - representing 21% of their baseline revenue. Base financial returns are expected to be a colossal **£19.7bn** over the course of the price controls, with incentive payments (money in exchange for delivering services particularly well or efficiently) forecast to be a further **£5.6bn**[3]. Companies will earn an average 10% return on equity, which is an average 19% profit margin on base revenue. Even considering these are more capital intensive businesses, when compared to the 4% margins the CMA stated are enjoyed by the 'Big 6' energy suppliers, these are eye-watering amounts.

However, it's not enough to simply identify the size of these returns as cause for concern. If the efficiency and innovation gains delivered by the companies that own our energy infrastructure were sufficiently enormous, it might well be our position - as the consumer advocate - that these returns were justified. **The analysis we present here strongly suggests this is not the case.**

Energy networks are privatised: they are run by companies in exchange for a profit. Because networks are natural monopolies - it only makes sense to have one set of pipes and one set of wires - Ofgem, the energy regulator, sets how much revenue they are allowed to collect from consumers in a **price control.** The current price control period is called RIIO - 'Revenue = Incentives + Innovation + Outputs' - and runs for 8 years. It has

[2] First year of price controls. Unless specified otherwise, all prices are in 2016/17 prices.
[3] These figures are calculated by summing actual and forecast debt costs and equity returns from the Price Control Financial Models (for base financial returns) and RIIO Annual Reports (for additional incentive payment estimates).

been in effect since 2013 for gas distribution (RIIO-GD1), electricity transmission (RIIO-ET1) and gas transmission (RIIO-GT1), and 2015 for electricity distribution (RIIO-ED1).

The design of these price controls intends to create incentives for companies to deliver energy networks as efficiently as possible. It does this by allowing companies to keep part of the difference between their actual costs and what Ofgem sets their allowed revenue as. The deal is supposed to be: as a reward for delivering an efficient, quality service to consumers, network companies receive a proportion of the revenue they collect as profit.

While it is true that networks' current price control has led to a markedly more efficient and innovative system, the returns that networks have earned as a consequence are far from proportionate. Rather than earning returns only because of the efficiencies they are driving, energy networks are being gifted additional billions in profits for no good reason at all.

This paper updates our previous research, *Many happy returns*, which analysed profits under previous price controls in the energy and water sectors. Since that research, new data on energy network companies' profits allows us to put quantitative estimates on the amount consumers are overpaying by for the first time.

1.2 The structure of this report

Chapter 2 presents an overview of how energy networks make their returns and our analysis of the judgements Ofgem made in designing the current price control. It specifies five key variables - the cost of debt, the risk-free rate, the equity beta, real price effects and calibration of incentives - where unnecessary billions have been gifted to energy networks.

Chapter 3 presents the results of our modelling of energy network returns, based on Ofgem's forecasts contained in their Price Control Financial Model. We provide quantitative estimates - based on adjustments to our five key variables - of how much consumers are overpaying.

Chapter 4 explains how Ofgem and energy networks can and should fix this. It sets out how Ofgem should change its decisions in future price controls and practical actions that could be taken now to reduce consumers' bills.

2. What's gone wrong with this price control?

Every year, every energy network earns a substantial profit. Their equity returns are forecast to be 10% on average over the course of the price control.

To answer whether this is justified, we start by asking: what outcome is Ofgem trying to achieve when it sets a price control? Its duty is to consumers, so it should seek to set the level of return at the lowest level that achieves the outcomes for consumers it defines as desirable while ensuring that networks' have access to sufficient finance for delivery. Specifically, Ofgem set its own aspiration as:

'An appropriately calibrated price control package [is] one in which the reward available for the best-performing companies provides the potential for double-digit returns while the downside is at or below the cost of debt."[4]

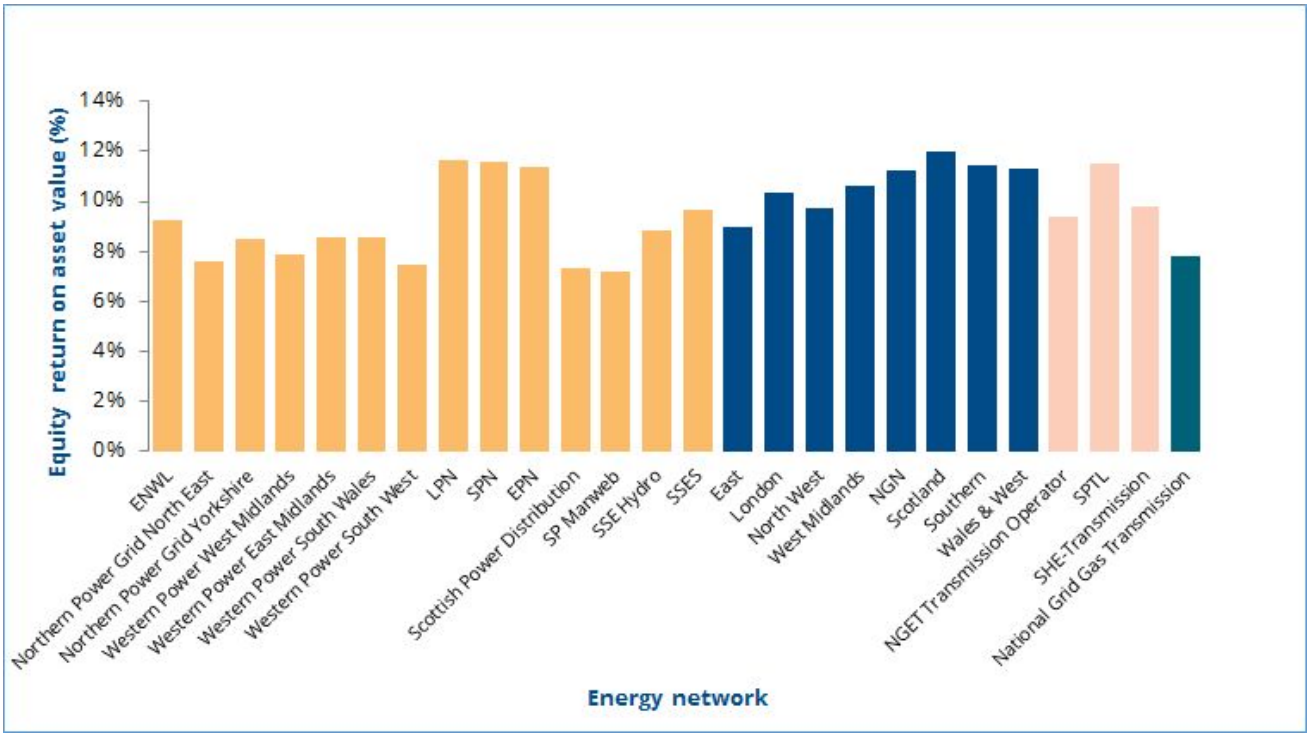
By this they mean that if network companies are performing substantially better than their peers, they should be rewarded for it; if they are performing substantially worse, then their returns should be sufficient to pay their debts, but no greater.

It is an open question as to whether energy networks should ever earn double-digit returns. We'll argue below that network companies are fundamentally low-risk businesses, so double digit returns may well be inappropriate even for exceptional performance.

However, even under the terms of its stated aim, the price control is failing to deliver. As Figure 2.1 shows, no company is experiencing any downside at all: it's all upside, with the only question being whether companies will achieve double-digit returns or just miss out. Prima facie, it is clear that this price control has not been 'appropriately calibrated'. The remainder of the chapter offers an analysis of why this has happened.

[4] RIIO Financeability Study, Ofgem, December 2012
https://www.ofgem.gov.uk/sites/default/files/docs/2012/12/9_riio_financeability_study_dec12.pdf

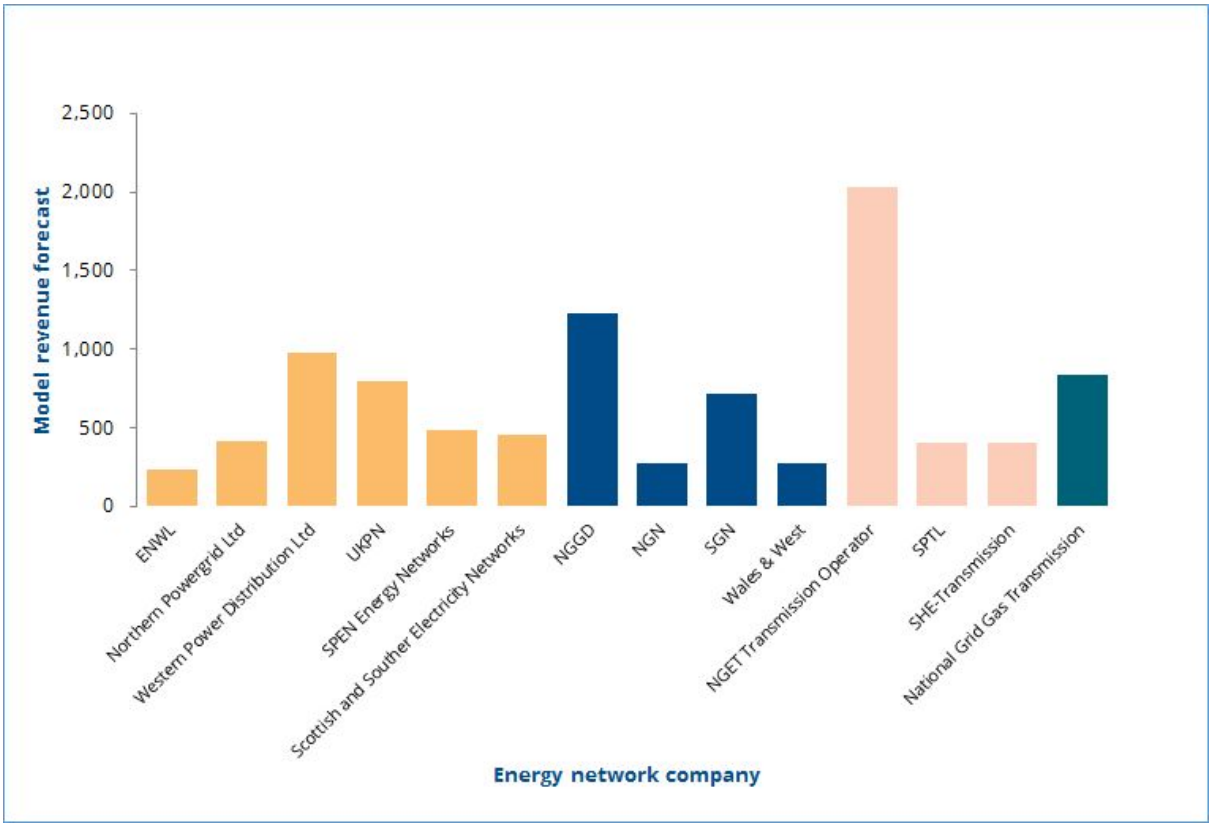
Figure 2.1: Energy networks' forecast equity returns[5]



What might equity returns look like if the price control had been appropriately calibrated, where the worst performers receive no equity returns (earning only enough to meet the costs of debt) and the best performers earn double digit returns? To estimate this, we randomly assigned a percentage return between 0-10% on companies' value for each year of the price control[6], which shows equity returns would reduce to £9.4-9.6bn under such a calibration - around half what Ofgem's models show them earning now. Figure 2.2 shows the returns for each network company.

[5] Source: Ofgem's Price Control Financial Models.
[6] This simulation was run 20,000 times to provide a reliable point estimate. It excludes any savings companies make on debt costs.

Figure 2.2: Simulated equity returns

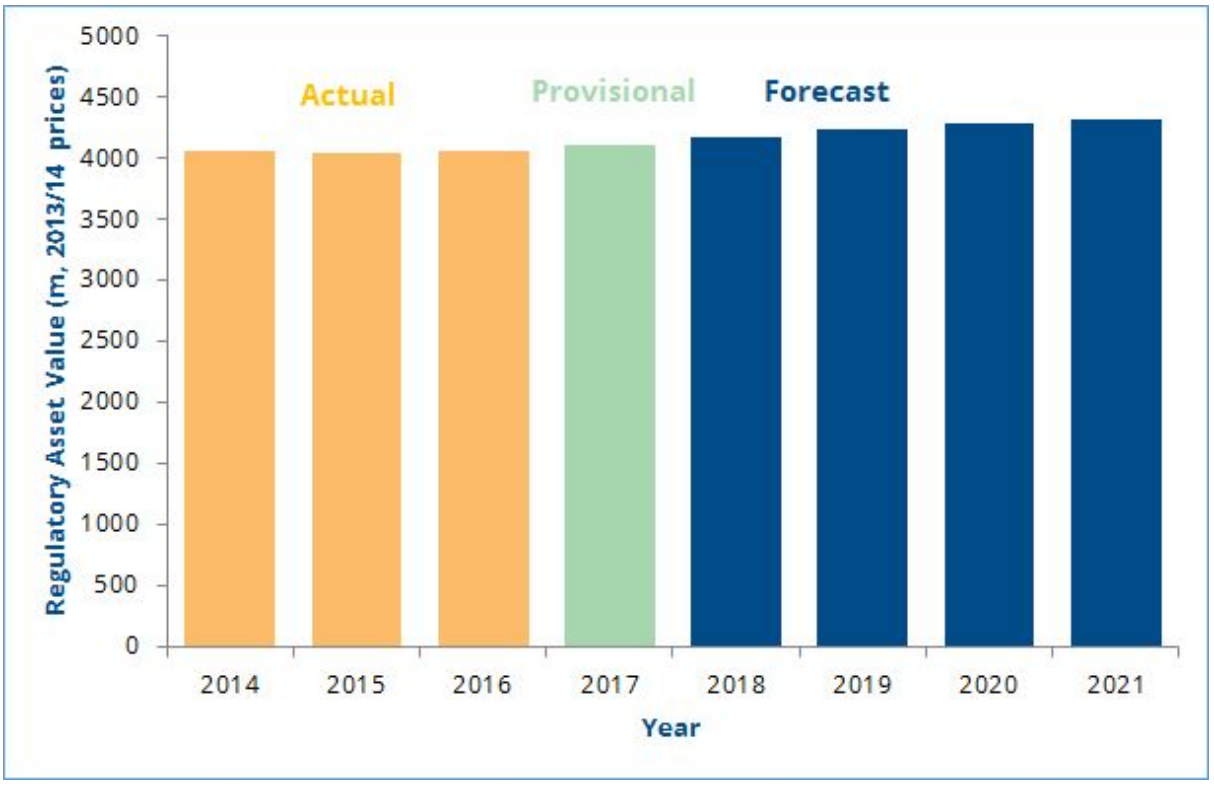


2.1 How energy networks earn financial returns

To understand energy networks' financial returns, the first concept we'll need is the Regulatory Asset Value, or the RAV. This is the financial value ascribed by Ofgem to the capital used by the network company. It's what energy network companies are earning a return *on.*

This figure fluctuates - as networks build new pipes and wires, it appreciates to include the value of these assets; as they wear and rust, reaching the end of their asset life, it depreciates to reflect this loss in value. For example, here is the forecast RAV of SGN, a gas distribution company, over the course of the price control:

Figure 2.3: SGN Regulatory Asset Value



There are two categories of return that network companies earn on on the RAV. The first, considered in section 2.2, is the standard cost of capital - the return that is expected on capital investments in the business, such as building a major new transmission power line - that is accounted for in the Weighted Average Cost of Capital (or WACC). The second, considered in section 2.3, is additional profits that Ofgem allows energy networks to earn if they meet certain conditions. This chapter considers each in turn.

2.2 The Cost of Capital

2.2.1 The Weighted Average Cost of Capital

Debt is money you borrow in exchange for a fixed rate of return.

Equity is money you raise in exchange for an ownership share of your business or property.

Companies raise finance for investing in their business in two ways: through debt and through equity. As debt provides a guaranteed, pre-agreed level of return, it is always a cheaper way of raising finance, but at the cost of increasing the equity risk of the business. Equity investors are not guaranteed a level of return, so require a higher level of return to account for this greater risk. Almost all large companies use a combination of debt and equity financing to fund capital investments in their businesses. The proportion of capital that is funded by debt is called the company's *gearing*.

In a competitive setting, companies would raise the amount of debt and equity financing they believed they needed as they saw fit at the level they were able to negotiate with private investors and creditors; if they get this decision right, they'd prosper; if not, they'd fail and a competitor would take their place. As noted above, because energy networks are monopolies, it can't work like that - Ofgem has to make a decision about what a company's cost of capital should be.

It does this by setting a figure for the Weighted Average Cost of Capital - the WACC - given by the formula:

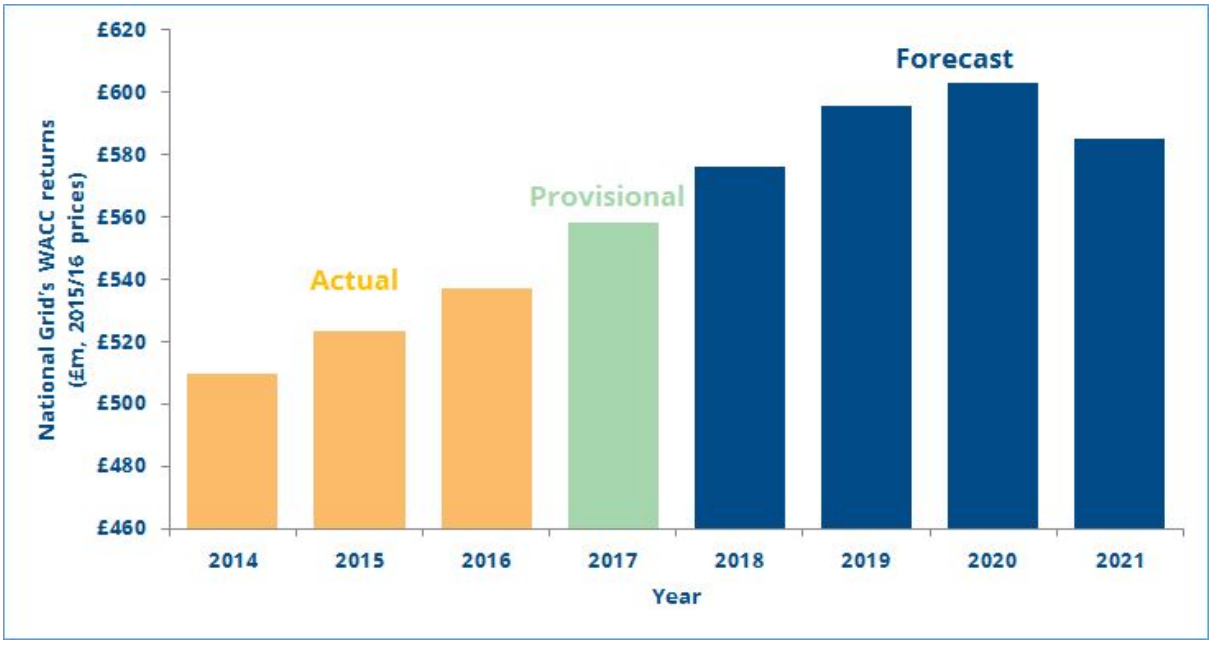
WACC = (*cost of debt* * *gearing*) + (*cost of equity* * (*1 - gearing*))

This simple formula expresses the average percentage return that capital earns on its investment in the business. For example, Ofgem decided that National Grid's cost of debt is roughly 2.3%, its cost of equity 7% and the proportion of capital it would finance through debt 60%. If we plug that into the formula above we get:

National Grid's WACC = (2.3% * 0.60) + (7% * 0.40) = 4.18%

This WACC[7] of 4.18% is earned on the RAV each year. Figure 2.4 shows the actual and forecast WACC returns for each year of the current price control for National Grid:

Figure 2.4: National Grid's WACC Returns



As Figure 2.3 illustrates, this leads to substantial returns on the WACC over the course of the price control. The crucial point here is that **small changes in the WACC lead to very large changes in energy networks' returns.** For example, if you reduce National

[7] Here we use the post-tax WACC ('vanilla WACC') - i.e. the actual return once corporation tax has been paid on equity. Pre-tax returns are higher, because they include an allocation to pay corporation tax.

Grid's WACC by 0.1%, their 8-year returns reduce by £80m. If you reduce every energy network's WACC by 0.1%, we estimate that their 8-year returns reduce by over £400m.

As we'll consider below, the key variables that need deciding on to set the WACC are the cost of debt and the cost of equity. We'll argue that both have been overestimated.

2.2.2 Cost of equity

Even though only a *minority* of networks' capital is financed by equity (35%-45%), it forms a *majority* of the cost of capital, because it requires a higher return than debt. This varies between network companies, but works out at around 57-59% of WACC returns. It's therefore a major source of cost. How, then, does Ofgem decide what a reasonable rate of return is for equity?

Cost of equity is determined by estimating three values: the **risk-free rate**, the **equity premium** and the **equity beta.**

The **risk-free rate** is the return on an entirely safe investment. An investor needs some reward to stick their money in that investment, to compensate for foregoing the opportunity to spend that money today. In practice, there's no such thing as a risk free investment, so we use the next best thing as a proxy: returns on Government bonds. Ofgem estimates the risk-free rate at between 1.7%-2.0% depending on the price control.

The **equity premium** is the additional return to equity for the entire market. Ofgem needs to take this into account, to make sure that investors in networks are getting a return that is equivalent to what they could earn in the open market; if they're not, investors will choose other stocks rather than energy networks. Ofgem estimates this at 5.25%.

Finally, Ofgem can't just derive the cost of equity from looking at the risk-free rate and the average returns to equity. Firms have industry-specific risks: the risk profile of a tech startup, with an untested, speculative product, looks very different to the risk profile of a water company, with its tested business model providing a necessary good. To capture this, Ofgem has to estimate the level of risk associated with a specific market: the **equity beta.** An equity beta of 1 is the average company's risk; greater than 1 indicates a riskier company, less than 1 indicates a safer company. Ofgem has estimated this differently for different price controls - mostly hovering around 0.9.

With these three concepts, we can calculate the cost of equity as:

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

For example, the cost of equity for Cadent, a gas distribution company, is estimated as follows:

Cost of equity = 2% + (5.25% * 0.9) = 6.7%

Our analysis focuses on the risk-free rate and equity beta. For both values, we argue that their chosen figures for the risk-free rate and equity beta do not reflect real market conditions and end up in consumers significantly overpaying.

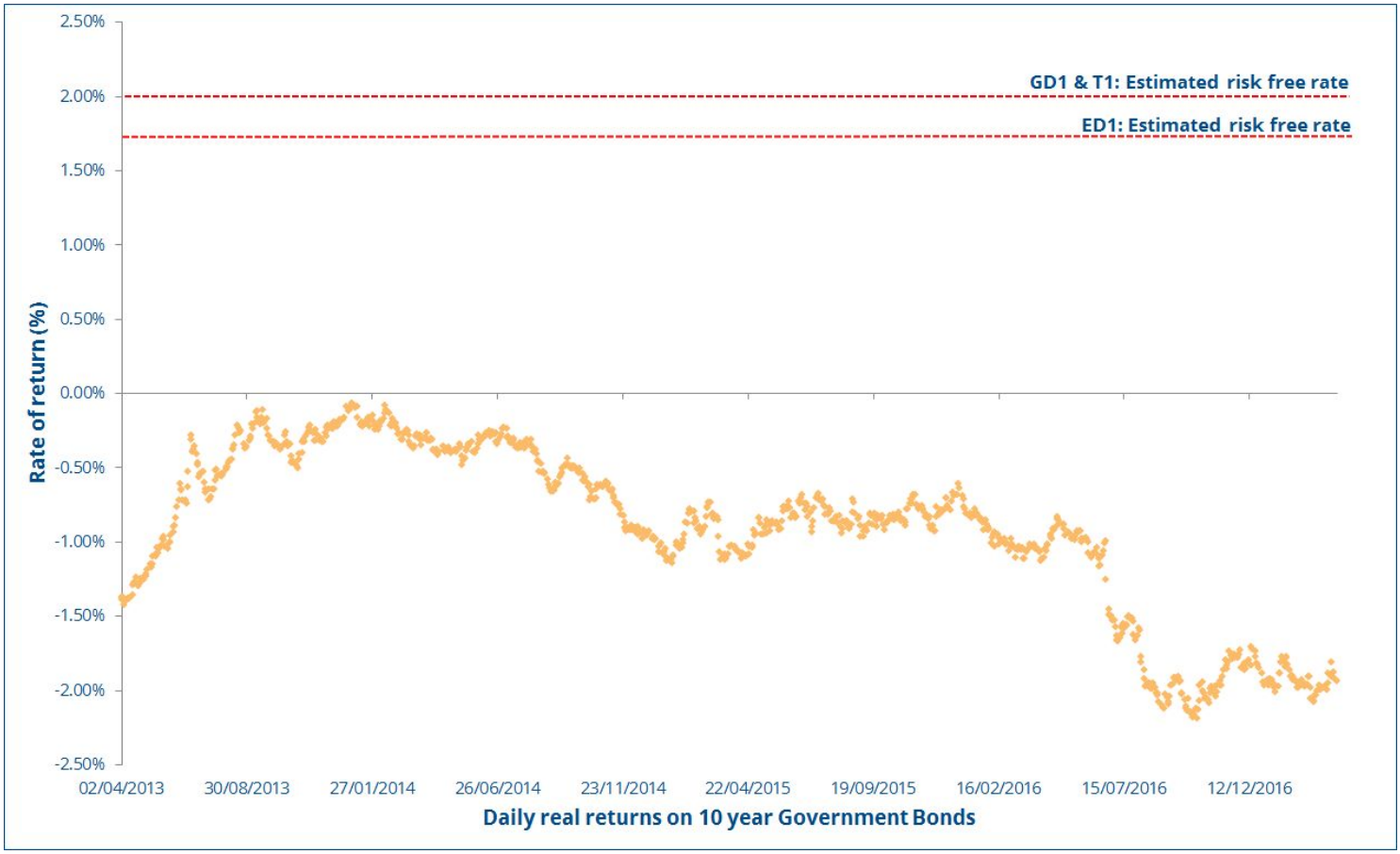
2.2.3 Risk-free rate

How did Ofgem arrive at its estimate of the risk-free rate? Primarily, through relying on contemporary market evidence about index-linked government bonds at the time of setting the price control and taking into account market expectations about the future risk-free rate. This led Ofgem to estimates of between 1.7-2.0%, depending on the price control.

Since Ofgem set the price control, the actual return on government bonds has been unprecedentedly low. Investors have increasingly preferred not to spend their money today, leading to Governments offering them lower and lower returns on bonds. Since 2011, this return has **been negative in real terms**, leading to a persistent difference in Ofgem's estimate of what the risk-free rate will be and what it has been, in the price control so far, as Figure 2.4 shows.

Ofgem's estimates were made between 2012 and 2014, when rates were already persistently low.

Figure 2.5: Difference between Ofgem's estimate of the risk-free rate and real returns on Government Bonds



From this graph, it's clear that the risk-free rate has been significantly below expectations. And while these could change in the other direction in future, so far energy networks have benefitted substantially. Ofgem would not let networks suffer the financial costs of an incorrect forecast either - they have a statutory duty to ensure networks are financeable and have specific procedures in place should network companies experience deteriorating financial conditions.

To illustrate this impact, our model uses a risk-free rate index. There's no ambiguity over the actual performance of the proxy for the risk-free rate - it's clear, observable data. In the model we present in Chapter 3, we should how indexing the risk-free rate to real market rates would have reduced consumers' bills. Given the level of divergence between Ofgem's estimate and the reality, as we argue in Chapter 4, it's essential this is implemented in the next price control design.

2.2.4 Equity beta

Energy networks are a critical feature of the energy system, perhaps our most nationally significant infrastructure: so pivotal are they to our economy, Government and the regulator will never let them fail. Their product - transportation of gas and electricity to our homes - is in demand and will be for the foreseeable future. While there are

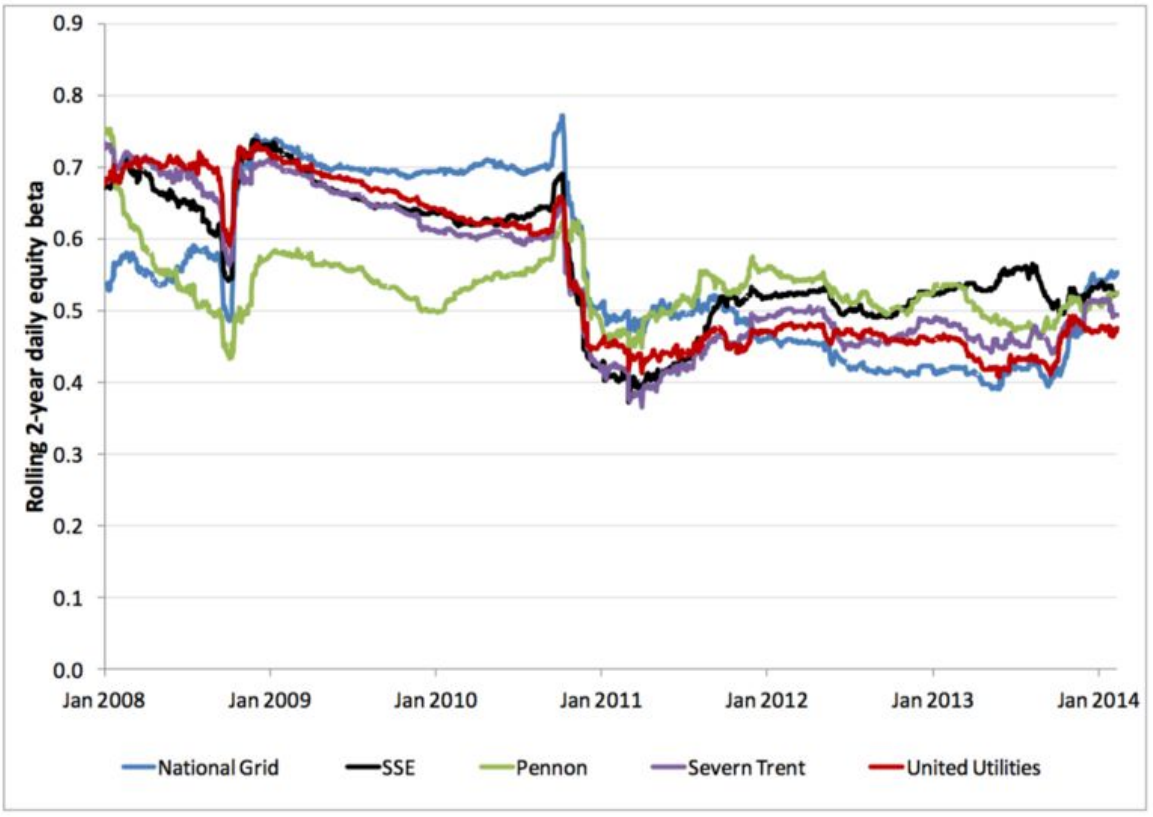
important challenges that networks play a role in - such as efficient decarbonisation and the smart energy transition - their core business is making sure energy gets from A to B. *This is not a risky business.*

In typical financial models, risk is captured in a different way, by a metric called the equity beta. This measures the correlation of returns to a wider market benchmark. In principle, calculating a company's equity beta should be a relatively simple estimation: it is a statistical measure comparing a company's or a specific market's share volatility (the degree of variation in share price over time) to the whole stock market's volatility. This should capture the market's view of how risky a business is. If we know the company/market's share volatility and the volatility of the entire market over a certain time period, the equity beta mechanically follows. Investors are willing to tolerate a lower return on investment for businesses with an equity lower than 1, because their returns are more stable over time.

However, this information is only available from listed companies, which most network companies are not. How, then, can the equity beta be calculated reasonably? One approach is to use the equity betas from publicly listed comparator utility companies, assuming that they face similar risks to energy network companies. Ofgem has conducted this analysis using equity beta estimates for five comparator companies over the six years preceding the price control. Figure 2.6 shows that, while there was somewhat greater volatility in the previous decade, the equity betas for each company have been remarkably stable in the years preceding setting the price control, hovering around 0.5. At no point does the risk approach Ofgem's benchmark of 0.9. Ofgem's consultants agree: a study by Europe Economics[8] provided a confidence interval of between 0.5-0.8, while two-year daily beta averages were hovering around 0.4-0.6 in the years when the price control was set.

[8] The Weighted Average Cost of Capital for Ofgem's Future Price Control, Final Phase I Report, Europe Economics, 2010

Figure 2.6: Comparator companies' equity betas



Source: Bloomberg

Of course, like all these estimates, it is possible that past data will not match future performance. But decisions should be based on actual comparator data, rather than uncertain estimates, so as to mimic market conditions a company in a competitive industry would face. At no point in the reviewed period did any of the companies touch on a 0.9 beta for a single day. The model we present in Chapter 3 outlines how adjusting the equity beta to values between 0.5 and 0.7 impacts on consumers' bills.

2.2.5 Cost of debt

The final element of the Weighted Average Cost of Capital that Ofgem has to determine is the cost of debt. In this round of price controls, Ofgem decided to index the cost of debt to an average of AAA and BBB rated debt bonds, adjusted for inflation expectations. This has led to debt costs that better reflect market prices.

However, this cost of debt indexation has not been tight enough. The length of the cost of debt index matters. A shorter index provides companies with a sharper incentive to acquire new debt efficiently, as their debt allowance more closely reflects current debt market conditions. And because debt was much more expensive ten years ago than it is today, including this data in trying to assess prices today artificially drags the cost of debt upwards. 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[9].

All price controls currently use ten year indexation, with ED1 also including a 'trombone effect', such that year 1 uses 10 years, year 2 uses 11 years and so on, up to a 20 year rolling index. This includes debt prices from when Tony Blair was last Prime Minister and drives up consumer costs in the current climate of exceptionally low debt costs.

The rationale for including a trombone effect merits further comment. Ofgem included this to provide network companies with an allowance for efficiently incurred 'embedded debt'. Embedded debt is debt that accrued in previous price control periods - for example, long term debt incurred in 2004, when debt costs were relatively higher than they are now.

We disagree with the rationale for including a trombone effect. It is preferable for simple indexes based on existing market debt prices be used leaving it to companies to manage the risks this presents them with, as any company in a competitive market would need to. As we argued in *Many happy returns*, there is a risk that, in the event of a sharp increase in interest rates, the regulator may not hold their nerve against protestations from companies that the trombone is preventing them fulfilling their financing obligations. It is possible that consumers are lumbered with the costs of outdated, higher interest rates when rates are falling and the costs of contemporary higher rates when they are rising.

We agree that existing *efficiently* incurred embedded debt should be recompensed. However, it is likely that prior to the RIIO price control, debt allowances were too high, due in part to the lack of indexation and consistent overestimates of returns on government bonds by regulators in setting an ex ante debt allowance[10]. If it believes embedded debt is a particularly pressing problem, a cleaner solution would be for Ofgem to make a separate allowance for legacy embedded debts and use a simple, tighter index going forward.

The model we present in Chapter 3 outlines how adjusting the cost of debt index to remove the trombone and reduce the index period to five years. Because we do not have access to data on network companies' embedded debt, we have not included a separate allowance for this in our analysis.

2.3 Incentives for exceptional performance

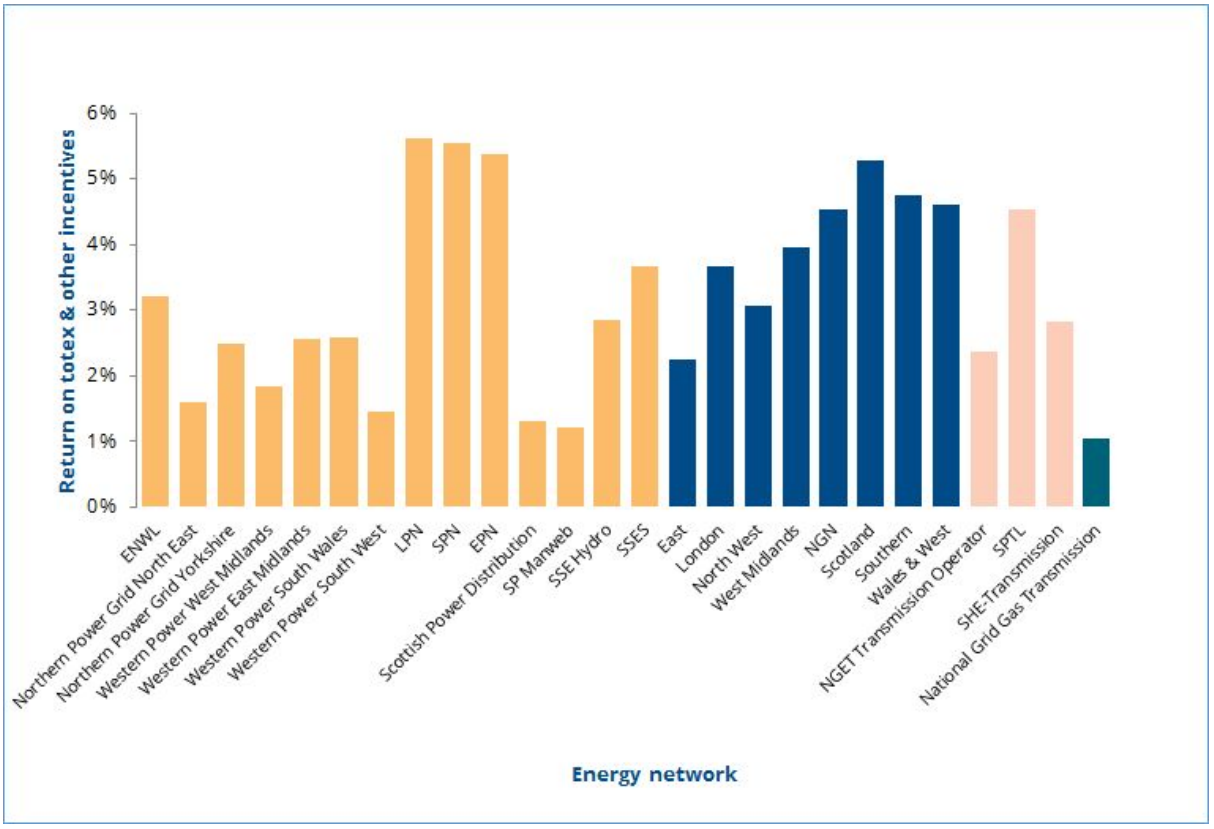
Ofgem doesn't just want the delivery of outputs in exchange for a return on that delivery when it's setting a price control. It wants to provide incentives for particularly efficient delivery, for exceptional customer service and for innovation that reduces the long-run cost of the energy system. Consumers want cheaper networks and good

[9] Utility Regulation, the RAB and the cost of capital, Dieter Helm, 2009
[10] Presentation on indexation of cost of debt, National Audit Office

customer service too, so it's appropriate that Ofgem adds an additional set of incentives to the price control.

In principle, these incentives also impose penalties on energy networks if they deliver outputs inefficiently or fail to provide good customer service. However, as Figure 2.7 shows, Ofgem expects incentive performance to be positive overall for all energy network companies.

Figure 2.7 Forecast return on incentives for exceptional performance (totex and other incentives)



Our analysis principally considers the totex incentive and how other incentives are inappropriately calibrated rewarding network companies for ordinary performance and rarely penalising them for bad performance.

2.3.1 Total expenditure incentive

Total expenditure (sometimes shortened to 'totex') is the revenue that Ofgem permits networks to spend on their activities, where some of those costs are controllable. Ofgem wants to incentivise network companies to run their business as efficiently as possible. That's why, for the total amount that energy networks underspend this allowance by, Ofgem allows them to keep a proportion as profit, with the remainder returned to consumers. If Ofgem thinks that pipeline will cost £180m, can the network

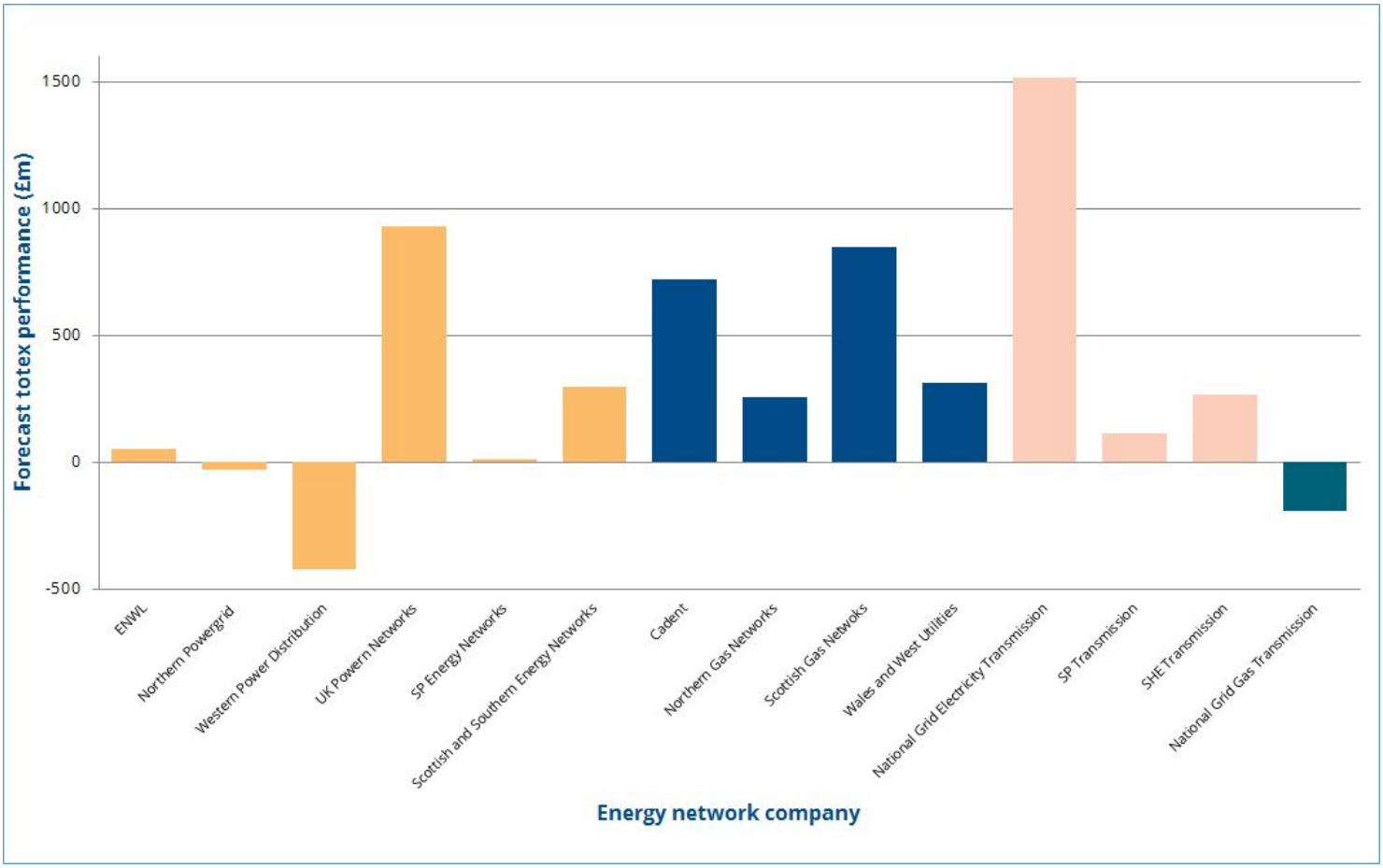
company build it with £140m? If so, they can keep some of the difference as profit[11]. Meanwhile, if you overspend on that output, then that money comes out of your profits.

While this system does drive some genuine efficiencies, it also creates incentives for energy networks to inflate their initial cost estimates to Ofgem, so they can capture more of the difference between this estimate and the actual cost as profit. This is a difficult problem to solve. Ofgem implemented an information quality incentive, which would penalise companies for misrepresenting information, but this put relatively little revenue at risk. For the latest electricity distribution control, Ofgem tried to incentivise accurate business plan by fast-tracking high quality applications. But there's little evidence this has worked - the slow track companies are earning profits at similar rates to the sole fast track company.

As Figure 2.8 shows, a small number of network companies are overspending against their total expenditure allowance and are experiencing a financial penalty as a consequence. However, the overall picture is still one of considerable success from networks: our model estimates that they will earn over £2.5bn in profit on their totex incentive over the course of the price control.

[11] Because of the way the price control is structured, most of this profit is realised through additions to the Regulatory Asset Value, which gives investors returns over a longer term. If the cost of capital is set too high over that period, this will lead to higher overall costs to consumers than we model here.

Figure 2.8: Actual and forecast totex over/underspend by network company



If all this outperformance is achieved as a result of increased efficiency, there is perhaps no particular problem. But increased efficiency isn't the only thing driving profits here.

In setting the allowance, Ofgem forecast how industry-specific costs for things like material and labour would change over the course of the price control and included that forecast in the allowed expenditure — what they call Real Price Effects. But it's now clear those forecasts weren't correct: Ofgem's analysis suggests prices for electricity transmission and gas distribution are expected to be around £1.9bn lower and the companies will be taking around £0.9bn that in profit[12]. Some of the outperformance is returned to consumers, but the network companies get to retain between 45-70% of the outperformance.

The model we present in Chapter 3 corrects for the effect of Real Price Effects, mimicking how a custom industry-specific inflation measure would impact consumers' bills.

[12] RIIO ET1 Annual Report 2015-16; RIIO GD1 Annual Report 2015-16.

2.3.2 Other incentive performance

Totex accounts for 45% of network companies' forecast incentive related profits. However, there are a large and varied set of other incentives that Ofgem designed to encourage companies to engage in specific behaviours - such as a stakeholder engagement incentive to encourage good engagement with stakeholders, a connections incentive to encourage network companies to connect new customers to the grid and a reliability incentive to encourage network companies' to keep supply as much of the time as possible.

Without these incentives, quality of service would likely suffer as firms' profitability would be increasingly determined by their ability to cut costs. The focus on incentives in RIIO has been welcome. However, with a net £3bn earned by network companies over the course of the price control on these incentives, it is not yet clear that they have been optimised.

In principle, these incentives should create a symmetrical balance of rewards for good performance and penalties for poor performance. Recall Ofgem's aspiration that poorly performing companies should earn at or below the cost of debt - it is through this system of penalties that this should occur. However, in practice most companies only ever experience an upside. The incentive system Ofgem has designed is - in practice - fundamentally asymmetric in companies' favour.

What company returns on incentives should net out to is a complex question and depends on considerations that have been made on the cost of capital. However, they should allow some companies to make negative and others to make positive returns. The model we present in present in Chapter 3 provides estimates for how more robust approaches to incentive calibration would impact consumers bills, estimating net reductions to equity returns of between 0.1%-0.2%.

2.4 Inflation measure

The final measure we highlight is the Retail Price Index. It was long custom for regulators to use the Retail Price Index (RPI) as their main mechanism for capturing how prices change from year to year. Each year, RPI is applied to the Regulatory Asset Value, so is a determinant of the rates of return that companies can earn on the RAV.

As Figure 2.9 shows, RPI is historically and consistently higher than its primary current alternative, CPI (Consumer Price Index).

Figure 2.9: Comparison of RPI and CPI

RPI has fallen out of favour in recent years. The Office for National Statistics has declassified it as a national statistic on the basis that it does not meet international standards and the Institute for Fiscal Studies has recommended that all public bodies cease using it and transfer over to CPI (and CPIH when it becomes statistically accredited). Other regulators, such as Ofwat, have already begun this transition.

The effects of changing from RPI to CPI are complex and it is not certain what the near-term impact on consumers' bills would be. In the longer term, consumers will benefit from the use of a credible inflation measure that has been historically lower than RPI. However, we do not include the effect of changing from RPI to CPI in the model we present in Chapter 3 and intend to carry out future work on the implications of this shift.

3. Our model's results

In order to assess the impact of these five key financial variables on consumers' bills, we built a model of companies' financial returns using data from the Ofgem Price Control Financial Model. This section outlines that model, the headline findings and the findings against each variable in more detail.

3.1 Overview of our model

This section provides an overview of the price control model we used. A fuller summary of the methodology can be found in the Technical Appendix.

We took the actual and forecast Regulatory Asset Values and Weighted Average Cost of Capital for each energy network and aggregated this by company and price control to derive estimates of actual and forecast returns over the course of the eight-year price control. We added the following elements to our model:

- Ofgem's cost of debt model
- Ofgem's totex actual and forecast data as published in RIIO annual reports
- Our own risk-free rate model, using Bank of England data on 10-year Government gilt yields
- RPI inflation indexes, using ONS actuals and OBR forecasts, to adjust to today's prices

The model provides figures for actual and Ofgem forecast returns and compares them to the returns that would have been/are forecast to be made if adjustments are made to the five key variables we include.

All figures are reported in 2016/17 prices[13].

[13] Ofgem reports prices in two base years depending on the price control - 2013/14 for GD1/T1 and 2015/16 for ED1. We have adjusted all prices to the same base years.

3.2 Headline results

Adjusting financial metrics is not a mechanical process; it requires judgement to decide which metrics should be adjusted and in which ways. To this end, we ran the model under multiple different variable combinations, producing a low, medium and high model of savings.

The medium savings model represents our central estimate of **£7.5bn,** with our lower bound in the low savings model reducing costs by £3.5bn and the high model reducing costs by £11.1bn.

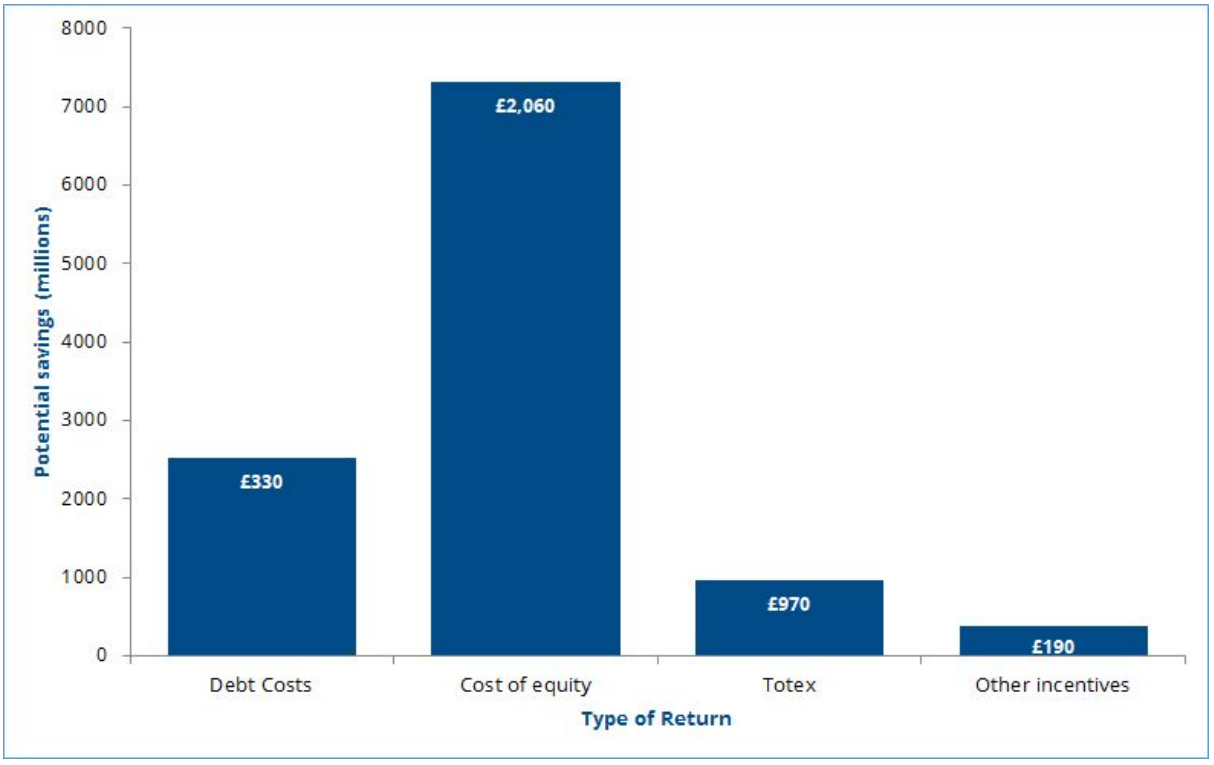
3.2.1 Low savings model

The low savings model adjusts the metrics in a relatively modest way. This model makes four major adjustments:

- It corrects for the real price effects under the totex incentive, as this follows from Ofgem's own analysis;
- It removes the trombone from the 10 year debt index;
- It reduces the equity beta to 0.7;
- It recalibrates incentives to make them modestly more difficult to achieve, costing companies' 0.1% on their equity returns.

The results of the low savings model are summarised in Figure 3.1 and total £3.5bn over the course of the price control.

Figure 3.1: Savings under low model



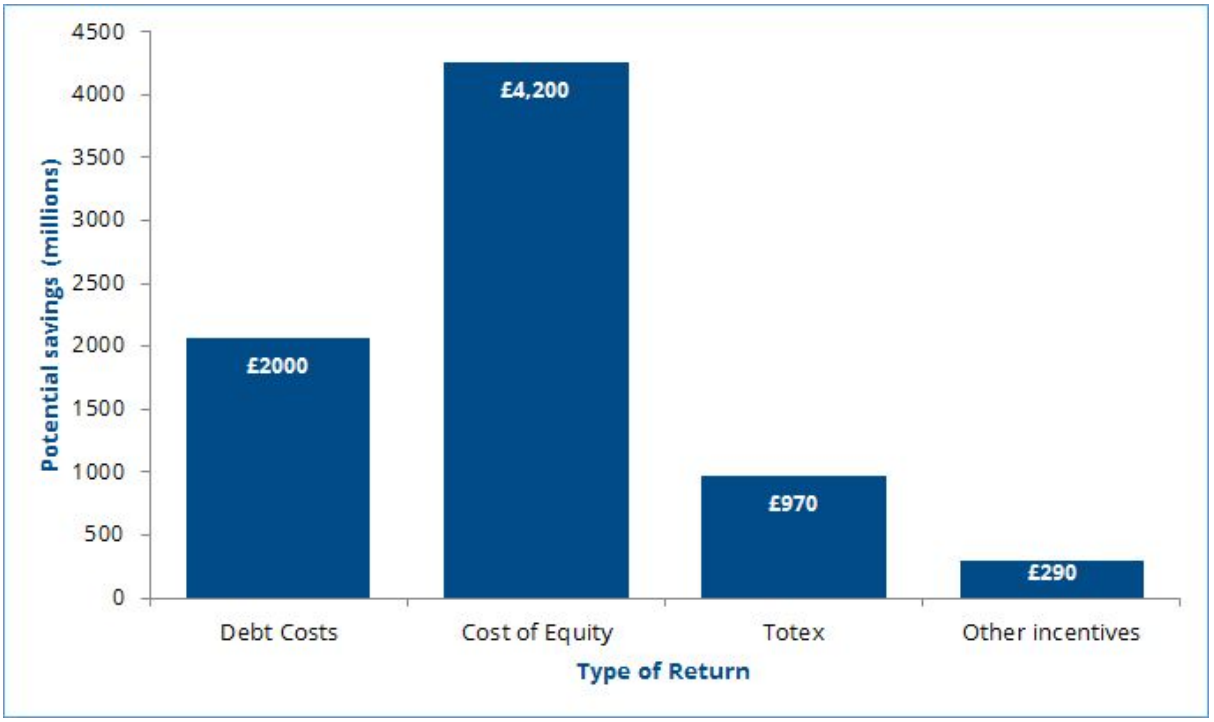
3.2.2 Medium savings model

Our medium savings model includes a more realistic version of all our major price control design recommendations. It makes the following further adjustments:

- It reduces the cost of debt index to 5 years rather than 10 years, but maintains the existing trombone;
- It introduces our proposed risk-free rate index using a 20 year average;
- It reduces the equity beta slightly further to 0.6;
- It recalibrates incentives to make them modestly more difficult to achieve, costing companies' 0.15% on their equity returns.

The results of the medium savings model are summarised in Figure 3.2 and total £7.5bn over the course of the price control.

Figure 3.2: Savings under medium model



3.2.3 High savings model

Our high savings model is the most robust implementation of our recommendations. It makes the following adjustments:

- It maintains a debt index of 5 years but removes any trombone;

- It introduces our proposed risk-free rate index, but at a shorter 10 year average;
- It reduces the equity beta to 0.5;
- It recalibrates incentives to make them more difficult to achieve, costing companies' 0.2% on their equity returns.

The results of the high savings model are summarised in Figure 3.3 and total £11.1bn over the course of the price control.

Figure 3.3: Savings under high model

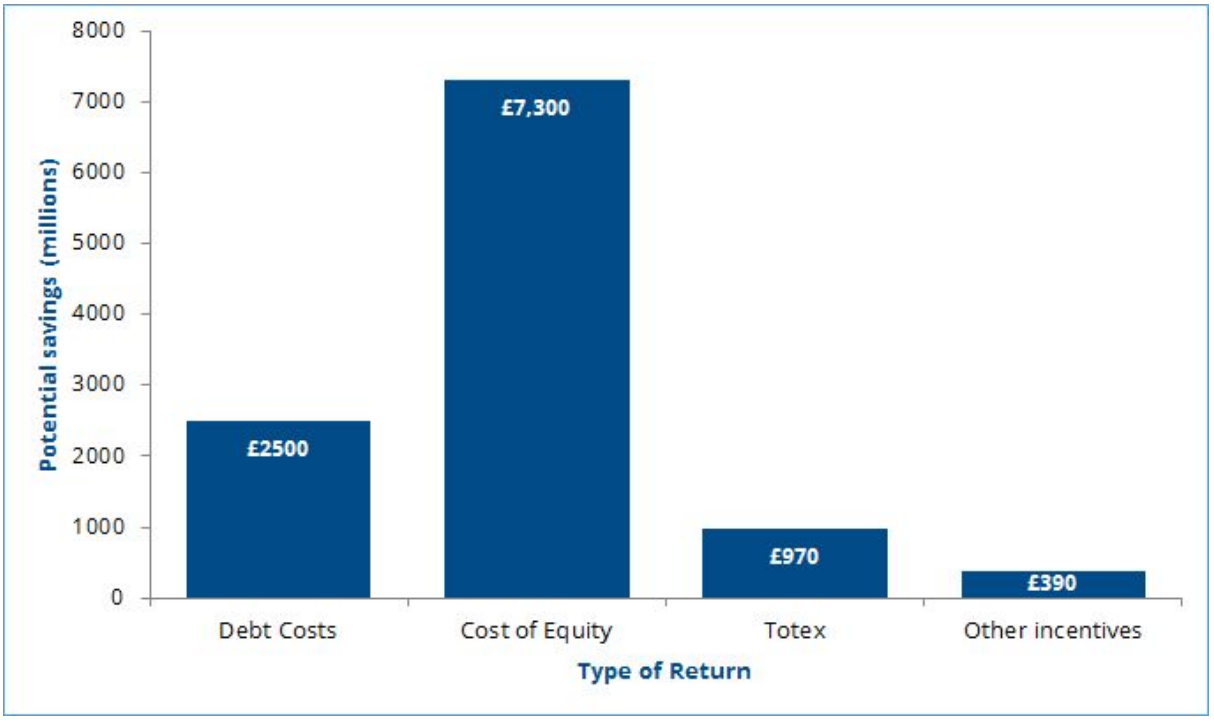


Table 3.4 summarises the key features and headline savings associated with each of our models.

Table 3.4 Headline model outputs

Model input	Low model	Medium model	High model
Cost of debt index:	10 years (no trombone)	5 years	5 years
Risk free rate index:	1.7%-2.0% (Ofgem forecast)	20 years	10 years
Equity beta:	0.7	0.6	0.5
Totex incentive:	£0.9bn (after sharing mech)	£0.9bn	£0.9bn
Recalibrate incentives:	0.1% reduction	0.15% reduction	0.2% reduction
Total savings:	**£3.5bn**	**£7.5bn**	**£11.1bn**

As we can observe, changes in these key variables make major differences in the total level of consumer savings, with a total high model saving of £11.1bn should the most robust version of our recommendations be implemented. However, even a more modest implementation, as in the medium savings model (our central estimate), reduces consumers' bills by £7.5bn over the course of the price control. And even with relatively minor tweaks, Ofgem could save consumers £3.5bn over the course of the price control.

The remainder of this chapter explores what drives this variability when inputs are modestly adjusted.

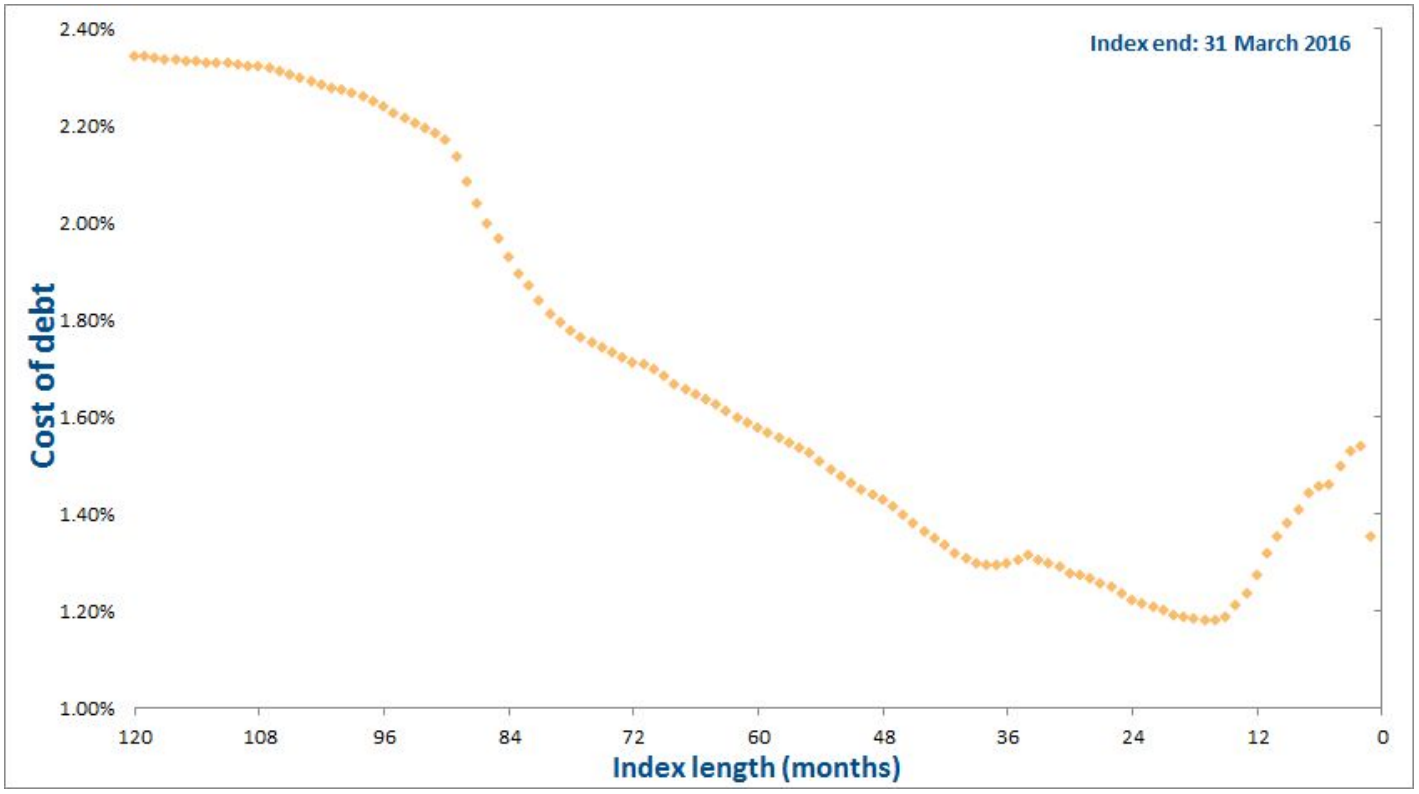
3.3 Cost of debt

Ofgem currently indexes the cost of debt on a ten-year basis, using an average of real debt costs of 10 year A rating & BBB rating bonds.

Figure 3.5 shows how decreasing the cost of debt index affects the percentage cost of debt. For this example, we use 31 March 2016 as the end of the debt index and shows how the cost of debt is affected by reducing the index from 120 months to 12 month. In practice, a rolling index is used for each year of the price control.

As it shows, because of the historically low current cost of debt, the more tightly the index matches current market prices the lower consumers' bills are forecast to be over the course of this price control. The five year index period is 120 basis points lower than the ten year index.

Figure 3.5: Relationship between cost of debt and length of index



Under the high saving forecast (reducing the index to 5 years without a trombone) bills would reduce by £2.5bn.

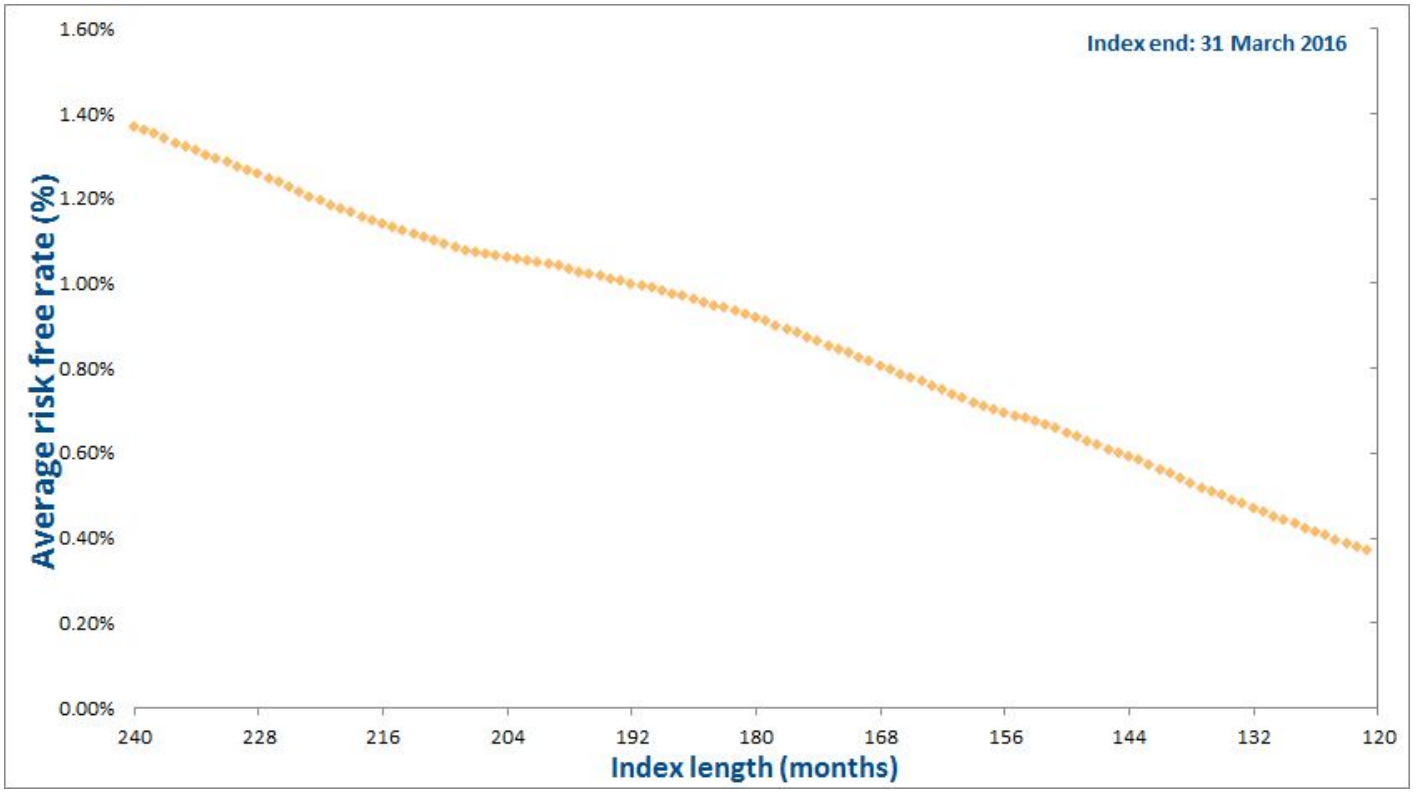
3.4 Risk-free rate

Ofgem does not currently index the risk-free rate. Because of the historically unprecedented low risk-free rate - for the past five years, it has been negative in real terms - introducing this indexation at any reasonable length would substantially bring consumers' bills down, compared to Ofgem's assumptions of 1.7%-2.0%. Our indexation of the risk-free rate then forms part of our calculation of the counterfactual cost of equity.

Figure 3.6 illustrates the impact of the length of the risk-free rate on costs. For this example, we use 31 March 2016 as the end of the risk-free rate index and shows how the risk free rate average reduces as we reduce the index from 240 months to 120 month.

We estimate the 20 year index would reduce consumers' bills by £1.1bn over the course of the price control and the 10 year risk-free rate index by £2.1bn.

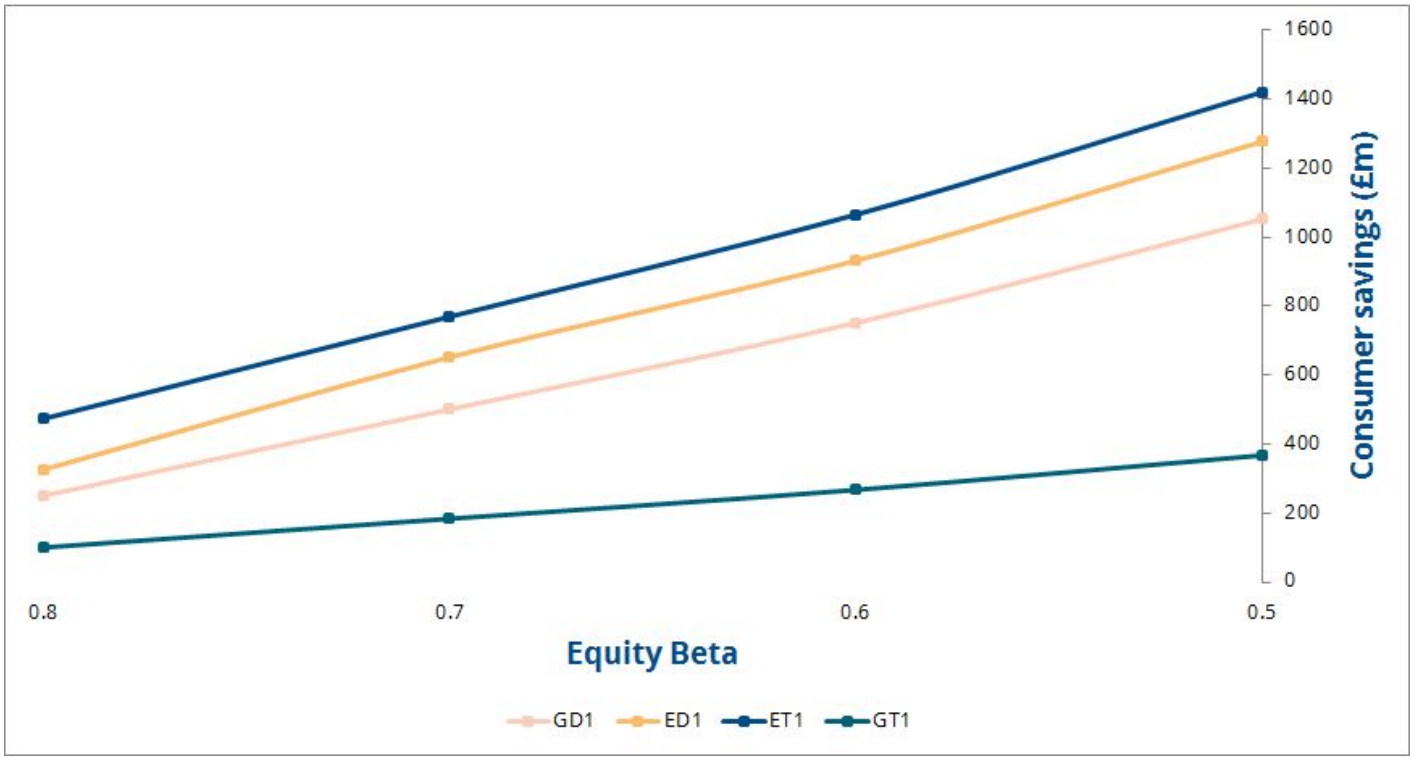
Figure 3.6: Relationship between cost of risk-free rate and length of index



3.5 Equity beta

Ofgem currently uses an equity beta of 0.9. For each price control, Figure 3.7 shows how adjusting the equity beta from 0.8 down to 0.5 (where Ofgem's consultants recommended it reduce to) impacts consumers bills. If we implement an adjustment of 0.2, consumers' bills reduce by £2.1bn. Under the most robust adjustment supported by the data to 0.5, consumers' bills reduce by £4.1bn.

Figure 3.7: Relationship between cost of equity and equity beta



3.6 Totex incentives

To produce our totex incentive effects, we rely on Ofgem's analysis in their RIIO reports. Across our models, therefore, we reduce real price effects by £1.9bn, leading to a consumer saving of £0.9bn.

3.7 Incentive recalibration

To populate our incentive recalibration model, we make adjustments to the total equity returns that network companies' are permitted to make on the RAV, in light of what we would anticipate if Ofgem were more robust in setting this adjustment.

Under our low savings model, consumers save £0.2bn. Under our high savings model this effect increases to £0.4bn.

4. Our recommendations

Energy consumers overpaying by billions is a plainly unsatisfactory state of affairs. It must not continue in this price control and future price controls must take steps to avoid this in future.

We make recommendations on how network companies should act to return money to consumers and how Ofgem can improve the design of the price control in the future.

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

National Grid - alone - recently announced an operating profit of £2.1bn in their UK network business[14], in a single year. Consumers cannot be expected to tolerate this level of return if, as our analysis shows, those returns are unjustified.

There will be a temptation to focus simply on forward looking solutions and avoiding the imperfections of these price controls in future periods. Indeed, we do not believe it would be fruitful for Ofgem to reopen the price control: they should focus on improving the design of the next one.

But the overpayments are too large not to act. Moreover, there are precedents when utility companies have been over-rewarded in the past - such as in the water industry - and limited action has been taken to address them. As the Chairman of Ofwat (the water regulator) commented in 2013, when facing similar problems of excess profit:

'Public trust is hard won and easily lost…I would have hoped companies would have shared gains that derive from external factors with customers.'[15]

Regulatory pressure ultimately led to water companies returning some £435m to consumers[16] out of a windfall gain of at least £1.2bn over the course of their price control.

More substantial sums than this must be returned to energy consumers in the form of a rebate on their bills. There is an opportunity here for network companies to recognise that much of the profit they are earning is not in consumers' best interests and - exercising some farsighted corporate citizenship - to voluntarily return it. As their colleagues in the supply business know, it does not take much for public opinion to curdle against an industry. Responsible companies would be wise to hedge against that possibility by returning profits now. Ofgem should work with them to ensure this happens.

However, if companies do not act, then government must act to ensure consumers get their money back. Partly, estimates were made that always seemed generous to industry, perhaps due to vigorous lobbying. Partly, this was a highly uncertain period, in overpayment which interest rates and bond returns were unprecedentedly low. The

[14] This includes their gas distribution business, which they recently sold a majority share in. http://investors.nationalgrid.com/~/media/Files/N/National-Grid-IR/reports/ara-2016-17-plc-06-06-2017.pdf

[15] http://www.ofwat.gov.uk/wp-content/uploads/2015/11/prs_spe20130305jcrae.pdf

[16] https://www.nao.org.uk/report/the-economic-regulation-of-the-water-sector/

uniqueness of the times and the level of the overpayment both provide the Government with excellent reasons to act if network companies will not.

4.2 Rely on indexes, not forecasts

This year Ofgem will begin making its early strategic decisions on the design of the next price control. It is crucial that the key financial decisions are made correctly, so we avoid the situation of energy networks making billions in unjustified profits. We think that indexes need to be at the heart of monopoly regulation and that they're an important tool in driving efficiency and consumer value.

A recurring theme in our analysis has been the limitations of the regulator's ability to forecast accurately. The most critical change Ofgem should make is therefore to stop relying on forecasts about what costs are going to be over an eight year period: a plainly impossible task for anyone, let alone a regulator subject to intensive industry lobbying. Lobbying is also asymmetric - consumers typically only have a small number of consumer groups fighting their corner, while energy networks have lavishly funded consultants at their disposal. Ofgem does its best to avoid this regulatory capture, but it faces an unenviable challenge.

The only way to avoid the pressures above is for the regulator to take their judgement out of the game. This is where indexation helps. Rather than relying on forecasts, the aim should be to simulate the market conditions a competitive company would face. Indexing key variables to market conditions achieves this. We therefore recommend that:

- The risk-free rate is indexed to yields on 10 year Government gilts, at either a 20 year or 10 year indexation rate;
- That the cost of debt index is reduced from 10 years to 5 years, so that the cost of debt that determines the WACC matches actual market conditions more closely;
- That Ofgem develop a custom inflation measure for industry specific costs, as it considered doing for the electricity distribution price control, so that it does not have to rely on its own forecasts of real price effects.

Greater indexation can lead to higher consumer costs in certain circumstances[17]. But these will be costs that are driven by real market conditions. In practice, we expect long-run market prices to be lower than the inherently more cautious regulatory forecasts of them.

4.3 A more justifiable equity beta

It is impractical to index the equity beta because of insufficient public information. Relatively few network companies are publicly listed and often own other assets alongside their regulated ones or don't just running British energy networks, so it would not be a perfect measure in any case.

[17] For example, if interests rates went up significantly, indexation would lead to higher consumer bills.

However, the long-standing practice of assuming that the risks facing network companies are close or equal to the average company is not justifiable for low-risk natural monopolies that are too important for the nation to let fail. The lack of a large data set also does not free the regulator of all the requirements of empirical rigor. As previously argued, there are comparator companies, for whom the beta hovers around 0.5 - which seems more reflective of networks' low-risk nature. These should be the anchor for Ofgem's estimate, rather than the conservative assumption of 0.9.

4.4 Chosen measure of inflation

The Retail Price Index has been treated as a discredited measure of inflation for some years by the Office for National Statistics and the Institute for Fiscal Studies[18]. Ofwat, the water regulator, has begun its transition to the preferred inflation measure of the Consumer Price Index. Ofgem should also begin this transition.

4.5 Incentive calibration

Incentives are providing outstanding rewards for run of the mill performance. How should Ofgem improve the calibration in future price controls? We'll be reviewing incentive performance and design in more detail in future work, but broadly we think there are two principal ways in which the incentives regime could be improved.

Firstly, Ofgem should dynamically benchmark incentives, so that all companies are held to the standards set by the best performers. This will lead to sharper incentives to perform excellently, as it increases the likelihood of financial penalties which have been relatively rare in the price control thus far.

Secondly, incentives should be bankable - once network companies' have been incentivised to achieve a standard, it should be treated as business as usual and companies should face penalties if they fail to achieve it.

4.6 New powers for consumer bodies

Network companies currently have a license condition to apply for a disapplication of the price control or an Income Adjustment Event, in a situation where:
'an efficiently managed company's allowance is not enough to enable it to finance its regulated activities. In such cases we will consider requests from that company for amendments to its price control."[19]

This is an important provision: in the (heretofore theoretical) event that Ofgem sets energy networks capital allowances too leanly and networks are unable to secure the necessary capital for investment, it's crucial that there's a mechanism in place to secure their financeability, giving Ofgem the latitude to review past decisions appropriately. Equally, if network companies are facing financeability problems due to poor management, Ofgem needs the power to step in and ensure the smooth transfer to new owners.

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[18] UK Consumer Price Statistics: A Review, Paul Johnson, Institute for Fiscal Studies: https://www.statisticsauthority.gov.uk/reports-and-correspondence/reviews/uk-consumer-price-statistics-a-review/

[19] https://www.ofgem.gov.uk/ofgem-publications/50667/guidance-document-final-oct-09.pdf

However, this provision is asymmetric. It protects network companies but offers no comparable opportunity for the price control to reopened in conditions of financial excess. There is a 28 day window for appeals - but many of the problems we identify here could not have been known within that window.

We therefore recommend that consumer bodies are given a similar power to request the amendment of a price control in cases where financial returns are excessive, with Ofgem required to give due and reasonable consideration to non-vexatious requests.

Technical Appendix: methodological note on our model

The purpose of our model is to compare energy networks' actual/forecast returns to modelled returns, which are generated by making adjustments to user-inputted amendments to particular financial metrics. This allows quantification of the impact that changing financial variables would have on consumers' bills, based on Ofgem's price control forecasts.

Primary data sources

Ofgem's Price Control Financial Models (post Annual Iteration Process 2016) and Cost of Debt Indexation Model. We also use daily real yields from 10 Year Government Securities (Real Zero Coupon) to construct a risk-free rate index and ONS/OBR forecasts for inflation terms. We use the latest RIIO Annual Reports (ET1, GT1, GD1, ED1) to construct our estimates of totex and all other incentive equity-related performance.

From the PCFM, we take:

- Regulatory Asset Values for each company for each year of every price control. We use the Net Present Value neutral value.
- Equity and debt costs for each company for each year of every price control, to create the weighted average cost of capital (WACC).

Model variables

This model uses six variables which can be manipulated by the user. The underlying analysis informing these variable choices is described above. The variables are:

Ofgem's cost of debt index

This is comprised of a simple average of the iBoxx non-financials 10+ A rating and iBoxx non-financials 10+ BBB rating to yield a nominal cost of debt.

Break-even inflation is then derived, for each work day, from the relationship between the nominal and real yields on 10 Year British Government Securities given by the formula:

*Break-even inflation = (1+(**Nominal Yield**/100))/(1+(**Real Yield/100**)) - 1)*100*

The real cost of debt, for each work day, is then derived from the relationship between the nominal cost of the iBoxx debt average and the break-even inflation rate given by this formula:

*Real cost of debt = (1+(**Nominal Cost/100)/(1+(Breakeven inflation**/100))-1)*100*

A daily ten year average is then calculated by taking an average of all the work days in a particular ten year period. For ED1, a trombone is added, as described above, where a ten year average is taken in the first year, an eleven year average in the second year and

so on up to a rolling twenty year average. This is then applied in each year of the price control.

Where debt costs are not available, we use the last day for which prices are available as the last day of our average for both the forecast and model revenues.

Our model allows the manipulation of the length of both the ten year average and the trombone. The trombone must always be longer or equal to the average and applies only to the ED1 part of the model (equality indicates the trombone has no effect).

Risk-free rate indexation

Our risk-free rate index takes the daily yield on 10 Year British Government Securities since 1985. It then constructs a rolling average, depending on the user specified input for number of years to construct the average in, for each year of the price control, similarly to the cost of debt index. We treat the risk-free rate as an independent variable. If the risk-free rate and equity premium are inversely related, then this would reduce the savings we identify in this report (though the effect would be dampened by our model's reduced equity betas).

Equity Beta

Our model allows adjustments to the equity beta. This directly feeds into the calculation of the cost of equity:

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

It is therefore a key constituent of the cost of equity shown in the model. Each price control's equity beta can be amended in this way.

Totex incentives

Our model allows the removal real price effects by inserting total real price effects into the model for each price control. Our model uses Ofgem's analysis of their scale for T1 and GD1 by default. These are then amended by Ofgem's sharing mechanism as so:

*Consumer savings = Real Price Effects * (1 - sharing mechanism)*

Where the sharing mechanism is a decimal value that represents efficiency savings returned to the consumer in any case. *1 - sharing mechanism* therefore represents 'unjustified' efficiencies returned to the company that would be removed by a RPE inflation measure.

Inflation measure

Our model allows adjustment of the inflation measure from Retail Price Index to the Consumer Price index. It does this by deflating the Regulatory Asset Values of all network companies from 2016-17 prices to the first year of the price control (either 2009-10 or 2012/13) and then inflates the value using CPI. Where inflation forecasts are not available, we use the last year's value for which OBR has presented forecasts.

Other incentives

For non-totex incentives, our model allows adjustment of the cost of equity to reflect tougher or weaker judgments by Ofgem on incentives performance. Each increment hard codes an increase or decrease to equity returns in our model.

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