

PwC Economics

Refining the balance of incentives for PR19

June 2017

Executive summary

Ofwat appointed PwC to consider whether the current balance of incentives in place are fit-for-purpose and whether there are alternative approaches they might consider. This involves considering how the incentives introduced at Periodic Review 2014 (PR14) are currently being used and whether there is any potential for improvement at the next periodic review (PR19).

Our report sets out the context to incentive-based regulation, and identifies the characteristics which enable a regulatory regime to be successful in incentivising companies to deliver outcomes which meet regulatory goals (Section 2). We then review the current balance of incentives, assessing how well the current package aligns the interests of customers, companies and investors; and identify potential gaps in the current regulatory framework (Section 3). We then assess how Ofwat could rebalance incentives in PR19, and, in particular, encourage plans that are ambitious and innovative (Section 4). We conclude by setting out a number of illustrations for how incentives could be rebalanced in the PR19 methodology (Section 5).

The characteristics which enable a regulatory regime to be successful

Academic study on incentive-based regulation has shown that there are a number of problems regulators face in attempting to mimic the conditions of a competitive market. Information asymmetries between a firm and its regulator give rise to two potential problems: (i) firms inflate their expectation of costs required for providing regulated services; and (ii) firms don't deliver cost efficiencies to the level approved by the regulator.

Effective regulatory regimes combine ex-ante (in the form of forward-looking allowances) and ex-post mechanisms (in the form of profit retention and/or penalties) to incentivise performance. This requires a careful balance between incentivising cost efficiency and service quality. To deliver that balance, effective regulation should have mechanisms that focus on:

Cost efficiency: Allowing regulated companies to retain short-term cost outperformance has been a central feature of UK utility regulation since privatisation. Cost sharing rates are important both for incentivising efficiency and mitigating risk of excess out- or under-performance once price determinations have been set.

Business plan quality: To address information asymmetry and encourage business plans which reflect efficient expenditure projections, academic studies suggests that menu regulation (an Information Revelation Device or 'IRD') and the associated cost sharing rates can serve as a useful tool for regulators. However, there are a number of critiques on the application and effectiveness of menus in practice. We find that alternative IRDs such as achieving 'fast-tracked' or 'enhanced' business plan status, can also be an effective tool in reducing information asymmetries.

Service quality: Price cap or revenue cap regimes can be accompanied by a set of performance standards with penalties and rewards if the regulated company performs above or below prescribed standards for service quality. This mitigates the risk that cost efficiency incentives result in companies sacrificing service quality in order to outperform on costs.

Penalties and rewards: There is a range of penalty and reward profiles which have been used by UK regulators. Rewards and penalties should not necessarily be directly linked to performance even if simple to implement. This is because customer valuations of service quality outcomes are not necessarily linear and therefore penalties and rewards should reflect this. The use of penalty-only outcomes have also been identified in studies as unlikely to incentivise companies to pursue ambitious levels of performance.

Appraisal of current incentives balance

The current incentives in the water sector use both ex-ante and ex-post mechanisms. This creates opportunities for companies to out-perform or under-perform against cost efficiencies, performance commitments and efficient financing cost targets. Analysing the Return on Regulatory Equity ('RoRE') achieved by companies (Figure 2 in Section 3) allows us to analyse performance relative to the expectations that Ofwat set out in PR14.

We find that:

- In 2016, on average, companies have outperformed the expected RoRE range set at PR14;
- The range of Outcome Delivery Incentives ('ODI') outturn performance across companies in FY16 was narrower than the final determination ('FD') 'P10' to 'P90' range and more symmetric than expected;
- As a consequence of outturn totex and ODIs performance in FY16, the relative contribution to the outturn RoRE ranges from totex and ODIs has been markedly different from the relative expected contribution to the RoRE ranges set at PR14;
- Direct financial rewards from being an 'enhanced' company were relatively small at PR14, however business plan incentives also come with significant procedural and reputational benefits;
- There have been large differences in financing performance across companies; however, on average in FY16 companies have neither out- or under-performed. Under-performance has typically been driven by lower than assumed RPI in FY16 (for nominal debt, lower RPI means a higher reported real cost of debt).

Companies perceive that benefits from having a business plan labelled by Ofwat as "enhanced" acted as a strong incentive for producing high quality and cost reflective plans in PR14. In contrast, companies view menus as a weak and complex feature of the price control. In company valuations, ODIs are treated relatively neutrally relative to other potential areas for outperformance such as totex and financing. From the perspective of investors, totex remains the main source for generating shareholder value above the allowed return.

There is a large quantity of relative calibration in price setting (e.g. cost benchmarking), but relatively little weight setting incentive rewards and penalties on the basis of relative performance assessments (e.g. SIM). Most companies consider relative performance assessment to provide a strong incentive.

In contrasting the current incentives of Ofwat to other regulators we identified key areas which could be the target of new incentives at the next periodic review. Specifically, **ambition** and **innovation**. Other sectors have regulatory mechanisms set up specifically to incentivise companies to be more innovative and ambitious in their plans. Some sector regulators, such those in the financial services and telecoms sectors, also offer a more supportive role and act as a guide for innovative firms.

Rebalancing of incentives

Following our review, we make a number of recommendations. Firstly in relation to introducing further regulatory mechanisms to incentivise both ambition and innovation and then to rebalance the current incentives in place.

Recommendation 1: 'Ambitious' should be a business plan category that is distinct from 'fast-tracking'. Ambition should be assessed across a number of factors and should be designed to balance the potential benefits to companies, customers and industry-wide externalities.

A potential gap identified in current set of incentives is that of ambition. Specifically, the gap is most relevant to companies which are already performing well relative to the rest of industry – those performing less well already have incentives to be ambitious in terms of the catch-up targets embedded into their regulatory allowances. Ambition can be broadly defined for a company as targeting a step-change from their own past levels of performance and/or as a step-change from other industry comparators. There are a number of different approaches that could be taken to assessing ambition. For example, it could be defined as going beyond the upper-quartile cost efficiency, or as moving the industry frontier forward. Any incentives implemented to encourage ambition need to protect customers as a key risk is that customers pay for ambition in a plan, but which is not delivered in practice.

Recommendation 2: Rewards for 'fast-tracked' companies should be procedural (e.g. early draft determination and do-no-harm principle) and reputational only, whereas rewards for 'ambitious' companies should also include direct financial rewards.

A company in the new 'ambitious' business plan category should receive an ex-ante direct financial reward. This is because customers stand to gain from the stretching nature of the plan. For the distinct 'fast-tracked'

category, rewards should be procedural and reputational in nature, but not financial. This reflects the high-quality and well-evidenced nature of the submissions - which assists the regulator during the price review – but recognises that high-quality and well evidenced plans do not necessarily lead to superior outcomes for customers. Furthermore, we recommend that Ofwat retains the option for a company to be ambitious but not fast-tracked through the review process. This could occur where the plan exhibits ambition, and is of a sufficient quality, but is not high-quality enough to gain procedural benefits. The justification for this category is that it may help avoid unintended consequences. For example, a company being deterred from submitting an ambitious plan due to the challenge of meeting the high quality hurdle.

Recommendation 3: Ofwat should consider providing further incentives to increase innovation. There are different incentive mechanisms that could be used for incentivising innovation such as ex-ante funding, calibration of ODIs, ex-post rewards, and capability assessments. These mechanisms could be combined to form an incentive package on innovation.

The current regulatory framework does incentivise innovation, where it helps companies meet cost and service performance targets and there are a number of good examples of innovation across the industry. However, the current regulatory framework lacks specific incentives targeted towards **innovation**. Specifically, where there is a trade-off between costs and performance, we find that the current regime may not be as well suited to innovation. The choice of incentive structure around innovation will ultimately depend on the where innovation is perceived to be weak. For instance, provision of ex-ante funding for innovation purposes should only be used for clearly identifiable innovation shortcomings. ODIs can be used to further incentivise innovation by allowing rewards to be earned over a longer time period and/or changing the profile of penalties and rewards. Ex-post rewards should be largely reputational given the challenges in making comparisons across companies. The different methods can be used together and a package of measures could be the best approach to achieve a proportionate approach to innovation. For example ex-post recognition of innovation performance and capability assessments could be built into the initial review of subsequent business plans.

Recommendation 4: The potential rewards and penalties from totex and ODI performance should be rebalanced, so that companies are more incentivised to deliver on outcome measures

There is a potential imbalance between ODIs and totex incentives, as shown by their relative contributions to RoRE performance in AMP6 to date (the scale of this potential imbalance should be monitored over the remainder of the AMP6 control period). Performance to date suggests that incentives are not aligned to their intended calibration; suggesting that there may be not enough strength on certain incentives to achieve the outcomes that matter to customers. Given this, and the current downside skew of setting ODIs, there are grounds for revisiting the balance between totex and ODI incentives. Potential options to recalibrate include strengthening ODI incentive rates, and adjusting cost sharing rates. Because totex performance and ODI performance are not strongly linked (and because there are other areas of Ofwat's incentive regime which are reducing risk), we consider there is scope for an increase in ODI incentive rates without increasing the overall risk which Ofwat has previously targeted.

Recommendation 5: Ofwat should consider introducing more incentive mechanisms which are assessed on a relative basis where comparisons are practicable.

Incentive mechanisms which are assessed (rather than merely initially calibrated) on a relative basis typically provide a sharper incentive than absolute targets, in part this is because of the greater reputational incentives of being ranked relative to industry peers. Relative mechanisms are seen as more powerful, especially for companies seeking to catch-up industry peers, but it may be inappropriate for incentivising some types of outcomes. Areas where relative measures could be introduced are in the areas of ambition and innovation, where only a select number of companies could earn the rewards from being labelled “ambitious”, or achieving innovative outcomes.

Recommendation 6: Partly as a consequence of the period of ultra-low interest rates, Ofwat should take a more market-aligned approach to setting required equity returns.

When setting allowed returns, there is a trade-off between long-term consistency and a more market-based approach. The former results in more stable bills, but may over remunerate companies. The latter may result in more volatile customer bills over time, but will more accurately reflect companies' current financing costs. We

consider that a more market-based approach is preferable, even if this results in slightly higher bill variability between price controls (see lower for longer subheading below).

Setting the cost of equity in a 'lower for longer' era

In setting the cost of equity, UK regulators have tended to take more of a through-the-cycle view of required returns, based upon long-run historical analysis of returns. However, current market interest rate conditions in the UK, and as a consequence returns, are expected to diverge from long-run historical averages for an extended period of time, covering multiple control periods (even in markets such as the US where short-term interest rates have recently risen, yields on longer-dated treasury bonds remain very low by historical standards). This means that historical approaches are not necessarily a good guide to future returns in the current financial environment.

As current market expectations indicate that the PR19 cost of equity is likely be set within this prolonged period of lower interest rates, it is important to understand the potential impacts of this lower for longer era on the methodology for calculating the cost of equity, in particular the assumptions for total market returns ('TMR').

We consider five approaches to estimating equity returns in a lower for longer era.

1. Dividend discount model ('DDM')
2. Inferred cost of equity from RCV premia
3. Competitive tender transaction data
4. Survey data
5. Multiples of corporate bond spreads

Of the techniques set out above, the first three provide helpful empirical insights into current market returns and surveys can be helpful where they capture views from a sufficiently wide and representative investor group.

Recommendation 7: Overall, we conclude that current DDM analysis, RCV premia based estimates and investor surveys of TMR support the use of an 8.0% to 8.5% nominal TMR range (9.7% at PR14). Combining this range with a forward-view of the RFR, and retaining asset beta and gearing assumptions from PR14, we calculate that the nominal cost of equity in the water sector in the current era of ultra-low interest rates could range from 6.7% to 7.4% (8.6% at PR14).

Our DDM analysis shows the current level of implied TMR is low by historical standards, similar to those levels in both 2009 and 2000. It also shows that TMR estimates have been falling gradually since 2014; during 2012 and 2013 TMR estimates were frequently above 9%, but are now consistently below 9%. This downward trend in return requirements across the market is consistent with evidence of reducing return requirements from surveys of infrastructure investors. The rate from our DDM analysis as at March 2017 is 8.3%, which is lower than the five year average of 8.8%. Supporting evidence from RCV premia suggest that a TMR figure lower than the spot DDM output may be justifiable, in the range 7.6% to 8.1%. The most recent survey of investors by Fernandez (2017) suggested a consistent figure of 8.1% for the UK.

However, we note that the range implied from the DDM sensitivity analysis was wider than this, and that this range will move in line with market expectations and market data between now and PR19.

A key policy consideration associated with a current market approach is the potential impact on customer bill stability. We find that as a result of switching to a market based measure of allowed equity returns, bills in the short to medium term could be approximately £8 lower. However, the additional bill volatility from a current market based TMR approach is approximately £16 higher than compared to using the historical approach. There is therefore a clear trade-off between short-term bill reductions and medium term bill volatility. A further policy consideration is the interaction between financing incentives and other incentives. Where equity financing allowances are more variable, there may be less capacity to increase incentive strength in other areas within the balance of incentives.

Conclusion

Overall, we find that there are arguments in favour of rebalancing the current incentives in place in the UK water industry. In some cases this could involve increasing the strength of existing incentives (e.g. incentives rates on ODIs), and in other cases this could involve the introduction of new aspects to the balance of incentives (e.g. additional incentives targeted at ambition and innovation).

Such rebalancing should incentivise companies to increase their focus on outcomes that are aligned with the interests of customers. Wherever rebalancing occurs Ofwat will need to be mindful that any increased incentivisation requires careful calibration and that there is a possibility of greater variability in company performance in future.

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1. Introduction

- 1.1 The 2014 price review (PR14) introduced a number of changes to the economic regulatory framework aimed altering the balance of incentives, risk and reward in order to incentivise companies to better focus on the in the services they provide to customers. For example, PR14 introduced incentives such as risk based reviews, outcome delivery incentives (ODIs) and the totex incentive mechanism.
- 1.2 Building on these changes, Ofwat is now in the process of developing the methodology that will be used in the next price review (PR19).
- 1.3 Therefore, Ofwat wants to review whether the package of incentive mechanisms and the balance of financial incentives are fit-for-purpose and whether there are alternative approaches they should adopt.
- 1.4 Ofwat has asked us to conduct this review and consider:
 - The theoretical and academic background to incentives based regulation, setting the characteristics which enable a regulatory regime to be successful (Section 2);
 - How well the overall incentive framework is aligning the interests of companies and customers, including a review of how incentives are currently being used, identifying potential gaps in the current balance of incentives (Section 3);
 - How specific incentives could be rebalanced at PR19 (Section 4); and
 - Potential policy options for the PR19 and their relative merits and drawbacks (Section 5).
- 1.5 In addition, Ofwat has also asked us to consider the implications of a 'lower for longer' interest rate era on the cost of equity for PR19 and how this links to the wider balance of incentives. This review is set out in appendices A to C.
- 1.6 Throughout the report we refer to a set of appendices which contain supporting evidence and exhibits. Data up until the end of 2016 was considered for the purposes of the analysis set out in the report. Ofwat should update this analysis during PR19 to inform water company business plan development and its own assessments.

2. Context to incentive based regulation

- 2.1 This section presents relevant background to the study of incentives. Specifically, we:
- Review the theoretical and academic background to incentives based regulation; and
 - Set out the characteristics which enable a regulatory regime to be successful in incentivising companies to deliver outcomes which meets the regulatory goals.

Background to incentive based regulation

- 2.2 Regulators look to align the efficiently incurred costs of companies with the prices paid by customers and, in doing so, prevent regulated monopolies from (a) earning super-normal profits; or (b) operating at a financial loss.¹ This is seen as being consistent with the economic goal of maximising “*the present value of expected net benefits to [existing and future] consumers plus producers, subject to a minimum profit condition and to various constraints on the distribution of benefits*”.²
- 2.3 In a well-functioning non-monopolistic market, costs and prices are aligned through competition between existing companies and the entry and exit of firms. However, “*this market-induced adjustment process does not happen in a monopoly market setting...In [these] circumstances, costs and prices can only be realigned by a regulatory review*”.³ Furthermore, such reviews need to be conducted on a repeated basis as changes in technology and input costs mean that prices and costs become unaligned overtime.
- 2.4 A number of problems arise when regulators attempt to mimic the conditions of a competitive market via regulatory reviews. Depending on the type of regulatory regime implemented, regulated monopoly firms can be incentivised:⁴
- i) to make submissions that inflate their expectation of the costs required for providing regulated services; or
 - ii) to avoid seeking cost efficiencies relative to the costs initially approved by the regulator.
- 2.5 Both of these issues arise due to significant *information asymmetries*, as companies typically have greater information on actual costs and areas for potential efficiencies than the regulator. This makes repeated regulation a strategic non-zero sum game, in which “[a]chieving efficient and stable solutions ... depends on establishing reputation, trust and effective signalling between the players”.⁵

Incentivising cost efficiency

- 2.6 In response to the issues above, economic regulation has historically focused on incentivising cost efficiencies by introducing a range of regimes and mechanisms. While there are a number of different forms of cost regulation, academic theory relating to economic regulation generally describes regulation

¹ Stern, Jon (2014) *The British utility regulation model: Its recent history and future prospects*, Centre for Competition and Regulatory Policy (CCRP), CCRP working paper no. 23, p. 18.

² Beesley, Michael and Littlechild, Stephen (1989) *The regulation of privatized monopolies in the United Kingdom*, p. 455. Emphasis added.

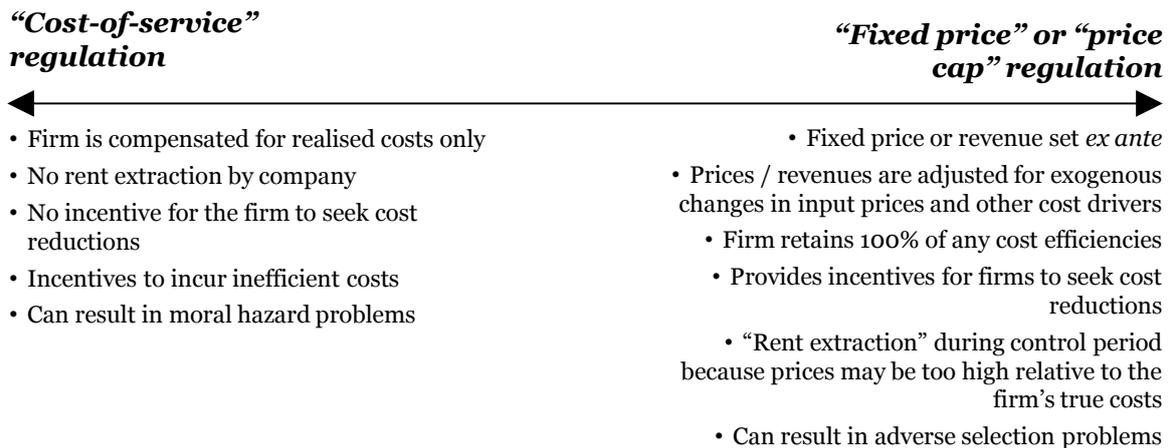
³ Stern (2014), p. 18.

⁴ See, for example, Flavio M. Menezes (2014) *Incentive regulation*, UniQuest Pty Limited prepared for the Queensland Competition Authority, p. 3.

⁵ Stern (2014), p. 18

along a spectrum with “cost of service” regulation at one end and “fixed price” or “price cap” regulation at the other.⁶ This is illustrated in Figure 1 below.

Figure 1: Regulatory regime spectrum



Source: PwC based on Joskow (2008), Liston (1993), Berg (1998)

- 2.7 Given the trade-off between the two types of regulatory regime above, i.e. the incentive to incur inefficient costs versus the incentive to report costs above their true level, the optimal regulatory mechanism is likely to lie somewhere between the two ends of this spectrum. This notion is described in different ways. Examples of an optimal regulatory regime have been described as:
- i) having “*a form similar to a profit sharing contract or a sliding scale regulatory mechanism where the price that the regulated firm can charge is partially responsive to or contingent on changes in realized costs and partially fixed ex ante*”.⁷
 - ii) including both “*ex-ante and ex-post elements, such that the regulated price is partially determined ex-ante but can be subsequently adjusted to reflect certain types of deviations from predicted costs. This can be implemented through a profit sharing agreement where the firm and the regulator agree on how to share any excess profits with customers*”.⁸
- 2.8 These concepts form the basis of effective incentive-based regulation, which is defined as “*the use of rewards and penalties to induce the utility to achieve desired goals where the utility is afforded some discretion in achieving goals*”.⁹ Furthermore, incentive-based regulation is forward-looking in that it “*proceeds from projected efficient cost*” as opposed to a simple observation of historically incurred costs.¹⁰
- 2.9 One method for implementing incentive-based profit sharing regimes is the use of regulatory menus (See Appendix G for more detail). Menus are a regulatory tool intended to mitigate the effects of information asymmetries and provide “*incentives to companies to reveal their current and expected future costs by making choices on required future expenditure to meet mandated standards*”.¹¹ There is a broad consensus in academic literature that menus serve as a useful regulatory tool, with some

⁶ Academics also identify other forms of regulation, e.g. “yardstick regulation” or “performance based regulation (PBR)”. However, these are usually implemented in conjunction with a cost of service, or more commonly, a price-cap type approach.

⁷ Joskow, Paul L. (2008) *Incentive Regulation and Its Application to Electricity Networks*, Review of Network Economics, Vol 7, Issue 4, December 2008, p. 552.

⁸ Menezes (2014), p. 15.

⁹ Berg, Sanford V. (1998) *Introduction to the fundamentals of incentive regulation*, Incentive regulation, p. 38

¹⁰ Hertog, Johan den (2010) *Review of theories of regulation*, Tjalling C. Koopmans Research Institute, Discussion Paper Series 10-18, p. 40.

¹¹ Stern (2014), p. 20. For theoretical discussion of menus, see also, Laffont, Jean-Jacques and Tirole, Jean (1986) *Using Cost Observation to Regulate Firms*, Journal of Political Economy, Vol. 94, No. 3, part 1, 614-641.

noting that offering “a menu of cost-contingent regulatory contracts with different cost sharing provisions” provides a better alternative than only offering a single profit sharing contract.¹²

- 2.10 Menu regulation can serve as a tool for regulators to reduce the impact of information asymmetries, and has been adopted some UK regulators. However, they have been criticised by some stakeholders as being too complex. There are a number of critiques in the application of menus as well as their effectiveness more generally. For example:
- i) The CMA identified some problems in the application of financial menus.¹³
 - ii) Internationally regulators have rejected a menu-based approach due to the perceived complexity that they add to the regulatory framework and the difficulty in calibrating them correctly.¹⁴
- 2.11 Regulatory menus are only one example of Information Revelation Devices (‘IRDs’). IRDs consist of mechanisms (financial or non-financial) that incentivise regulated companies to reveal accurate information. The process of fast vs. slow tracking of company business plans in the case of Ofgem, or enhanced vs. non-enhanced in the case of Ofwat, is an example of an IRD. IRDs, other than menus, have not received significant attention by academics. However, other IRDs such as Ofwat’s risk-based review process at PR14, arguably provide stronger truth-telling incentives than menus¹⁵.
- 2.12 For example, Joskow (2008) notes the importance of company reputation in the context of repeat regulation, such as periodic price controls. The regulator will learn more about the companies in the industry with each round of regulatory proceedings because price controls occur on a repeated basis. Through this repeated process, firms will develop a reputation based on the credibility of the information and plans they submit. As a result, repeat regulation, in itself, serves as a useful regulatory mechanism for reducing information asymmetries.
- 2.13 The use of regulatory menus and IRDs provide incentives for regulated companies to reduce costs / achieve cost efficiencies. However, one academic study has noted that:
- “Any incentive regulation mechanism that provides incentives only for cost reduction also potentially creates incentives to reduce service quality when service quality and costs are positively related to one another. The higher powered are the incentives to reduce costs, the greater the incentive to reduce quality when cost and quality are correlated”¹⁶*
- 2.14 Due to this, it remains important for regulators to also provide additional service related incentives to prevent a reduction in service quality.

Incentivising service quality

- 2.15 In order to prevent a deterioration in service quality, price or revenue cap regimes can be accompanied by a set of performance standards with penalties and rewards if the regulated company falls above or below these standards.¹⁷ However, from a theoretical and academic standpoint, less attention has been given to service quality incentives compared to cost efficiency incentives. Some of the learnings and key points relating to cost efficiency are also applicable to service quality incentives. For example,

¹² Joskow (2008), p. 552.

¹³ The CMA found a number of problems with Ofwat’s menu incentive regime in the Bristol Water 2014 appeal, but has noted that Ofgem’s use of menus provided clearer incentives for accurate business plan submissions.

¹⁴ For example, menus, which were viewed as unnecessarily complex, were rejected by the Ontario Energy Board in 2000 and 2008. Similarly, the Alberta Utilities Commission also rejected the use of menus because the proposals for such an approach were poorly calibrated for and difficult to understand and implement.

¹⁵ Stern (2014), p. 21.

¹⁶ Joskow (2008), p. 555.

¹⁷ Joskow (2008), p. 555.

information asymmetries are likely to exist, which means the company has a better view of their (potential future) performance levels than the regulator.

2.16 Sappington (2005) notes that service quality incentives:

*“should not be designed in isolation. Instead, they should be carefully coordinated with other relevant regulations. To illustrate, more stringent safeguards against undesired quality deterioration may be advisable when the regulated firm operates under a high-powered reward structure that offers substantial financial rewards for reducing operating costs.”*¹⁸

2.17 In this context, so called “high-powered” incentives relating to costs should be balanced against “high-powered” service incentives. In order to achieve the welfare-maximising level of service quality, the level at which the marginal benefit of delivering additional quality should be equal to the marginal cost of supplying additional quality.¹⁹ Therefore, to determine the welfare maximising level of service quality, an economic regulator needs to know the costs and benefits of different service levels.²⁰ This can be obtained from:

- i) Customer surveys: These provide information about the value (benefits) that customers derive from certain levels of service quality²¹. In a world with increasing access to data, it may also be possible to collect this information in real time and in greater detail to find out customers' preferences beyond information that could be extracted from surveys.
- ii) Engineering surveys / information: These provide some information about costs of delivering service levels.

2.18 Unlike cost efficiency incentives, service quality incentives are multi-dimensional. That is, there are multiple areas of service quality that can be incentivised. Hence, the reward and penalty structures for service quality can be complex, particularly because “*customer valuations of service quality typically are nonlinear and because valuations on one dimension often vary with the levels of service quality delivered on other dimensions*”.²² Service quality incentives often fail to deliver the welfare-maximising level of service on all dimensions due to this complexity.

2.19 Non-financial (e.g. reputational) incentives can also play a role in regulating service quality. In particular, there is a trade-off between the cost of delivering better service and the impact on the firm's reputation resulting from success, or failure, when delivering outcomes against different service metrics²³. Following this, Laffont and Tirole (1986) note that one way to encourage higher service quality, therefore, would be to highlight companies' performance levels influencing their reputations.

Penalty-only / skewed incentives

2.20 Sappington (2005) commented on the problems associated with penalty-only incentive structures. He notes that where service quality is wholly or partially influenced by random elements (e.g. weather), penalty-only incentives will penalise the regulated firm, even when, on average, the supplier delivers the specified quality standards.²⁴ This suggests that penalty-only incentives, or incentives with a downward skew, may be more suitable for service indicators over which the company has a greater degree of control.

¹⁸ Sappington, David E. M. (2005) *Regulating Service Quality: A Survey*, Journal of Regulatory Economics, 21:2, 123-154, p. 147.

¹⁹ Sappington (2005), p. 134

²⁰ Sappington (2005), p. 134

²¹ Using willingness to pay or choice-based conjoint analysis techniques.

²² Sappington (2005), p. 135

²³ Laffont and Tirole (1986), p.630

²⁴ Sappington (2005), p. 133

- 2.21 Furthermore, penalty-only incentives are only likely to incentivise companies to achieve a minimum level of performance. It is unlikely to increase quality above the minimum required standard.²⁵ This suggests that penalty-only incentives may only be suitable where the regulator wants to prevent a decrease in service, but is insufficient when it wants to create an ambitious performance target.

Implications for enabling a successful incentive regime

- 2.22 Economic regulation in the UK reflects many of the features above. Broadly speaking, economic regulation of water and energy in the UK has evolved from a focus on so-called “yardstick” approaches, based on industry benchmarking of efficiency levels, to alternative approaches. In particular, yardstick approaches were unable to solve information asymmetry problems because there were “*strong incentives for companies to show that they were ‘special’ so that the regulator’s preferred benchmarking model should not be applied to them*”.²⁶ UK regulators have moved toward a hybrid regime described as “*a form of forward-looking, incentive-based rate of return regulation*” to address these problems.²⁷
- 2.23 From the discussion above, we set out a number of features of regulation which are believed to incentivise regulated firms. These are all supported by the academic literature. A successful incentive regime need not apply all features, but a regulatory regime with none of these features – or too few – is unlikely to deliver meaningful incentives.
- i) **A combination of ex-ante and ex-post mechanisms:** Cost allowances or performance commitments are set *ex ante* but the value of any reward / penalty should be determined *ex-post* based on a firm’s actual level of performance, in order to ensure that cost efficiencies are shared with customers
 - (1) **Forward-looking ex ante regulatory allowances:** While cost and performance targets will, to some extent, be derived from an analysis of historic data, the targets should reflect a desirable and achievable view of future performance and thereby incentivise companies to operate more efficiently.
 - (2) **Ex post rewards:** An element of profit retention is essential to incentivise firms to seek cost efficiencies. Higher-powered retention incentives will provide stronger incentives for firms to beat cost allowances.
 - ii) **Use of non-linear rewards and penalties:** Customer valuations of service quality outcomes are not necessarily linear and therefore penalty / reward should reflect this. For example, customers have a diminishing marginal utility for some service improvements and will therefore be less willing to reward incremental improvements beyond a certain service level. On the other hand, large rewards may be justified where companies push forward the industry frontier – leading to externality benefits across the industry. In practice, however, implementing non-linear rewards and penalties can be a complex task.
 - iii) **Selective use of penalty-only incentives:** Penalty-only incentives can be powerful for achieving minimum requirements, but beyond the minimum level of performance required their power fades.
 - iv) **Tools for reducing information asymmetries:** In recent price controls, regulatory menus have been a key tool for mitigating the effects of information asymmetries, however, other IRDs associated with business plans such as ‘fast-tracking’ can also play a prominent role in reducing information asymmetries. Reducing information asymmetries narrows the scope for excessive out- or under-performance.

²⁵ Sappington (2005), p. 143

²⁶ Stern (2014), p. 19

²⁷ Stern (2014), p. 18

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- v) ***A balance of cost efficiency incentives with service quality incentives:*** On their own, cost efficiency incentives may result in companies sacrificing service quality in order to outperform on costs. Therefore, a regulatory regime should also include incentives to achieve desirable levels of service quality. This is particularly true where costs and service levels are correlated.
 - vi) ***Use of reputational incentives:*** Regulators can highlight company performance and reputation to provide incentives for service delivery. The process of repeat regulation, in itself, also provides reputational incentives for firms to submit credible information and plans to the regulator.

2.24 We are guided by these desirable features as we review the current balance of incentives in the UK water sector in the next section.

3. Appraisal of current incentives

- 3.1 Having set out a theoretical overview of incentive-based regulation and identified desirable features in the section above, this section of this report:
- Provides an overview of the current incentives in the UK water sector;
 - Reviews the balance of those incentives; and
 - Draws lessons for the water sector from the application of incentives in other sectors.
- 3.2 We conclude this section by highlighting potential gaps that exist within the current incentives.

Overview of current incentives

- 3.3 The current balance of incentives in Ofwat's regulatory regime creates opportunities for water companies to outperform or underperform against:
- *Cost efficiency thresholds* - outperforming against target levels of total expenditure ('totex') determined through Ofwat's totex modelling exercise and outperforming against average cost to serve in the household retail control.
 - *Outcome performance commitments* - financial rewards and penalties, created through outcome delivery incentives (ODIs) and performance targets, offer the potential for additional returns beyond the notional RoRE allowance.
 - *Service quality relative to other companies* - Relative incentive mechanisms such as the Service Incentive Mechanism (SIM) rank company performance and reward companies who perform significantly above the industry average.
 - *Financing assumptions* - companies can outperform against the notional allowed cost of capital; through differences in capital structure and debt financing costs.²⁸
- 3.4 Each of these incentives can be analysed through the potential impact on the variation in the range for the Return on Regulatory Equity (RoRE).²⁹ There are also incentives not explicitly captured through the Ofwat's RoRE analysis, such as the Wholesale Revenue Forecasting Incentive Mechanism (WRFIM) and direct financial rewards for achieving 'enhanced' status. For a full description of the individual incentives in place please see Appendix E.
- 3.5 Below we provide an overview for each of these incentives before summarising the current balance between them.

The current balance of incentives

- 3.6 We have assessed how the water industry's performance compares with Ofwat's expectations (at PR14), by focusing on the current incentives from PR14 and using data from FY16. Given the variety of incentive mechanisms, and the range in company size, it is important to ensure that the strength and impact of incentives are assessed on a comparable and meaningful basis.
- 3.7 The RoRE presentation, which was introduced at PR14, enables company returns (profits) to be expressed as a proportion of that regulatory equity. Company returns can be disaggregated into their constituent parts in order to understand the sources of company profit. In addition, RoRE allows a like-for-like comparison across companies, across incentive types, and provides a direct measure of the magnitude of incentive impact on company profits.

²⁸ Companies can also outperform with respect to their taxation allowances.

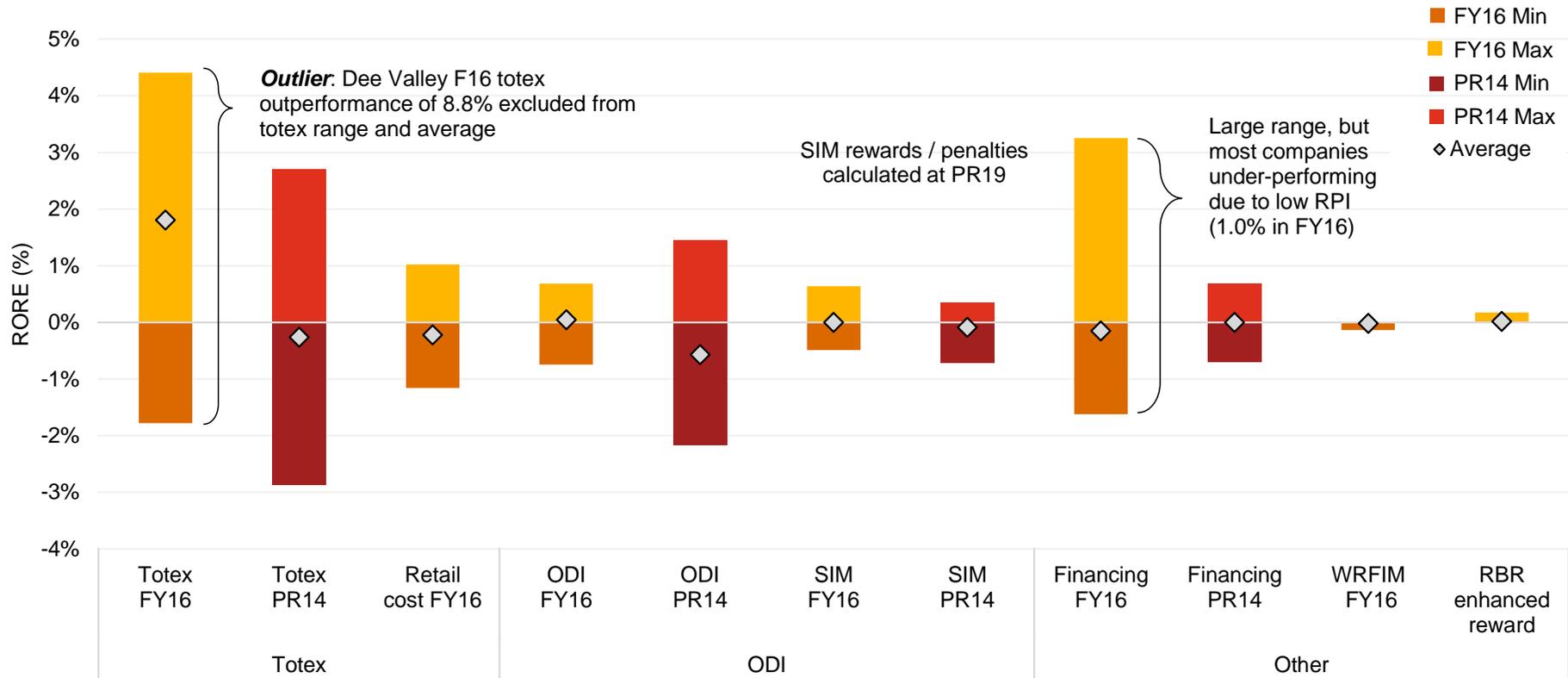
²⁹ Ofwat's RoRE range captures P10/P90 outturn performance relative to allowances.

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- 3.8 We therefore use the RoRE in order to assess the current balance of incentives. Specifically, we compare industry performance against different incentive types in FY16 to the RoRE ranges included in company final determinations at PR14. We consider the overall variation in performance for each incentive type as well as the average level of performance in FY16 across companies. Conclusions should be treated as tentative as our analysis is based on a single year's data. For example, over a single year it is hard to distinguish between totex efficiency and totex deferral.³⁰
- 3.9 It is important to note that the forward-looking RoRE range is a probabilistic outlook measure. It is calibrated such that there is a 10% chance that the outcome is outside of the range (both above and below). This may be due to wider market or economic movements which can move the whole industry in one particular direction relative to ex-ante allowances, or due to company specific performance differences. Because there is data on 18 separate water and wastewater and water-only companies, we expect variation across companies and this expected performance variation should reflect the forward-looking potential variation built into the incentives regime at PR14. So we would not expect the forward looking RoRE ranges to match actual performance variation, but there should be a broad alignment.³¹
- 3.10 This analysis is set out in Figure 2 below and includes an assessment of the following incentives:
- Totex (wholesale cost performance)
 - Retail cost performance
 - ODIs
 - SIM
 - Financing
 - WRFIM
 - RBR enhanced reward
- 3.11 The specific calculation methodology for each of these components is set out in detail in Appendix K.

³⁰ As a reference point, we also set out 'totex' performance (as shown by the sum of opex and capex) in over previous price controls.

³¹ Such a comparison of forward looking RoRE ranges and actual performance is hard to do in industries with fewer company datapoints.

Figure 2: The current balance of incentives



Source: PwC analysis, Ofwat, Company data

Note: Out/underperformance, rewards and penalties are expressed as post-tax figures, consistent with the post-tax basis of the return on equity. For wholesale totex and retail, actual performance versus allowances accounted for company specific cost sharing rates, the prevailing corporation tax rate was then deducted from remaining out/underperformance retained by the company. For financing, the actual cost of debt as sourced from annual performance report table 1E was compared to the cost of debt allowance, for all companies a notional capital structure was assumed, the prevailing corporate tax rate was then deducted from out/underperformance. For ODIs and SIM, consistent with the tax allowances discussed in the reconciliation rulebook, the rewards and penalties are already taken to be post-tax figures. Penalties associated with the WRFIM are also taken to be post-tax. RBR enhanced rewards (£11m for SWT and £4m for AFW) are also taken to be post-tax figures.

3.12 We can still draw some insights into the current balance of incentives even though it may not be fully representative to use only FY16 data for comparison with the expected balance of incentives over a five-year period. For instance, it could be the case that totex performance over a one year period for one company may not reflect the overall five year period performance if there has been a material deferral of expenditure to later in the control periods. Nonetheless, drawing insights from the current balance of incentives can help monitor how the industry is performing in advance of PR19 – informing options for adapting methodologies.

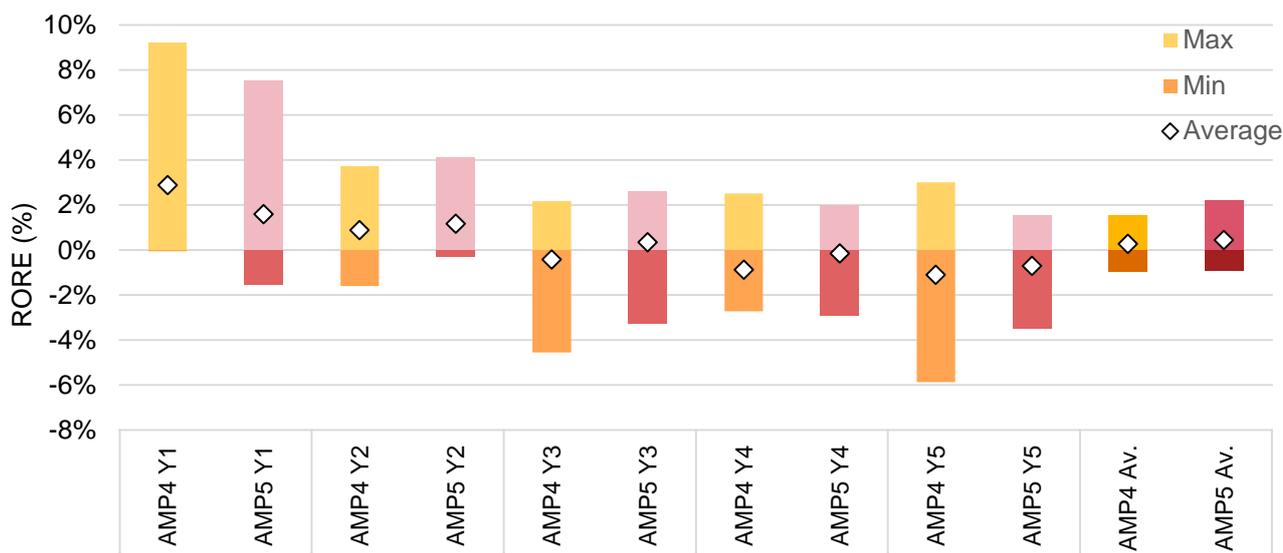
3.13 From Figure 2 we observe the following themes:

The totex range is in line with expectations, but companies have, on average, out-performed

3.14 At PR14, the total RoRE range attributable to totex performance was approximately 5.6%. From FY16 data, the total outturn range is close to this at approximately 6.2%. However, a key difference is that this RoRE range for FY16 is shifted higher, with lower underperformance and greater outperformance. Given that this is the first year of the AMP, it is unclear to what extent this is driven by deferral of expenditure as opposed to outperformance.³²

3.15 To help understand the extent to which this performance is deferral, we can compare to previous control periods.³³ Figure 3 below shows how totex performance in RoRE terms has evolved over the past two control periods (referred to as AMP4 and AMP5). This historical evidence suggests that performance in the first year of the control period is typically stronger compared to latter years – reflecting deferral of spending. It also suggests that the RoRE range associated with totex performance may be narrower on average than the first year alone would imply. FY16 results alone should therefore be interpreted with caution.

Figure 3: Totex RoRE variation in past control periods



Source: Ofwat, PwC analysis

Note: The historical figures presented are on an actual basis relative to allowances. The figures will therefore be influenced by factors such as the prevailing set of incentives, cost sharing rates and tax rates. We have not sought to adjust for the differences between these factors and PR14.

ODI outturn is narrower than P10 to P90 range

3.16 The RoRE range attributable to ODI FY16 outturn performance is narrower at 1.4% compared to the range of 3.6% expected in the P10 to P90 range. Portfolio effects could explain this observation. This is

³² For PR14 totex, the average is below zero as for the typical company totex RoRE was marginally skewed to the downside.
³³ Past price reviews did not assess expenditure on a totex basis, and therefore comparisons are not fully comparable. Our approach to measuring AMP5 and AMP6 performance is set out in Appendix K.

because it is unlikely that companies will outperform on all ODIs nor underperform on all ODIs, but rather there is likely a mix between outperformance and underperformance, hence few companies reach near the maximum level of outperformance and underperformance. As discussed in Ofwat's outcomes consultation, at PR14 the top and bottom of the potential ODI range "*is likely to over-represent the potential financial impact at PR14 because they assume very good or very poor performance across all a company's ODIs which is unlikely to be the case*".³⁴

- 3.17 Furthermore, ODI performance in FY16 is more symmetric than was expected. The industry average RoRE impact from ODI performance is 0.0% from FY16 data,³⁵ whereas the expected average at PR14 was -0.6% over the five year period, indicating the industry is performing better than expected so far. A potential explanation of this is that penalties provide stronger incentives. Alternatively, it may reflect information asymmetries between companies and Ofwat in setting ODIs for the first time.
- 3.18 Another observation is that the outturn FY16 balance between totex and ODIs performance is markedly different from the balance anticipated their PR14 RoRE ranges. On a RoRE basis the ratio of totex to ODI performance at PR14 was set at approximately 1.6x, but on an FY16 outturn basis this ratio has been closer to 4.4x.

Direct financial rewards are relatively small

- 3.19 The Risk Based Review ('RBR') incentive offers a direct financial benefit to firms delivering high quality, well evidenced plans. This is relatively small (approximately 0.2% RoRE) compared to other incentives, however, 'enhanced' status also brings reputational benefits, procedural benefits and indirect financial benefits (e.g. access to an enhanced cost sharing menu and "do no harm" principle). Along with direct financial rewards, this combination could lead to a significantly more powerful incentive overall.

Financing incentives are large

- 3.20 Outturn financing performance shows there is a large difference in financing outperformance across companies. The figures shown for FY16 are based on total debt, comparing the real cost of debt reported by companies to the real cost of debt allowance set at PR14. Accordingly, underperformance has typically been driven by lower than assumed RPI in the first year of AMP6 (for nominal debt, lower RPI means a higher reported real cost of debt).³⁶ As the RoRE range used in PR14 is focused on performance for the cost of new debt allowance, this comparison of RoRE an outturn is not a directly equivalent one³⁷. However, focusing on outturn impact, it demonstrates that financial incentives are broadly similar in power to those of totex.

There is a large quantity of relative calibration in price setting, but relatively little weight on relative performance assessments

- 3.21 Only SIM is scored for performance on a relative basis, even though many elements of the price control are calibrated through benchmarking and relative assessments. Within ODIs, comparative ODIs have a relative calibration, whereas non-comparative ODIs are tailored to company-specific circumstances. Figure 4 below shows that the ODI range associated with comparative ODIs is approximately 1.2%. SIM, another relative performance assessment has a range of approximately 0.6%. Therefore, even when combined, these incentives have a low amount of financial weight in the current balance of incentives.

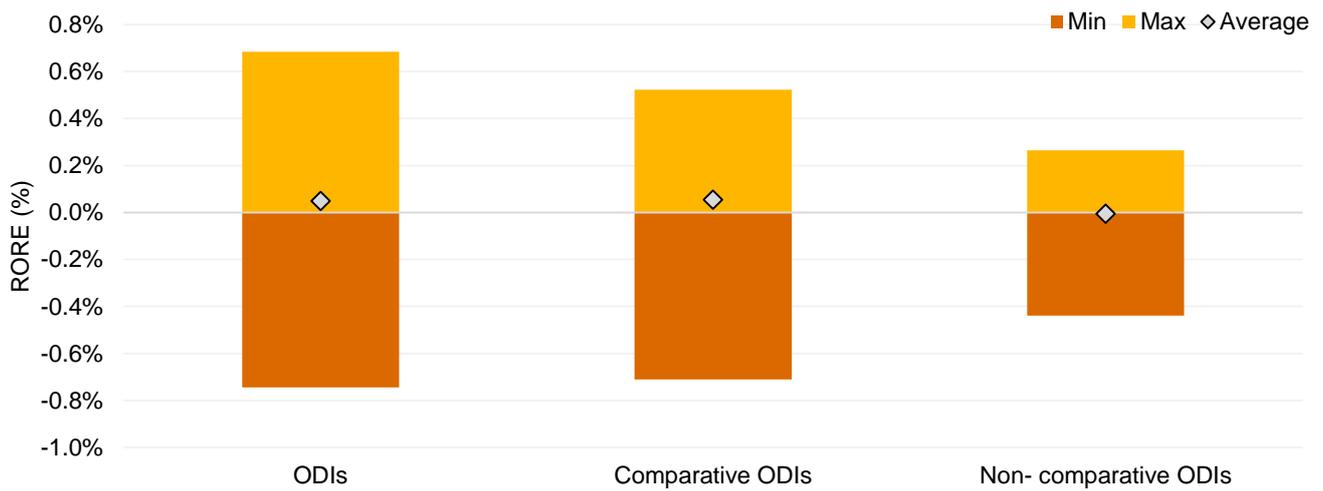
³⁴ Ofwat, Outcomes consultation, p. 6.

³⁵ Companies earned net ODI rewards in FY16, but this rounds to a RORE impact of 0.0% to one decimal place.

³⁶ A notional financing structure has been assumed so these figures may differ from individual company calculations of actual RoRE.

³⁷ PR14 RoRE analysis did not include embedded debt as this is not subject to uncertainty. However we have included embedded debt in our analysis to demonstrate the full incentive strength associated with current and historically raised debt finance.

Figure 4: The current balance of ODIs³⁸



Source: PwC analysis, Ofwat, Company data

3.22 Having set out the themes in the current balance of incentives, in Table 1 below we set out a rating of each incentives' overall relative strength, where performance is assessed on an absolute or relative basis and company performance against it to date.

³⁸ Comparative and non-comparative ODI range does not sum to total ODI range as the company with the max/min performance on comparative ODIs is not the same company who has the max/min performance on non-comparative ODIs. Each group has been ranked independently.

Table 1: Summary of PR14 incentives

Incentive	Financial strength	Performance assessment	Performance to date
Financial business plan incentives	Initial financial award similar in magnitude to SIM rewards. 5% higher cost sharing rate but applied to both under and over performance. Low	Absolute	Soth West Water ("SWT") earned a modest (relative to RCV) net reward on ODIs for 2015-16. Meanwhile Affinity Water ("AFW") had a negative net reward of £1.6m. This demonstrates that there is not necessarily a strong link between outcome outperformance and business plan quality.
Procedural business plan incentives	'Do no harm' principle applies to the cost of capital. Earlier draft determination. Medium	Absolute	
WACC	Can be a powerful incentive to finance efficiently. High	Absolute	Performance to date has been influenced by out/underperformance against the assumed real cost of embedded debt (2.65%). At the lower end of the spectrum companies have close to 0% real cost of debt while other companies are closer to a 3.5% real cost of debt.
Totex incentive mechanism (TIM)	Approximately +/-2.0% RoRE. High	Absolute	Totex performance to date shows a positive skew towards outperformance. Industry average RoRE for FY16 was 1.8% (excluding Dee Valley). Outperformance range significantly greater in FY16 compared to PR14 expectations, although this may be deferral of expenditure to later years.
Retail average cost to serve	Approximately +/-1.0% RoRE in FY16 Medium	Absolute	Retail cost performance to date has been relatively symmetric. This is reflective of the average benchmark used to set allowances. The performance range may narrow beyond FY16 consistent with the glide paths set at PR14.
ODIs - Reward & penalty	Medium	Combination of relative and absolute	ODI performance to date has been mixed, with Thames Water and United Utilities incurring net penalties but the industry as a whole achieving a modest net reward.
ODIs - Penalty only	Approximately +/-1.5% RoRE Medium	Combination of relative and absolute	
SIM	Approximately +/-0.3% RoRE Low	Relative	SIM performance in FY16 shows that the industry has improved since AMP5, with the average SIM score rising from approximately 78 to 82.5. Companies are also more tightly bunched in terms of score than they were in AMP5. Company rankings also exhibit persistence. ³⁹
WRFIM	None relative to allowance with accurate forecasts. Low	Absolute	In FY16 most companies' revenue collection was within 2% of the revenue allowance. This meant the application of penalties was minimal.

³⁹ PwC analysis of SIM rankings show that 10 out of 18 companies remain in the same quartile over the period FY12-FY16. Macquarie Research also note the bunching in SIM scores in their UK Utilities equity research (23 January 2017), p.38

3.23 Next, we set out company and third party views on the current balance of incentives.

Views on the current balance of incentives

Water company views

- 3.24 In setting out company views we draw upon our experience of work with companies as well as papers produced by companies. Specifically we draw upon Anglian Water's paper ('ANH') on the future use of menus⁴⁰ and United Utilities' paper ('UU') on performance measures and incentives.⁴¹
- 3.25 One view expressed by companies has been that greater awareness of the financial rewards available to companies from being enhanced would have strengthened the financial business plan incentive. Supporting this view, the outputs from a survey of companies showed that the benefits from being enhanced acted as strong incentive for high quality and cost reflective business plans – more so than menus.⁴²
- 3.26 In that same survey, menus were viewed as not effective at revealing true costs. ANH believed this was because Ofwat's assessment was revealed before companies made their final menu choices. Furthermore, they used survey evidence to justify the view that the totex menu was a weak incentive relative to other aspects, such as business plan rewards.
- 3.27 The relative nature of some mechanisms such as the comparative ODIs and SIM is seen to create a powerful incentive. UU highlighted that the main strength of comparative ODIs is that they provided strong incentives for providers to discover new ways to deliver outcomes – reducing cost and improving service. However, the key drawback of comparative ODIs was that they lacked tailoring to local customers' preferences and cut across local engagement. The SIM incentive was further reinforced by the average cost to serve challenge embedded in the retail control.

Third party views on the current balance of incentives

- 3.28 In setting out third party views we draw upon our experience and a large sample of analyst reports on the water sector.
- 3.29 In the PR14 RBR, third parties thought that relatively little weight was placed on past performance and reputation to determine whether a company was 'enhanced'. Companies considered that this created greater ex-ante uncertainty on which companies were more likely to be enhanced.
- 3.30 In company valuations by analysts, ODIs were treated relatively neutrally compared with other potential areas for outperformance such as totex and financing. For many companies, totex remains more important than ODIs as a source for generating shareholder value above the allowed return. Penalty ODIs, by their nature do not generate investor value, while the rewards available on 'penalty and reward ODIs' are typically seen as second order relative to the value available through outperformance of other allowances.
- 3.31 A notional industry WACC is seen as a powerful driver of out/underperformance, and therefore provides a strong incentive to lower financing costs. As corporate bond yields remain close to historic lows, the notional of cost of debt will pose an increasingly large challenge to those companies with long-dated index-linked debt raised prior to steep falls in yields, both in AMP6 as well as subsequent price control periods.
- 3.32 Lastly, menus are viewed as a complex element of the price control and are not as well understood as other elements.

⁴⁰ Anglian Water, 'Future use of menus as part of price setting methodology', 2015.

⁴¹ United Utilities, 'Developing Performance Measures and Incentives', 2016

⁴² As set out in Anglian Water's paper.

Developments that impact the balance of incentives

3.33 As Ofwat heads towards PR19, there have been developments to its regulatory framework that will impact the future balance of incentives. We highlight these in the subsection below.

Cost of Debt

3.34 In PR14, and previous price control periods, Ofwat set a forward-looking cost of debt for all companies that was a forecasted average over the control period. The cost of debt allowance, which was set in real terms, was fixed for the entire control period. Companies could then under- or out-perform against this benchmark depending their own financing costs and subsequent movements in market interest rates.

3.35 For PR19, Ofwat is considering an approach in which it will index the cost of new debt in line with market movements while the cost of embedded debt will continue to be set under a fixed rate approach.⁴³ This means forecast errors relating to market movements will, in effect, not influence customer bills and therefore, companies will not need to be compensated for bearing this risk. The embedded cost of debt does not face the same forecasting error, hence the approach remains the same as in PR14.⁴⁴ The implication of this is reduced scope for the notionally financed company to outperform (or underperform) against the new cost of debt allowance in future control periods, reducing the RoRE range associated with financing costs.

Outcome delivery incentives (ODIs)

3.36 Outcomes-based regulation was a priority for Ofwat at PR14. This was introduced to encourage companies, through both reputational and financial incentives, to focus more on delivery in accordance with customer needs and preferences. The outcomes and performance commitments are set by companies themselves following engagement with customers and local stakeholders.

3.37 Based upon what it has learnt from the first year of reporting ODI performance, Ofwat considers that using rewards and penalties drive better performance than a penalty only approach.⁴⁵

3.38 As set out in its consultation, for PR19, Ofwat is looking to build on its ODI incentive mechanisms, with particular focus on the following four areas:

1. Making performance commitments more stretching

- Some of the areas Ofwat is considering include defining a set of common performance commitments, making information more available to allow stakeholders to compare performance, and encouraging the setting stretching performance commitments for leakage which is a priority issue for customers.
- Considering whether a measure to replace SIM should be developed.

2. Strengthening ODIs to encourage companies to deliver on performance commitments

- Considering how reputational impact of ODIs can be enhanced.
- Discussing the appropriate use of in-period ODIs, whether the existing aggregate cap and collar on ODIs should be removed, and the case for adopting industry-standard ODIs.
- This section of the consultation also covers how ODIs would be related to an approach based on a variable cost of equity reflecting a company's level of ambition.

3. Better reflecting resilience in outcomes

- Ofwat has decided that companies' five-year performance commitments should be supported by long-term projections for at least a further ten years.
- Ofwat are consulting on whether there should be resilience planning principles and how to measure resilience.

⁴³ Ofwat (October 2016), *Consultation on the approach to the cost of debt for PR19*

⁴⁴ This approach also addresses issues arising from the National Audit Office (NAO) review of Ofwat's methodology, which compared Ofwat's previous approach to setting the cost of debt to an alternative indexation approach, similar to Ofgem's. The NAO concluded that customer bills could have been lower in the 2010-15 control period if indexation was used

⁴⁵ Ofwat, (November 2016), *A consultation on the outcomes framework for PR19*

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- Its is also considering whether there should be a move towards more standardisation of the companies' approaches to asset health.

4. Making performance commitments more transparent

- This area primarily considers how to make the performance commitments easier to understand through reporting requirements, making them more visible to customers, CCGs and other stakeholders.

3.39 The implication of these proposals is that the role of ODIs in the balance of incentives may change at PR19 relative to PR14. For instance, through changes to the balance between penalties and rewards, or through changes to the overall range.

Wholesale markets

3.40 At PR14, Ofwat set four separate price controls – wholesale water, wholesale wastewater, residential and business retail. For PR19, the water and wastewater value chain will be disaggregated further into five separate controls – water resources, network plus water, bioresources (previously known as “sludge”), network plus wastewater and residential.⁴⁶ This approach is intended to allow some parts of the value chain, such as water resources and bioresources to develop markets, whilst other parts, which are more natural monopolistic, remain regulated.

3.41 Ofwat has proposed that there will be separate binding price controls for both the bioresources and water resources markets, with parts of the RCV being allocated to bioresources and water resources. Total revenue controls remain for the water and wastewater network plus price controls (i.e. parts of the value chain that remain once bioresources and water resources are excluded).⁴⁷

3.42 A potential implication of this disaggregation is the possible interaction with incentive mechanisms. For instance, penalties and rewards associated with ODIs lead to changes in revenue, but some ODIs may be linked to multiple parts of the network. In this case, there will need to be clarity on which price control the reward or penalty relates to.

Approaches in other industries

3.43 Having set out the current balance of incentives in the water sector in the subsection above, we now compare this to approaches in other industries. Appendix F sets out the detail underlying the summary of approaches in other industries that we set out below. From these industries we draw out implications and possible lessons for the water sector. We begin with the energy sector, followed by, Australian Water, Healthcare, Rail, Financial Services and then finally, Telecoms.

Summary of implications from the approaches in other industries.

3.44 In the table below, we summarise the implications from the approaches in other industries discussed in Appendix F.

⁴⁶ A sixth business retail control will also apply in Wales.

⁴⁷ Ofwat (May 2016), Water 2020: our regulatory approach for water and wastewater services in England and Wales, p.6

Table 2: summary of approaches

Industry	Description of incentives	Implications
Energy	<p>In addition to cost efficiency and service quality incentives, Ofgem has introduced:</p> <ul style="list-style-type: none"> • The Network Innovation Stimulus – providing financial incentives for companies to engage in innovation through adjustments of allowed revenue. • The Low Carbon Network Fund - set up specifically by the regulator to target an industry and society wide, environmental issue. 	<p>In energy, innovation stimulus is driven to some extent by externalities (e.g. carbon reduction, disaggregation of the value chain). In addition to cost and service quality incentives, Ofwat may consider a similar approach if there is a specific industry wide issue that should be encouraged and prioritised, especially if there are relevant externalities that would not otherwise be addressed.</p>
Australian Water	<p>Application to the various funding schemes through a competitive process with certain criteria that have to be met by companies to receive funding.</p> <p>The regulator for water in Victoria, Australia, introduced a new approach to assessing water companies' business plan submissions – the PREMO framework. This new addition to their regulatory approach aims to reward ambitious companies through assigning such companies a more favourable cost of equity.</p>	<p>The continued focus from Ofwat on ODIs and totex incentives means that a direct translation of the PREMO approach may not be appropriate. Nonetheless, the concept of greater rewards for ambitious business plans could be adopted by Ofwat.</p>
Rail	<p>Cost efficiency and service quality incentives exist for Network Rail. These include capex and opex performance incentives, and incentives which align the interests of Network Rail with train operators.</p> <p>In addition to these, the ORR offered a matched funding scheme specifically targeted at R&D and innovation.</p>	<p>In a similar vein to Australian water, the differences in the regulatory environment (compared with water and wastewater) needs to be considered when thinking about the impact of incentives on the companies, given that Network Rail operates as a sole monopoly network. However, the focus on innovation in a regulated sector can provide guidance for Ofwat.</p>
Healthcare	<p>The NHS set up the Vanguards programme in order to provide funding and support for organisations in the healthcare sector which are at the forefront of developing solutions for challenges in the sector. Particular focus was on sharing best practice and learning across the industry.</p>	<p>If an innovation fund were to be set up, Ofwat may be able to learn the best practices of how to encourage innovative ideas to apply for the fund, how the criteria should be set, as well as how best to support successful applicants through the implementation of the initiatives.</p>
Financial Services	<p>The financial services sector has firms offering a wide variety of products. Besides the regulator's duty to promote stability and protect consumers, a recent focus on innovation within the sector prompted several initiatives including:</p> <ul style="list-style-type: none"> • Regulatory Sandbox – offers support to assist unauthorised innovative firms to become authorised, as well as offering authorised firms protection from regulation which may be breached under new technological developments. • TechSprints – events which bring together market participants into one space where solutions are formed and tested to problems within the industry. 	<p>Ofwat may be able to gain insights and ideas into how to facilitate innovation in areas where it considers such stimulus is needed, especially around how firms may need to navigate around policy issues and regulation in the emergence of new technologies. The FCA adopts an integrated and involved approach to developing regulation alongside companies. The driver for this in financial services would appear to be that regulation may cause barriers to innovation.</p>

Telecoms	Ofcom adopts a more supportive role for companies rather than creating specific incentives for innovation. This may be because the industry is already innovating at pace and the focus is more on how to build regulation and policy around the emergence of new technologies. To do this, the regulator engages in research and ensures its information is up to date, involving companies within its decisions.	Similar to the financial services example, the regulator acts in a supportive role. Ofwat can draw guidance from this in developing policies which do not restrict innovation yet still protect the customer. However, this scenario differs from the water sector as telecoms already has high levels of innovation, whereas the water sector may require greater incentivisation to encourage water companies to be innovative.
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Conclusion

- 3.45 We conclude with a number of thematic findings, highlighting potential gaps that exist within the current balance of water regulation incentives.

Incentives to outperform on costs appear to be strong

- 3.46 Our review of the PR14 mechanisms (and mechanisms historically) have shown that there is a strong incentive to outperform on costs. Through the totex mechanism there has been a greater performance range in relation to RoRE compared to outcome incentives and other types of incentives. As there is only a single year's data for the water sector drawing conclusions about magnitude of any totex under/outperformance should be interpreted cautiously, however, the power of the totex mechanism has also been demonstrated in the energy sector. Under RII0-GD1, all companies have so far outperformed on their totex allowances in the current control period to date.

The 'enhanced' status benefits are a strong incentive

- 3.47 Despite the relatively modest financial reward associated with obtaining an enhanced business plan, there is evidence to suggest that the 'enhanced' status benefit acted as a strong incentive because of the reputational and procedural benefits received. A survey of companies has found that the business plans incentives were generally viewed as more powerful than the menu approach used in the totex cost sharing incentive.⁴⁸ This indicates that the additional income element of the menu approach may be less effective at incentivising 'truth-telling' behaviour than transparent business plan incentives.

Relative performance appraisal mechanisms are seen to be powerful

- 3.48 Water companies and third parties expressed how powerful they consider incentive mechanisms with relative performance assessment appeared to be, such as the SIM and to a lesser degree comparative ODIs. Having a relative mechanism can stimulate competition for firms to reduce costs and improve service. As shown in Figure 4, analysis of ODI performance in FY16 demonstrates that there is a wider range in RoRE impact from comparative ODIs than non-comparative ODIs.
- 3.49 In addition to the relative nature of SIM, this mechanism has been praised for its simplicity and reputational benefits that can be achieved via ranking companies in a league table. There may be drawbacks to this type of incentive though, for example SIM might not incentivise performance as strongly for those companies at the top-end of industry performance. Over the period FY13 to FY16 we find that the top industry score for SIM has been relatively flat, with no company breaking through the 90 mark, meanwhile, the bottom industry score has increased significantly.⁴⁹

⁴⁸ Anglian Water, 'Future use of menus as part of price setting methodology', 2015.

⁴⁹ Ofwat company performance tables show that in FY13 the lowest industry SIM score was 62, but for FY16 the equivalent figure was 73.

Menus are perceived to be complicated

- 3.50 Economic theory suggests that menus offer an efficient solution to the problems of asymmetric information in a regulatory setting. However, the totex cost sharing menu implemented in the current price control has been viewed as complicated and not a particularly strong incentive compared with other mechanisms. The negative perception of menu use has been further expressed by water companies in the consultation which discussed a possible use of menu for the cost of equity, based on the PREMO scheme. Other international regulatory decisions share this perception of complexity. For example, menus were rejected by the Ontario Energy Board in 2000 and 2008 on the basis of complexity. Similarly, the Alberta Utilities Commission also rejected the use of menus because the proposals for such an approach were poorly calibrated for and difficult to understand and implement.

Ofwat does not have a specific incentive targeted directly at innovation

- 3.51 Ofwat's current regulatory toolkit including cost sharing, ODIs and procedural / reputational incentives in the business planning process, does indirectly provide incentives to innovate. However, after comparing incentives used in other sectors and internationally, we can observe that other regulators have included specific incentives directly designed to further encourage innovation. This a potential gap in the current Ofwat price control framework. Ofgem, the ORR and the NHS have developed funding schemes to address innovation.

Ambition is not yet comprehensively incentivised and recognised

- 3.52 Ambition is another area which is missing in the current price control framework. Not many regulators have formally recognised ambition – as distinct from high-quality, well evidenced plans – but there are potential lessons from the PREMO approach. PREMO aimed to incentivise ambition, as well as high quality pricing submissions, via a cost of equity menu approach. However, there needs to be careful consideration of the potential challenges associated with assessing companies' ambition, particularly when used in conjunction with menus.

4. *Rebalancing of incentives*

- 4.1 In this section, we build on the appraisal of current incentives in Section 3 and assess how incentives could be rebalanced at PR19. The outputs from this assessment will inform the policy option illustration that we subsequently set out in Section 5.
- 4.2 The structure of this section is as follows:
- i) Firstly, we begin with a discussion of incentives for ambition;
 - ii) Secondly, we discuss incentives for innovation; and
 - iii) Lastly, we discuss specific areas of the balance across incentives, focusing on: totex and ODIs, rewards and penalties, relative and absolute performance, financing and operational incentives, and the balance between stable and market-consistent allowed returns.

Ambition

- 4.3 In this subsection we discuss the potential gap of ambition, its meaning in a price review context, considerations in implementing incentives for ambition, and highlight the risks to customers through the creation of new incentives.
- 4.4 Broadly defined, we see ambition as a company targeting a step-change from their own past levels of performance or as a step-change from other industry comparators. By its nature ambition is forward-looking and is likely to involve an element of risk on the part of companies to show their commitment to achieving stretching targets.

The potential gap

- 4.5 PR14 business plan incentives awarded companies with an “enhanced” status for high-quality, well-evidenced and customer-centric business plans. This categorisation meant that “enhanced” status was not necessarily awarded on the basis of industry-leading performance or ambition relative to other companies.⁵⁰ As “enhanced” companies received financial rewards, there is the risk that the PR14 approach did not fully align the interests of companies and customers.⁵¹ This is because customers ultimately benefit from outcomes not the provision of submissions to Ofwat, therefore rewarding business plan quality may not necessarily benefit customers.
- 4.6 Given the above, a gap in the incentive framework exists for an approach that provides incentives for ambition that are distinct from business plan quality incentives. Specifically, incentives for ambition should reflect the value that customers obtain through ambitious plans. In other words, there is scope for rebalancing incentives relating to plans and performance.
- 4.7 The need for rebalancing may vary according to the abilities of companies. On the one hand, those companies which currently lag the upper-quartile on wholesale costs and/or the average cost to serve in retail may have incentives to be ambitious relative to their current performance. This incentive to be ambitious arises from the implied “catch-up” embedded in their cost allowances. On the other hand, those companies which are already near to upper-quartile, or industry leaders, may have more limited incentives under the current framework to stretch themselves in their business plans. Therefore, it is for those companies near to upper quartile that further incentivisation of ambition could lead to better outcomes for customers.

⁵⁰ Although ambition in this sense was not explicitly categorised, we acknowledge that there will have been some role for ambition through the customer centricity of plans.

⁵¹ These financial rewards were in addition to reputational benefits, procedural benefits and the benefits from the ‘do-no-harm principle’.

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- 4.8 The benefits for customers from ambition are easiest to see through the lens of costs. For example, the benefit to customers could be felt at both a company-specific and industry-wide level. At a company-specific level, the customers of an ambitious company benefit from lower cost allowances in their bills,⁵² while at the industry-wide level there are positive externalities enjoyed by customers of all companies when the upper quartile efficiency challenge is stretched.⁵³

Ambition in the context of a price review

- 4.9 Ambition can be interpreted in different ways, and in the context of a price review could take a variety of forms. We delineate ambition between (a) the specific output level, and (b) at the aggregate business plan level.
- 4.10 As discussed in Section 3, there are a range of incentives currently in place that seek to encourage efficiency and performance in the interests of customers at the specific output level. For example, incentives to outperform on costs once the allowance has been determined, or incentives to deliver industry-leading customer service. We therefore find that ambition at the specific output level can, and will, be incentivised through the existing tools in place – albeit with scope for rebalancing between these tools as discussed later in this section.
- 4.11 In other words, when considering ambition here, we are addressing the aggregate level of ambition as opposed to ambition at the specific output level, where the interests of customers and companies are already aligned. In particular, we consider that aggregate ambition is best assessed with a focus on company business plan incentives. That is, the incentives for companies to submit ambitious plans which are stretching and push the industry frontier forwards across a number of areas.

Key considerations for implementation

Part 1: Where to assess ambition?

- 4.12 Although assessing ambition is inherently challenging, there are components of business plans that will be easier to assess for ambition than others. In particular, components that are readily quantifiable and prepared on a consistent basis across companies will be best suited. This means that a core part of the assessment of aggregate ambition – as exhibited through business plans – is likely to be cost efficiency and comparative performance commitments.
- 4.13 Moving away from these components into more qualitative areas of judgement creates difficulties when trying to differentiate between plans. This will be especially challenging where companies may have coalesced around focal points set out in Ofwat’s guidance. Therefore, were ambition to encapsulate broader elements of business plans, it may be appropriate to limit the weight assigned to these components, as they will inevitably require a greater degree of subjective assessment.
- 4.14 There may be a case for assessing ambition through bespoke ODIs where there is historical performance data of a sufficient quality. However, despite a history of data, there is a risk that Ofwat remains at an information disadvantage to companies in this area, as they cannot observe or measure historic levels of management effort.

Part 2: How to assess ambition?

- 4.15 In the context of cost efficiency, there are a number of different approaches that could be taken to assessing ambition, we set out two examples below:
- i) Ambition could be defined as going beyond upper-quartile cost efficiency. For example, a more stretching percentile, or even an industry-leading level of performance i.e. the top ranking performer (relative to a historical or forward-looking level).

⁵² Or an improvement in outcomes for a similar level of bill.

⁵³ This requires weight to be placed on company submissions when determining the upper quartile efficiency challenge, otherwise there will be a lag between ambitious plans, resultant performance and recalibration of industry-wide upper-quartile performance targets.

ii) Alternatively, ambition could also be captured by the impact of a company submitting a cost forecast that moves the industry frontier forward by more than it would have done otherwise had the company maintained its place in the existing cost efficiency rankings.

4.16 Building on the two examples set out above, in the table below, we set out a stylised example of how ambition could be assessed across different categories. This captures that ambition could be assessed on the basis of change in historical ranking as well as performance relative to the rest of the industry.⁵⁴

Table 3: stylised assessment of ambition

Category	Weight	Upper quartile	<-----	Relative to industry	----->	Industry leading
		No increase from historical ranking		Relative to historical ranking		Large increase from historical ranking
Costs	%					
Outcomes	%	Less likely to be categorised as ambitious		<----->		More likely to be categorised as ambitious
Innovation	%					

4.17 Furthermore, it may be desirable to recognise that for companies who have historically been less efficient, an ambitious cost target may not necessarily be at the frontier. A company that goes from poor performance to high performance may have made more ambitious steps than one that is already at the frontier. However, there are two reasons why such a company may not fit with the ambitious categorisation described here. Firstly, as discussed above, the current balance of incentives may already provide some incentives for this level of ambition, so it wouldn't be appropriate for customers to pay an additional premium. Secondly, there will not be industry-wide customer benefits as the upper quartile efficiency challenge would not be stretched.⁵⁵

4.18 Regarding outcomes, a similar percentile based approach could be used for comparative ODIs. For bespoke ODIs assessing the degree to which the performance commitment proposed is ambitious could be appropriate where data quality is sufficiently rich. For bespoke ODIs with little data availability and scheme ODIs, there is less scope for a practical assessment of ambition as it is more difficult to draw accurate comparisons across business plans.

4.19 Finally, approaches such as those set out above would have to recognise that all companies will have a mix of strengths and weaknesses; and as such, expecting frontier level ambition across all areas may be unrealistic in terms of deliverability.⁵⁶

Part 3: Specific design considerations

4.20 Having set out a focus on the aggregate form of ambition, we now discuss what mechanisms or tools that can be implemented to incentivise it.

4.21 Although there is a precedent for incorporating ambition into business planning from the PREMO regime used by the Essential Services Commission, Victoria, Australia (see Appendix H), we find that a mechanism such as the PREMO cost of equity menu is unlikely to be suitable in the context of UK regulation. This is because the PREMO framework was developed by the ESC primarily because of the lack of other incentives in the regulatory regime. In contrast, as explained in Section 3, Ofwat has

⁵⁴ We discuss innovation in more detail in the subsection below.

⁵⁵ On the basis of a different efficiency target e.g. average efficiency rather than upper-quartile, the effects of this wider customer benefit may not be as strong.

⁵⁶ See Specific areas of balance discussion below for further detail on the correlation between outcomes and costs.

implemented a varied incentive regime with a range of specific financial and non-financial incentive mechanisms.

4.22 However, there are some initiatives from the PREMO approach that may be relevant to Ofwat, e.g. the use of a scorecard approach when trying to capture the degree of ambition.⁵⁷ More generally, due to the lack of directly transferable precedents on incentivising ambition, we set out below a list of key considerations regarding implementation:

- i) Incentivising ambition is likely to require a change to business plan categorisation.
- ii) Any rebalancing will strike a balance between risk and return that should align the interest of both companies and customers.
- iii) If incentives are to be limited to a subset of companies through a relative benchmark for ambition, reflecting another finding from our review of the current balance of incentives, it is important that any implementation involves clear communication to companies regarding the availability and magnitude of incentives prior to the initial review of business plans.

4.23 The design of incentives for ambition will need to be carefully calibrated, given these key considerations, notably, consideration (ii). Specifically, the rewards available to companies need to balance three factors:

- i) The private benefit to companies from their business plan being recognised as ambitious. A key component of this could be an ex-ante financial reward for achieving ambitious status. As noted in the current balance of incentives, the rewards for enhanced status are relatively modest in financial terms compared to other incentives at present.
- ii) The net benefit to customers of the ambitious company to ensure that the interest of company and customer are aligned. The net benefit will weigh the magnitude of any financial rewards given to ambitious companies against the gains customers will receive from different levels of outturn performance.
- iii) The wider customer benefit from ambitious plans that push the industry frontier, i.e. the positive externalities from ambition. For example, ambitious plans are likely to create a more stretching cost challenge for the industry as a whole, either in current or future periods. This can be done, for example, by placing some weight on company plans and submissions when benchmarking industry costs.

Potential options

4.24 With these key considerations in mind, we consider potential options for categorising an initial review of business plans that includes ambition.

4.25 One option is set out in Figure 5 below, and shows the incentives across four review categories. These categories share similarities with the approach taken at PR14 but provide a different balance of incentives. In particular, compared to PR14 there is a clearer delineation between ‘high-quality, well evidenced plans’ and ‘ambitious plans’.⁵⁸ We describe each category below:

- i) Sub-standard – an option for this category is that it contains a number of disincentives including reputation, additional procedural costs and asymmetric cost sharing to protect customers.
- ii) Standard – an option for this category is that it is similar to the non-enhanced path currently in place. Determinations follow the standard timetable.

⁵⁷ Ultimately an approach such as this would rely on a mix of quantitative and qualitative information, and when characterising ambition would have to recognise that all companies will have a mix of strengths and weaknesses; and as such expecting a frontier level ambition across all areas may be unrealistic.

⁵⁸ We note that at PR14 ambition will have played a role in the risk-based review but was not explicitly categorised and incentivised in a targeted manner.

- iii) Fast tracked – an option for this category is that companies get an accelerated determination, leading to reputational and procedural benefits. The pre-requisite for this category is a high-quality business plan, but one that is not ‘ambitious’.
- iv) Ambitious – an option for this category is that companies get an accelerated determination, the largest reputational benefits, an ex-ante financial reward and a higher cost sharing rate. The financial reward is justified as customers benefit from the aggregate ambition in the plan. Meanwhile, the increased cost sharing rate offers a very high powered incentive to outperform on the ambitious plan, while also ensuring that customers receive protection in the event of underperformance (relative to the ambitious plan).

Figure 5: Categories and incentives for the initial review of business plans ⁵⁹



Source: PwC, Ofwat

4.26 Linked to the four categories above, we consider further options for the link between plan quality and ambition. A potential option here is for quality of plan and the level of ambition to have a degree of independence as characterised in Table 4 below. The setup shown below builds on Figure 5 above as it shows that a sufficient quality of plan would not preclude a company from being designated as ambitious.

⁵⁹ DD standards for Draft Determination.

Table 4: Illustrative link between ambition and plan quality

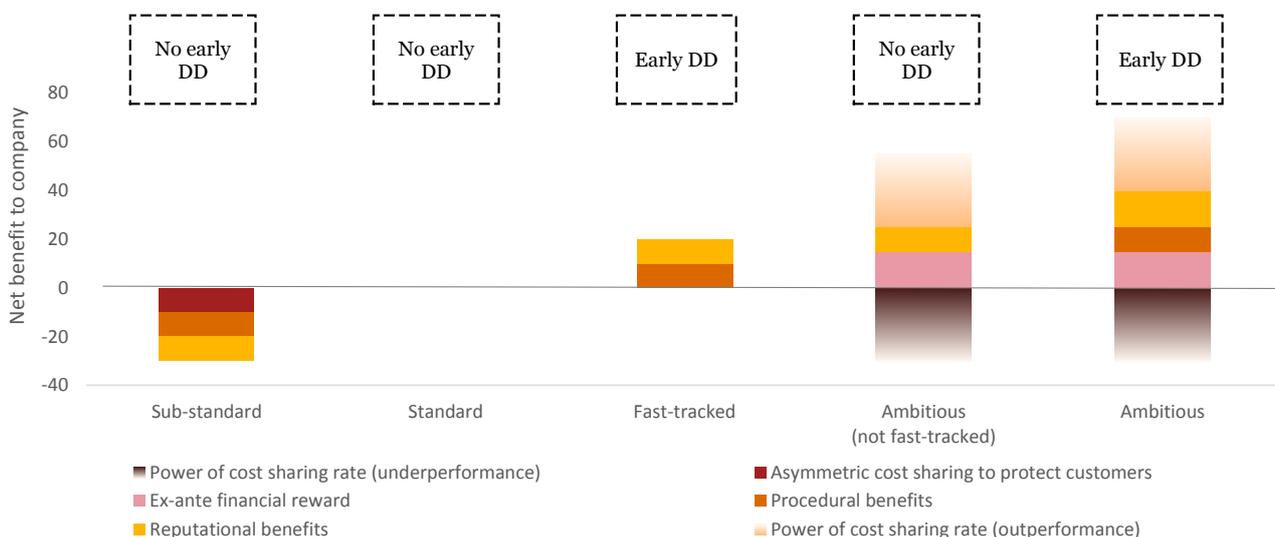
		Quality of plan		
		High	Sufficient	Insufficient
Ambitious?	Yes	Receives procedural benefits. Receives additional financial rewards and more powerful outperformance incentives. Maximum reputational benefit. Ambitious	No procedural benefits due to lower quality of plan. Still receives additional financial rewards and more powerful outperformance incentives. Lower degree of reputational benefit Ambitious, DD follows standard process	No procedural benefits. Quality of plan prohibits recognition of ambition. No reputational benefits. Sub-standard
	No	Receives procedural benefits. Still receives some reputational benefit. Fast-tracked	Receives no procedural benefits. Receives no reputational benefits. Standard	

Source: PwC

4.27 Table 4 above shows that each of the four categories shown in Figure 5 can be fitted into this framework with one exception. Where the quality of a plan is sufficient to avoid being in the sub-standard category, but is not 'high-quality' and is also ambitious, there may be the option for another category that is neither standard, fast-tracked nor ambitious. In this situation, there is an option for a company to be given the features associated with that of an ambitious company (an increased cost sharing rate and an ex-ante financial reward), but not to be given the procedural benefits of an early DD). The justification for this category is that it may help avoid the unintended consequence of companies being deterred from being ambitious due to the hurdle of business plan quality. If being categorised as ambitious is also conditional on high plan quality companies may be deterred from pursuing ambitious status in the first place – this may work against the interests of customers.

4.28 Factoring in this link between plan quality and ambition, an alternative option for categorisation may look as shown in Figure 6 below.

Figure 6: Alternative categories and incentives for the initial review of business plans



Source: PwC, Ofwat

Addressing risks to customers

- 4.29 With any rebalancing of incentives, the potential risks need to be considered alongside the opportunities. A key risk with the rebalancing discussed above is the possibility that planned performance set out in ambitious plans do not feed through to delivery from companies. If this were to occur there is a risk that customers pay for ambition in a plan but which is not realised in practice. This poses the question of how customers should be protected against such an outcome. We consider three potential options for doing this:
- i) The first is an **ex-ante assessment** of the deliverability of the commitments made in the business plan – this could take place as part of the initial review of business plans. This check on deliverability would scrutinise plans relative to past performance and the evidence put forward by management to support the projections proposed. A check such as this would be consistent with Table 4 above, as a plan of insufficient quality would not provide the requisite quality of evidence to provide assurances on deliverability.
 - ii) The second is the use of the **cost sharing rate** as a mechanism to protect customers – while also providing a high-powered outperformance incentive to companies. For example, if an ambitious business plan is linked with a higher cost sharing rate, i.e. if the company retains a large proportion of any out/under-performance, then underperformance of the ambitious cost target is only borne to a limited extent by customers.
 - iii) The third is an **ex-post assessment** that re-assesses the cost-sharing rate and/or claws back a proportion of ex-ante financial reward depending on the degree of difference between plan commitments and outturn performance. Although this assessment would not be able to claw back procedural benefits in a meaningful way, as discussed above, procedural rewards could be awarded for well-evidenced, high-quality business plans rather than the criteria of ambition.
- 4.30 An important consideration that permeates all of the points above is that these protections must not defeat the purpose of the incentive, which is to encourage ambition. It must be recognised that ambition and commitment are not guarantees of ultimate success and that companies may fail to achieve targets for a number of reasons. As such, companies could be disincentivised from presenting ambitious plans if there is a punitive penalty for failure. The key is to ensure that customers are protected from outcomes which are within management control but significantly diverge from business plan commitments. For example, the implementation of any form of ex-post clawback would have to be transparent and mechanistic so companies do not face additional uncertainty that could run counter to the intention of the incentive.

Conclusion

- 4.31 **Aggregate business plan ambition is suited to an assessment of cost efficiencies and comparative ODIs:** Components of business plans that are readily quantifiable and prepared on a consistent basis across company business plans will be best suited to assessments of ambition. However, this does not mean that they should be the only elements of the assessment. Assessing ambition for bespoke ODIs may be challenging even where historical data exists as management effort cannot be observed.
- 4.32 **The design of incentives needs to balance three factors:** The potential benefits to companies, the net benefits to customers of those companies categorised as ambitious and the industry-wide externalities that arise from ambitious business plans.
- 4.33 **Any incentives implemented need to protect customers:** A key risk is that customers pay for ambition in a plan but which is not realised in practice. There must be due recognition that companies will not always meet their targets but it is also key is to ensure that customers are protected from outcomes that are within management control but diverge significantly from business plan commitments.

Innovation

- 4.34 Innovation was an area identified in Section 3 as being a potential gap in the current incentives framework. While the water sector does not lack innovation (see Box 1 below), the current set of incentives are more aligned to a specific number of areas, including:
- i) The need to manage costs, keep bills affordable and meet regulatory efficiency challenges;⁶⁰
 - ii) Compliance with environmental and quality standards;
 - iii) Response to the threat of competition, the need to offer greater choice and better service to customers; and
 - iv) Climate adaptation and mitigation.⁶¹
- 4.35 However, where there is a trade-off between costs and performance, the current regime may not be as well suited to innovation (see Appendix J for further discussion). We have seen other sectors and regulators, such as Ofgem and ORR, where innovation has been specifically targeted through an incentive regime to address the recognition that innovation may not be carried out efficiently in a regulated market. This suggests that there is potential for Ofwat to adopt specific innovation incentives.
- 4.36 This section identifies the forms that innovation could take, the challenges to incentivising innovation and the potential approaches to incentivising innovation.

⁶⁰ We note that the shift to totex allows greater flexibility in how companies deliver solutions compared with the previous cost allocation totex and capex.

⁶¹ See, WWT Online, Comment: Innovation - the future of the water industry.

Box 1: Examples of innovation in the water and wastewater sector⁶²

The UK water sector is recognised for its expertise at managing aging networks while keeping bills affordable (doing more with less). Companies have achieved this through innovation solutions, i.e. by applying new thinking and technologies. The emphasis on affordable technologies means that the industry may compare less favourably with other countries in terms of the level of risk-taking with new technology or adopting costlier innovations. A number of thematic areas of innovation have emerged. These include:

- *Automation*: A trend towards remote monitoring of network assets using telemetry, reducing the need for staff on the network, driven by the need to reduce costs and improve performance.
- *Leakage reduction*: In response to performance monitoring by the regulator, leakage has reduced significantly since privatisation. No-dig leakage detection/ monitoring solutions and pressure-management systems are particular fields of speciality in the UK.
- *Drinking water quality, environmental improvements driven by DWI standards and environmental quality legislation*: An example of a cost efficient innovation is the industry's adoption of orthophosphate dosing to avoid lead pipe replacement when the standard for lead in drinking water tightened in 2013 (reducing from 25µg/l to 10µg/l).
- *Process and operational innovation*: Driven by data improvements (e.g. making informed maintenance decisions on whether to replace proactively or run to failure) or practical concerns (e.g. improving throughput and energy generation in the sludge treatment process, reducing the volume of grit/rags getting into the wastewater treatment process).
- *Increased renewable self-generation of electricity*: Driven by emissions reduction incentives such as Carbon Reduction Commitment. Examples include biomethane CHP generation from the sludge digestion process, wind turbines on water company land and floating solar panels on reservoirs.
- *Increased partnership working* through catchment management activities driven by the need to tackle diffuse pollution.
- *Customer service improvements driven by SIM*: A focus on retail activities deriving from specific price control targets, and better understanding of customers' priorities through improvements to customer engagement (especially for the lower ranked companies).
- *Innovative financing*: Companies have innovated to benefit from lower financing costs, through new capital structures and for example through issuance of CPI linked debt.

Future innovation will be needed to respond to drivers and disruptors in the sector, for example:

- Adoption of digital technology and other advances in IT and robotics to enhance customer experience, improve network operations and generate further efficiencies.⁶³
- The potential to use advances in data analytics to draw insights that generate innovation e.g. condensing large amounts of data provided through social media or third party customer feedback platforms.
- The need to innovate to improve resilience and adapt to climate change. For example, the industry might make greater use of sustainable drainage to capture surface water/ improve flood management.
- The need to adapt supply to an increasingly urban population.
- Technical improvements in wastewater treatment to reduce pollutants such as phosphate and nitrates, and greater use of effluent recycling to optimise water resource availability.
- The opening of the business retail market will place even greater emphasis on providing a high quality customer experience.
- Greater competition within the bio-resources market in future may also spur innovation as companies compete for market share.

⁶² See, UKWRIP, HTechO Tapping the Potential: A Fresh Vision for UK Water Technology; CIWEM, Lead in Drinking Water; and DWI/Defra, UK Water Industry Research Limited: Alternatives to Phosphate for Plumbosolvency Control.

⁶³ For example, 'Software robotics' can help to provide call agents with better data about customers, helping to provide make clearer decisions about how to serve a customers.

What forms can innovation take?

- 4.37 Innovation can be defined ‘as the creation and delivery of new value to consumers and companies’.⁶⁴ It can also take many forms, for example, a process, technology, service or product. From a regulator’s perspective, the ultimate benefit from innovation should be for the customer, balanced with the sustainability of the water sector.
- 4.38 Below, we have identified three potential *forms* that innovation could take:
- i) **Creation of a new idea and successfully embedding it** – generating ideas is the first step to innovation and can include the invention of a new procedure or technology. Once ideas have been generated, the next stage is to decide which ideas should be implemented and how this should be done effectively in practice.
 - ii) **Continuous enhancement of existing processes or technologies** – innovation may not require the generation of new ideas but can be the continual development of current methods to enhance performance of the organisation away from the industry norm.
 - iii) **Combining of existing processes or technologies to form a solution** – innovation could involve the new applications of current methods in other markets to solve a problem in the water sector.
- 4.39 The *way* in which innovation flows through a market should also be considered, as this will influence how Ofwat will structure innovation incentives. The potential paths that innovation can take include:
- i) Trialling ideas at an industry level;
 - ii) Instigating innovation on a large scale in a large project;
 - iii) Applying innovation on a smaller scale with many smaller projects;
 - iv) Targeting innovation to common problems in the industry (particularly where externalities exist);
 - v) Targeting innovation towards creating an advantage in a competitive market.
- 4.40 There are advantages and disadvantages to each of the above. For instance, trialling ideas at an industry level means that efforts do not need to be replicated. If an initiative fails then others can learn from this – avoiding inefficient replication of similar innovations across companies. Similarly, if an initiative is successful, then other companies can then roll out the innovation industrywide. However, experience in energy has shown that there may be a stronger link between those that originate innovation and those who ultimately implement it; showing that industry-wide rollout is not straightforward to achieve.
- 4.41 Some initiatives may require execution on a large scale through one large project that requires high costs and high efforts. This could potentially be the best solution to adopt if it was required for the whole industry to change at once, but the risks and associated consequences are much larger also. On the other hand, there is often a lot of breadth of innovation potential to be found in many smaller projects, with potentially lower risk (and perhaps better cost to benefit ratios too). Although, this may be a slower, more evolutionary process than a targeted large scale transformation.
- 4.42 Another suggestion for how Ofwat can facilitate innovation to flow through the industry is to target specific problems that exist industry wide, perhaps where the current incentive regime has not been able to resolve the problems. For example, Ofgem initiated an innovation fund targeted towards low carbon initiatives. Targeting common issues such as this may be justified where a regulator believes a lower societal discount rate should be applied in place of a higher discount rate companies may use when discounting potential long-term costs. The advantages of this are that, again, efforts do not need to be duplicated, and, secondly, that Ofwat will be able to prioritise the issues where it believes there is a currently an undersupply of innovations.

⁶⁴ PwC Innovation Benchmark Survey

Challenges to incentivising innovation

- 4.43 PwC's experience of working with the water and wastewater sectors, suggests that idea generation is not typically a challenge in the industry. More challenging is the implementation of ideas through to innovative outcomes. In this subsection we therefore identify some of the key challenges companies currently face in the implementation of innovation.
- 4.44 Innovation is difficult to incentivise due to its nature. The primary challenge for Ofwat is that it may not be best placed to identify new sources of innovation,⁶⁵ nor can they know the outcomes of innovation ex-ante. Hence there is not a simple solution to structuring incentives.
- 4.45 For example, an approach that seeks to incentivise innovation from ODI rewards would require assumptions regarding the scale of rewards that would be sufficient to incentivise a desirable level of innovation. Where rewards were set too high, or too low, Ofwat could inadvertently incentivise a sub-optimal level of innovation activity.
- 4.46 From the companies' perspectives, the implementation of innovation faces the following challenges:
- i) **5-year price control period** – the shorter-term mind-set that is associated with the 5 year price control periods may deter investments with longer pay-back periods. This is because the incentives associated with delivering a certain level of performance can change between price controls, and some innovation, research and development may require longer periods of time before benefits start to arise.
 - ii) **Risk aversion** – the company and stakeholders may be risk averse, and this risk aversion could be exacerbated by the prevalence of penalty-only performance incentives and the high standards of service to which companies are held accountable by a range of regulatory bodies.
 - iii) **Insufficient capabilities or resources** – the ability to manage ideas through to the implementation of innovation will vary by company.
- 4.47 Furthermore, from a societal perspective, innovation may be undersupplied due to the presence of **externalities** that are not considered at the individual company level.
- 4.48 All these factors could lead to the undersupply of innovation in a regulated environment, hence the need may exist to encourage greater innovation beyond current levels.

Potential approaches for incentivising and assessing innovation

- 4.49 The introduction of totex at PR14 has provided companies with extra scope to innovate, the introduction of ODIs too, has provided extra incentives for innovation. Looking forward, by knowing more about the specific challenges that companies face in implementing innovation, Ofwat can consider how to potentially further incentivise and assess innovation. Solutions that provide the right conditions for innovation and reduce barriers to the implementation of innovate ideas could work in the interests of customers. An approach that is too prescriptive may risk breeding inefficient innovation or unintended practices.
- 4.50 The following section outlines several possible approaches to incentivising innovation and the main advantages and disadvantages associated with each. It is important to note that the approaches set out are distinct, but can be combined in varying degrees to suit the overall incentive regime's purpose.

Approach 1: Ex-ante funding

- 4.51 This method involves funding for a select number of projects within a pre-determined budget in a similar manner to other funds such as Ofgem's Low Carbon Networks Fund (LCNF) or the NHS's Vanguard programme. Ofwat could learn from the best practice from these and other funds. Both the

⁶⁵ Nor is this part of their statutory duties.

LCNF and Vanguards programme were initiatives driven by NHS England and Ofgem respectively, with government being supportive of the priorities and overall direction.

- 4.52 Ex-ante funding would likely be a competitive process and could be administered by a third party. For a funding incentive to be successful, a high standard needs to be set for what innovation is required.
- 4.53 A key advantage of this approach is stimulating a competitive environment to encourage the best and most innovative ideas to come forward. For the customer, having a fund at the industry level limits customer bill equity issues due to the pre-determined allowed amount of funding.
- 4.54 This approach is also suited to targeting industry-wide issues, as Ofwat would have the flexibility to shape priorities for innovation in specific fields. One caveat to this approach though, regards the question of who is best placed to carry out innovation for the water sector. Truly innovative initiatives may not come from within the industry but from other bodies. Whether the fund should be accessible to other applicants may determine how the fund functions and Ofwat should consider what other avenues for innovation are available. Another consideration is to take into account is whether the problems identified by Ofwat are regulatory issues or broader policy issues (which are best addressed by government).
- 4.55 The ex-ante nature of this potential approach also means that proposals and planning are rewarded rather than the outcomes. This imposes a certain level of uncertainty over whether the initiatives will succeed meaning that companies receiving funding bear less risk for the failure of the scheme.
- 4.56 Despite proposals and planning being rewarded rather than outcomes in themselves, Ofgem calculates that the LNCf has generated net benefits⁶⁶. However, the catalyst for the scheme's creation was a common externality issue (the perception that individual companies would not devote sufficient resources to tackling issues affecting all companies and their customers). In the absence of a clearly defined externality, there is a risk in an ex-ante funded scheme that customers pay for projects that would have otherwise occurred in the ordinary course of business. We therefore find that the bar for introducing such a scheme should be high.

Approach 2: Expanding the ODI framework

- 4.57 Another approach involves the recalibration of the current ODI framework to factor in innovation. This could involve the adjustment of the payment and rewards structure. For example, greater emphasis could be placed on rewards or there could be a potential change in the shape of the pay-out (e.g. a non-linear incentive rate compared to the current linear structure) of the current ODI framework but with longer term rewards and penalties. The rationale for the scale of changes would be based on whether higher risks should be rewarded with higher pay-outs, given that innovation often involves greater risks.
- 4.58 The main advantage of this method is that it more closely mimics market conditions, in which success is rewarded and failure is not.
- 4.59 However, there are several difficulties with using this type of framework. Firstly, calibrating the structure of pay-outs is complicated because Ofwat cannot know the outcome of initiatives. Ofwat may also have difficulty around calibrating and aligning the periods of incentive pay-outs with the timeframes of innovative solutions, given that benefits are often realised in the long term. Moreover, they will need to carefully consider whether incentives will align to customer priorities.
- 4.60 Further to this, as some investment into innovations will fail, the rewards for those which do succeed may need to be large for this approach to be effective. From a company's perspective, if the reward is large enough to balance the risk of failure then they are more likely to implement an innovative solution which has uncertain outcomes. This is especially true in circumstances where companies cannot immediately financially benefit from an innovation.

⁶⁶ <https://www.ofgem.gov.uk/publications-and-updates/ofgem-tells-companies-deliver-more-innovation-less-following-review>

Approach 3: Ex-post award

- 4.61 Alternatively, innovation can be judged at the end of the price control period. This involves the review of innovation across companies with separate rewards for the best in industry innovation. This could create competition to be the best in the sector.⁶⁷
- 4.62 However, this approach may place too much emphasis on shorter-term outcomes that can be easily demonstrated. There is also the potential risk of skewing the emphasis of innovation towards larger and more tangible investments, creating unintended consequences for resource allocation.

Approach 4: Capability assessment

- 4.63 A final approach could focus on the business planning process which involves checking whether companies can demonstrate their capability to deliver innovation, with less emphasis placed on detailed reviews of specific projects or investments. A capability can be defined as a combination of processes, tools and systems, knowledge, skills and behaviours and organization that allows a company to deliver a specified outcome.⁶⁸ In this context we are focused on whether water companies have an effective capability to deliver innovative initiatives.
- 4.64 This could involve assessing whether a company has sufficient innovation management and processes in place. Areas of consideration could include:
- i) **Resources targeted towards innovation.** For example, during the assessment of initiative submissions to Ofgem's Network Innovation Competition (NIC), Ofgem required the project to 'involve appropriate partners and external funding' which suggested that the company must have had systems and contacts in place to help deliver innovative ideas. To attract investors or direct internal investment into an innovative project also implies that there were resources targeted specifically towards innovation. However, Ofgem did not specify to what level this capability weighs in the final judgement of whether the project receives funding.
 - ii) **Company culture which fosters the creation of new ideas and collaboration between employees.** For example, the LCNF initiated by Ofgem had criteria which submissions were judged on. Ofgem were focused on ensuring that the successful projects in the competitive process could 'generate new knowledge that can be shared amongst all network operators'.⁶⁹
 - iii) **Ownership for the creation of new ideas and innovation.** Including specific roles or objectives linked to innovation. For example, The NHS Vanguard's selection criteria also specified the preference for a governance structure which helped manage processes and secure effective delivery of the project.⁷⁰
 - iv) **Incentives within the organisation that encourage innovation.** For example, in addition, to having ownership of ideas and innovation, groups or individuals could also be rewarded either financially or have reputational benefits associated with being innovative. This could be seen as within-organizational capability that can further encourage innovation and strengthen a company's submission.
- 4.65 Judgement of these factors can form the basis of the capability assessment, with additional criteria to be added if there are specific problems that Ofwat would like the companies to address.
- 4.66 The central advantage of this approach is that it is based on tangible capabilities. However, given the capability focus of this incentive structure, it may not necessarily lead to improved outcomes. For this

⁶⁷ This could build upon existing industry-specific annual innovation awards – the Institute of Water Innovation Awards and the Water Industry Achievement Awards (run by WET News and WT magazine). *Utility Week* also runs annual awards, which are open to power and gas as well as the water sector. Examples of recent winning innovations include water saving devices, innovative collaborative projects, catchment management techniques, and use of forensic science techniques to detect protected species.

⁶⁸ PwC Strategy&, 'Capabilities Driven Strategy explained', strategyand.pwc.com/cds/approach#VisualTabs2

⁶⁹ Low Carbon Network Fund brochure <https://www.ofgem.gov.uk/ofgem-publications/64028/lcnbro.pdf>

⁷⁰ NHS, 'Selection Criteria and Frequently Asked Questions for Urgent and Emergency Care Vanguard's', p.3

reason, a capability assessment approach may work better as part of an innovation incentive package, rather than as a standalone approach to encouraging innovation.

Conclusion

4.67 The changes made to the current balance of incentives at PR14 have provided companies with additional scope and incentives to innovate, especially where innovation is targeted towards cost reductions. Looking forward, the choice of incentive structure around innovation will ultimately depend on the challenges that need to be targeted. The different approaches can be implemented as a package to achieve a balanced approach to innovation incentivisation. For example, it may be both important to take into account the innovation capability of a company as well the assessment of which companies should receive innovation funding. Ofwat could also decide that it is required to reward both ex-post and ex-ante to ensure companies are fully encouraged to plan to be innovative and deliver. The key conclusions that we can draw from this section on incentivising ambition are summarised below:

- **Ex-ante funding should only be used for clearly identifiable issues.** This approach is best suited to industry-wide issues that are not being adequately addressed by the current set of incentives. The bar for identifying such issues should be high in order to protect customers.
- **ODIs should be structured for the long term (i.e. across multiple price controls) but calibration is challenging.** ODIs are currently structured for outcomes which are tangible in the short term. However, given the often long term nature of innovative initiatives, ODIs need to adapt to cater for long-term solutions if this approach is to be used. However, longer-term commitments do heighten the risk of mis-calibration.
- **Ex-post rewards should be largely reputational.** Similar to the reputational and procedural benefits gained from submitting a high quality business plan for the ‘enhanced’ companies, ex-post rewards should be reputational given the challenges in making comparisons across companies.
- **Capability assessments should be built into the initial review of business plans.** The capability assessment approach may not be a sufficient measurement of innovation alone but would help Ofwat consider which initiatives are more likely to succeed and hence merit a reward.

Specific areas of balance

4.68 Having covered the topics of ambition and innovation, which were not directly assessed in the PR14 framework, we now cover specific components / features that did form part of the PR14 balance of incentives. Specifically, we consider how they could be amended for PR19 (AMP7). These include:

- i) Balance between totex and ODIs
- ii) Balance between penalties and rewards
- iii) Balance between absolute and relative performance measures
- iv) Balance between financing and operational performance
- v) Balance between stable and variable allowed returns

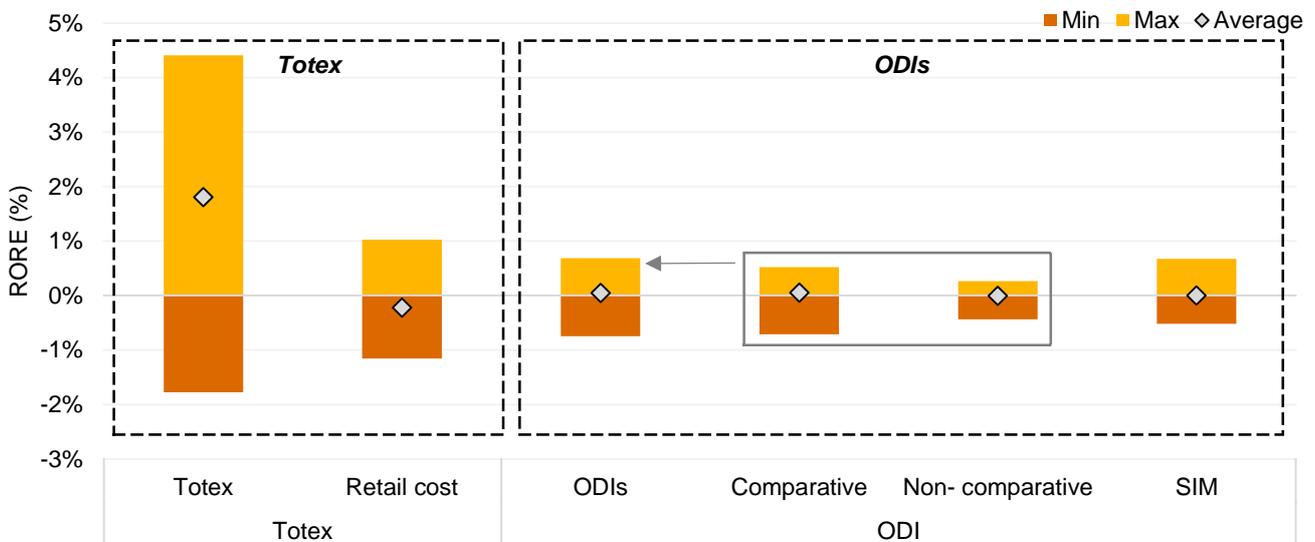
4.69 Drawing upon theory and industry experience, we discuss the balance of each area and draw conclusions, which will help form options going forward. We consider each of these areas in the sub-sections below.

Balance between totex and ODIs

4.70 As discussed in Section 3, in FY16, the range in totex performance was 4.4x that of ODI performance, significantly higher than the 1.6x implied in the RoRE range included in Ofwat’s Final Determinations for PR14. The relative scale of totex incentive to outcome incentives is therefore larger than the designed level, where the design was also for totex to be larger in scale than ODIs. The magnitude of totex performance relative to ODIs for FY16 is shown in Figure 7 below. While this only represents a

single year of AMP6, these outputs suggest that the balance between totex and ODIs could be recalibrated for PR19, in order to place greater weight on outcome incentives rather than cost incentives.

Figure 7: Range in totex performance and ODI performance, FY16 ⁷¹



Source: PwC analysis, Company data

Note: As with Figure 2, totex performance excludes Dee Valley, which had a significantly higher level of outperformance in FY16 of 8.8% of RORE.

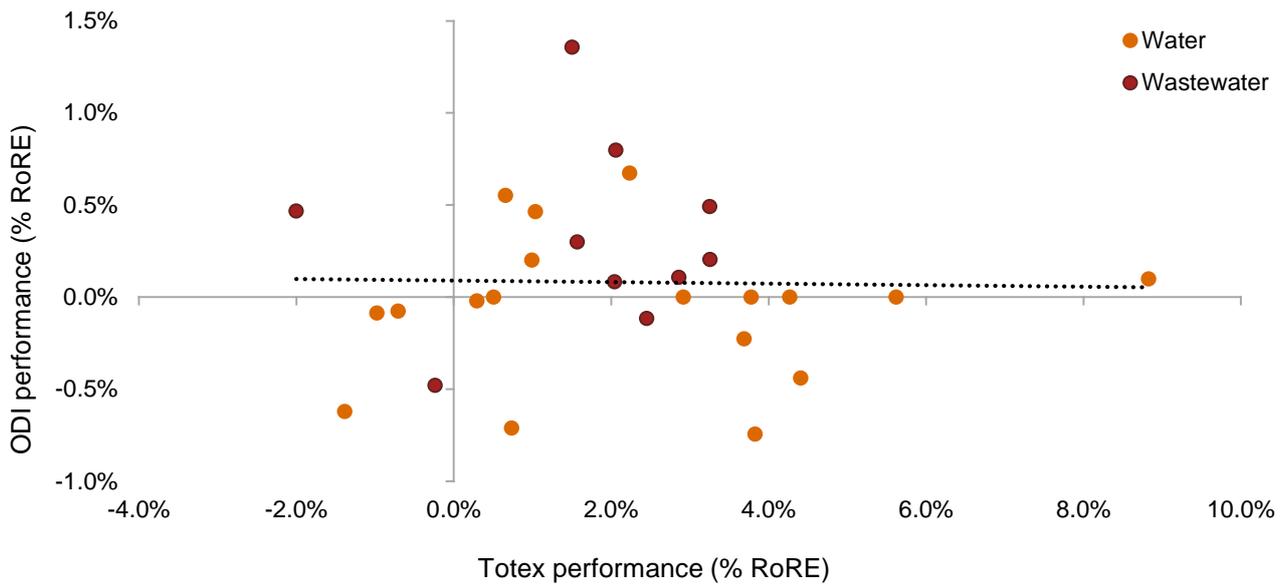
- 4.71 In theory, there could be a trade-off between totex performance and ODI performance. That is to say, if a company wanted to improve performance on ODIs it may need to invest or increase expenditure in order to achieve the higher level of ODI performance. In contrast, a company could also sacrifice performance against ODIs in order to outperform on costs. However, based on companies' financial results in AMP6 to date, this relationship does not seem to prevail. For example, in its FY17 mid-year report Severn Trent noted that it expects to achieve £670 million of totex efficiencies across AMP6 with £120 million being reinvested for customer benefit.⁷² However, Severn Trent also earned £18.8 million in ODI rewards in FY16. This indicates that such a trade-off may not currently exist. Evidence of no trade-off is also suggested by United Utilities who achieved a net reward of £2.5 million for ODIs in FY16 but still expect to meet the 2015-20 wholesale totex final determination allowance, as stated in their FY17 mid-year report.⁷³
- 4.72 In order to explore further, we have considered the relationship between totex performance and ODI performance, measured in RoRE terms. Figure 9 below shows totex and ODI performance in FY16, splitting between wholesale water and wastewater to improve comparability (i.e. performance against water ODIs is compared to performance on water totex). As can be seen, there does not appear to be any clear relationship between totex and ODI performance based on FY16 data.

⁷¹ Comparative and non-comparative ODI range does not sum to total ODI range as the company with the max/min performance on comparative ODIs is not the same company who has the max/min performance on non-comparative ODIs. Each group has been ranked independently.

⁷² Severn Trent, Half yearly financial report, 24 November 2016, p. 1

⁷³ United Utilities, Half yearly financial report, 23 November 2016, p.1, p.6

Figure 8: FY16 totex performance v. ODI performance



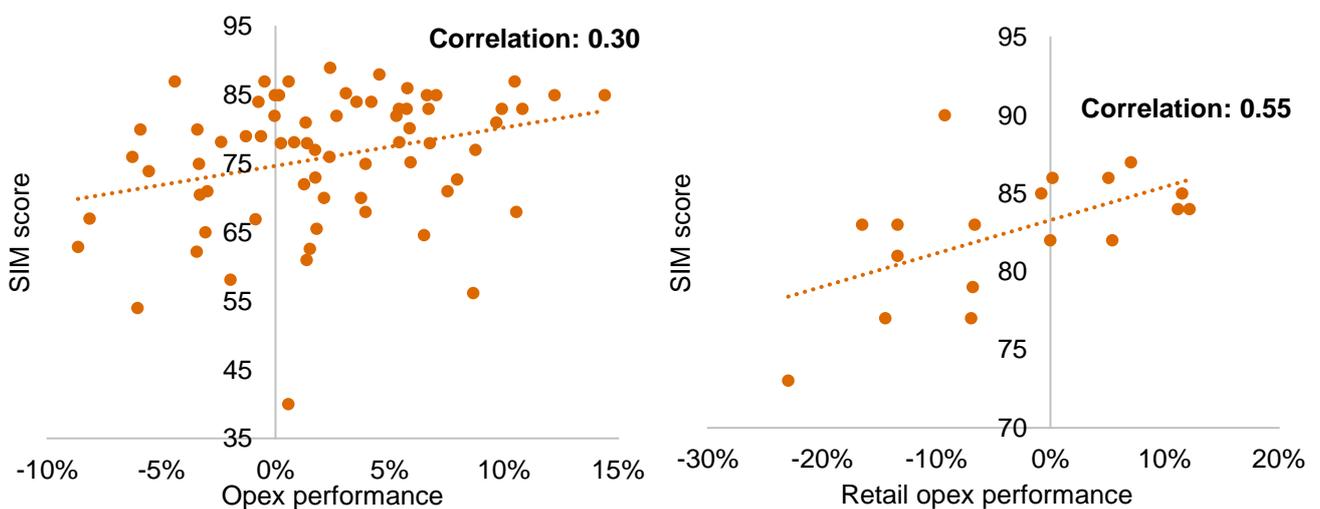
Source: PwC analysis, Ofwat, Company data

- 4.73 Due to the limitations of this analysis, in particular the fact that only a single year of data is available, we have also considered if insight can be derived from AMP5 performance data.
- 4.74 While, the use of service level (i.e. outcome) incentives was more limited in AMP5 compared with AMP6, outcomes were linked to financial incentives in two ways (1) through the SIM; and (2) through end of period serviceability assessments and potential penalties for shortfalls. We consider whether cost performance in AMP5 was related to performance against these service-level incentives.
- 4.75 Figure 9 below shows the relationship between SIM and opex performance. The chart on the left-hand side shows the relationship between company SIM scores and the magnitude of opex out (under) performance in each year between FY11 and FY14. This indicates that there was a weak positive correlation (0.30) between these two variables. The chart on the right-hand side shows a similar relationship but for *retail* opex performance and SIM score in FY16, which exhibits a slightly stronger correlation of 0.55.

Figure 9: SIM performance relative to opex performance

FY11 to FY14: SIM v. opex performance

FY16: SIM v. retail opex performance



Source: PwC analysis, Ofwat, Company data

NB: FY15 is excluded because SIM was not calculated on a consistent basis across companies in this year.

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- 4.76 While drawing conclusions on any causal relationships from this analysis is not possible, there does appear to be some relationship between these two variables. Potential explanations for why this relationship is only weak include:
- i) Outperforming companies tend to outperform in both cost and outcome incentives due to superior capabilities and/or ambition and vice-versa.
 - ii) Alternatively, companies that have low SIM scores may tend to underperform on costs as they spend in an attempt to raise their SIM score, whereas companies that have a high SIM score do not have as strong incentive to spend in order to improve their score.
- 4.77 We also considered the relationship between capex out/under performance and the level of serviceability shortfalls across the industry in AMP5. However, this analysis is limited significantly by the small number of observations with only eight serviceability penalties applied (five water and three wastewater).⁷⁴ No relationship appears to exist based on this small sample.
- 4.78 Based on the evidence above, we consider that the balance between totex and ODIs could be amended at PR19. In calibrating these components in the future, there appears to be greater scope to rebalance these. Performance in FY16, and in AMP5, indicates that companies can outperform simultaneously on totex and ODIs. Potential options to recalibrate this include:
- i) **Strengthen ODI rewards / penalties.** Stronger rewards and penalties would provide stronger incentives for companies to target higher ODI performance commitments, potentially leading to a wider range of RoRE outcomes.
 - ii) **Introduce asymmetric cost performance sharing rates.** In this case, customers would benefit from a greater share of cost outperformance and would bear less risk when companies underperform. Given the current upside skew of totex performance, this approach would (a) reduce the level of upside performance; and (b) potentially result in a more symmetric cost performance RoRE range.
 - iii) **Make greater use of relative performance assessment.** ODIs, except for SIM, are based on absolute measures of performance assessment. If rewards and penalties were based on industry rankings, then this would increase the power of ODIs. However, there are issues of inter-company comparability and fairness that may limit the applicability of this solution. There is also an issue that industry performance can slip back as a whole and some absolute checks are needed on relative measures of performance.

Balance between penalties and rewards

- 4.79 The current incentive framework makes use of a variety of reward and penalty structures. Table 5 below shows the number of each type of incentive for AMP6. This indicates that most incentives are reputational (“no financial incentive”), while reward & penalty incentives are the most common type of financial incentive structure with 170 such incentives. However, penalty only incentives are also widely used with 142 such incentives.⁷⁵

⁷⁴ Serviceability penalties were applied to the wholesale water RCV for Dwr Cymru, Severn Trent Water, Bristol Water, Dee Valley Water and South East Water; and to the wholesale wastewater RCV for Severn Trent Water, Southern Water and Thames Water.

⁷⁵ These were often supported by customer research, which showed preferences for penalty-only structures. We also note that prospect theory supports the use of penalty-only incentives – this theory would indicate that the utility loss to the company will be greater for a penalty compared to the utility gain from a reward of equal size.

Table 5: Industry incentive structure

	No financial incentive	Reward only	Penalty only	Reward & penalty	Total
Water	89	1	84	92	266
Wastewater	47	2	50	49	148
Retail (HH)	70		6	27	103
Retail (NHH)	2		1	2	5
Thames Tideway	4		1		5
Total	212	3	142	170	527

Source: Ofwat – PR14 FD outcome PC and ODI base data

- 4.80 The current incentive framework has the effect of skewing *potential* ODI financial incentives to the downside. As discussed in section 2, the use of penalty-only incentives:
- i) Will tend to incentivise a minimum required level of service rather than ambitious performance.
 - ii) May penalise firms unduly, where performance, or an element of performance, is dependent on factors outside company control.
- 4.81 An important extra consideration is that not all performance commitments will be suited to rewards. For example, where performance is related to statutory obligations.

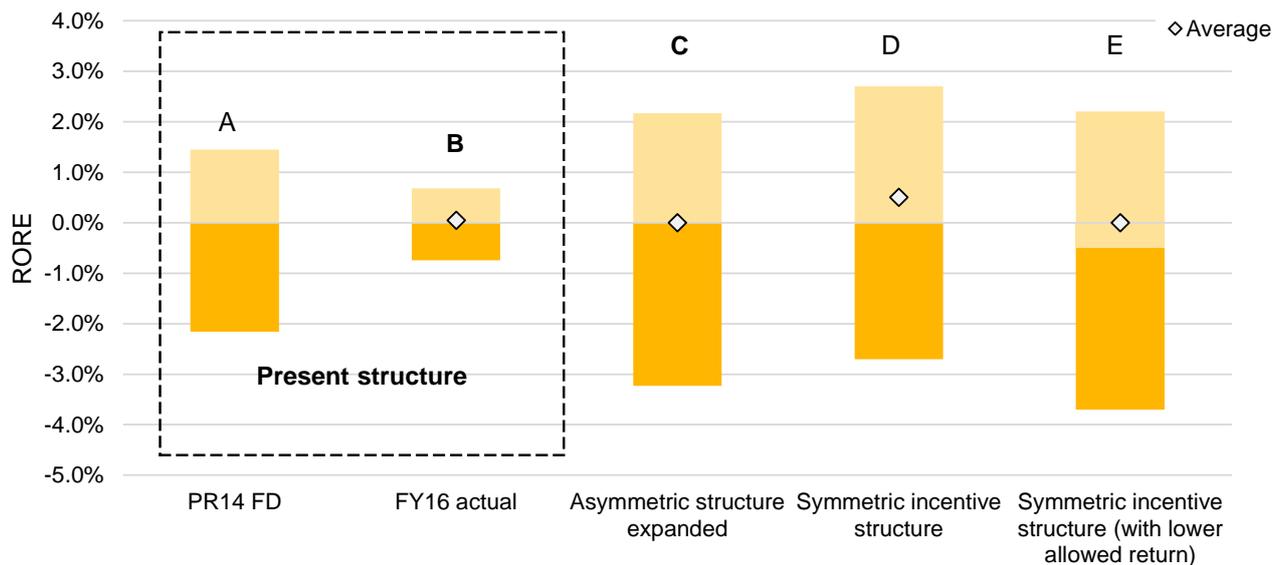
Symmetry of rewards and penalties

- 4.82 Ofwat’s outcomes consultation also notes how an over-emphasis on penalty-only incentives could result in higher customer bills.⁷⁶ Specifically, penalty-only incentive mechanisms increase the risk to which companies are exposed. Figure 11 considers this further by comparing the ODI range included in PR14 FDs, with actual ODI performance:
- i) Bar A on the figure below shows the RoRE range included in PR14 final determinations. This demonstrates the asymmetric (downside) structure of the ODI range.
 - ii) Bar B shows the observed ODI performance in FY16. This shows that the actual ODI performance is symmetric with average industry performance of close to 0%.⁷⁷ This could be due to:
 - (1) Penalty-only ODIs providing stronger incentives than ODI incentives with rewards; and/or
 - (2) Information asymmetries which led to ODI performance commitment levels and deadbands (see Appendix I for an illustration of deadbands) being set at levels that were not as challenging as initially thought.
 - iii) Bar C illustrates a continued asymmetric (downside) structure, but with greater incentivisation (more potential for both upside and downside). This assumes companies can, on average outperform within this range, consistent with FY16 performance.
 - iv) Bar D illustrates the potential distribution of a symmetric ODI structure. This shows that if the strength of penalty only ODIs and information asymmetries persist, then companies will, on average, outperform on ODIs.

⁷⁶ Ofwat, Outcome Consultation, p. 7.

⁷⁷ Companies earned net ODI rewards in FY16, but this rounds to a RORE impact of 0.0% to one decimal place.

Figure 10: ODI penalty and reward framework



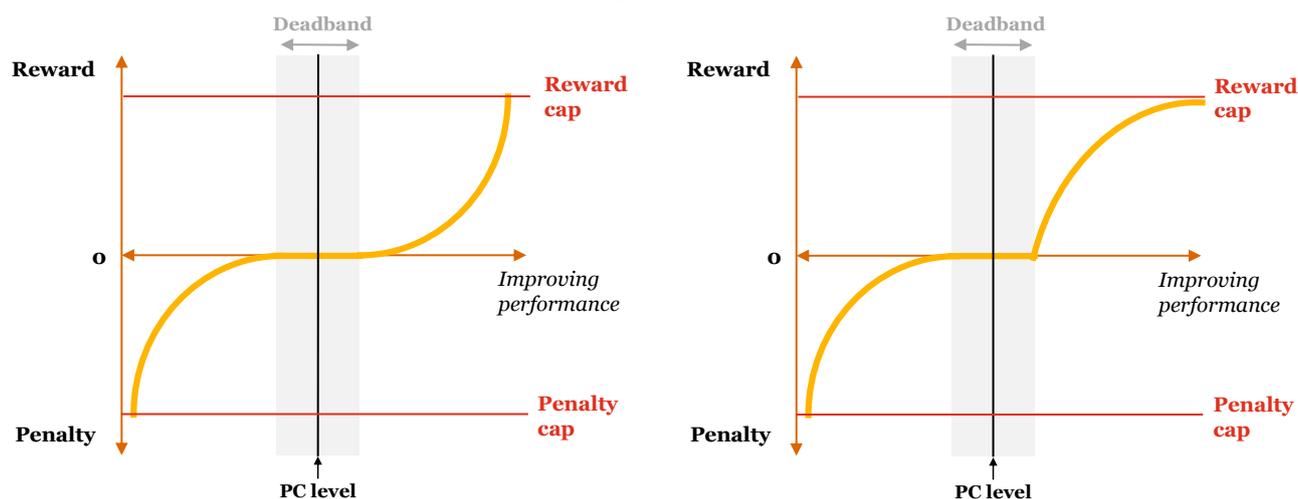
Source: PwC analysis, Ofwat, Company data

- 4.83 In theory, Bar B, in the figure above, represents an appropriate incentive distribution, with performance distributed around an expected average performance of zero, meaning that on average companies are expected to neither out-, nor under-, perform.
- 4.84 In the “symmetric incentive structure” in Bar D, expected average performance above 0% on ODIs may deliver superior outcomes for customers. However, in the absence of a high level of ODI performance or without offsetting adjustments elsewhere in the incentive framework this could lead to over remuneration of company performance.
- 4.85 One solution to mitigate this affect would be to offset higher average ODI returns with a lower allowed return as illustrated in Bar E. The size of such an adjustment could be calculated with reference to the expected level of outperformance on ODIs. This approach is not without drawbacks though. For example, making an adjustment to the baseline level of RoRE may detract from the transparency of the cost of equity figure, and a precise calibration may be difficult to achieve. Also, this approach could complicate the assessment of financeability.
- 4.86 Additionally, it should be noted that the observations above are based only on FY16 data. Ofwat should monitor carefully ODI performance in the industry for the remainder of AMP6 to see if the symmetric level of performance is sustained. If such performance is not sustained, then adjustments to the allowed return may not be appropriate.

ODI pay-off structures

- 4.87 More symmetric ODIs could also be introduced, these could adopt different pay-off structures that may more accurately reflect customer preferences e.g. non-linear. The current structure of ODIs is linear, with specified deadbands, caps and collars (see Appendix I). While the use of caps and collars provide sensible safeguards against excessive under- or over-performance, the use of a linear pay-off may not adequately incentivise companies to seek the best level of performance.
- 4.88 We have set out two illustrative non-linear pay-off structures in Figure 11 below to demonstrate how such incentives may better align company incentives and customer priorities.

Figure 11: Illustrative non-linear reward and penalty structures



Source: PwC

Note: y-axis shows total reward amount

- 4.89 In the left-hand pay-off structure, a company is rewarded (penalised) at an increasing rate the more they out (under) perform. This structure would provide stronger incentives for a company to achieve higher levels of performance and avoid poor performance, which could result in better outcomes for customers.
- 4.90 In contrast, the pay-off structure in the right-hand diagram would penalise companies at an increasing rate the more it underperforms (as with the left-hand figure), but it would reward companies at a decreasing rate the more it outperforms. While this may dull the incentives for companies to perform at a high-level, for some outcomes it may better reflect customer preferences, i.e. diminishing marginal benefit from performance improvement at higher commitment levels. For example, customers may be more willing to reward initial improvements in leakage, but after a certain level customers cease to value further improvements.
- 4.91 Based on the discussion above, we consider that the use of penalties and rewards could be rebalanced at PR19. Specifically:
- i) **Increase symmetry of rewards / penalties.** More symmetry in ODIs could have benefits by reducing the asymmetric risk companies are exposed to. However, this should be treated carefully, in order to avoid unjustified outperformance. In particular, the range of rewards and penalties would need to be carefully calibrated with other parts of the incentive framework.
 - ii) **Introduce non-linear incentive pay-offs.** While this would not necessarily affect the overall balance of incentives, it may sharpen the incentives for companies to perform well against their delivery commitments. However, introducing non-linearity may lead to a significant delivery challenge, as this would increase the complexity in calibrating several hundred outcomes.
 - iii) **Removal of deadbands.** The removal of deadbands from ODIs could sharpen company focus on performance. Specifically, this would prevent any performance complacency as every level of performance would have a financial consequence. The drawback of this is that it could heighten risk to customers associated with performance commitments being set too low and in turn companies earning excess rewards.
 - iv) **Greater use of common performance commitments and ODIs.** Greater use of common performance commitments would place more weight on relative company comparisons – potentially sharpening incentives. Two key challenges with this rebalancing are achieving standardisation and resolving potential conflicts with local customer preferences.

Balance between relative and absolute performance measures

- 4.92 In paragraph 3.21, we noted that while many elements of the incentive framework, and price control in general, are calibrated through relative benchmarking and assessments, incentive performance is not widely assessed on a relative basis. The only in-period incentive mechanism that uses a truly relative assessment approach is the SIM.⁷⁸
- 4.93 With most other incentive mechanisms, it is possible, albeit unlikely, that all companies could earn a penalty or reward, e.g. all companies could outperform on costs and earn a reward. In contrast, SIM fits all companies to a distribution based on their scores throughout the AMP, and the companies ranking relative to its peers determines the resulting reward or penalty.
- 4.94 The relative nature of the SIM assessment has focused company attention and companies have recognised the success of SIM in delivering improvements to customer service.⁷⁹ The success of SIM is reflected in the convergence of SIM scores since its introduction in AMP5. In FY12, company SIM scores were widely dispersed with scores ranging from 56 to 85 with an average of 75. In contrast, FY16 SIM scores had both a higher and narrow range of 73 to 90 and a higher average of 82.5.
- 4.95 Given the relative size of the potential SIM reward / penalty (-12% to 6% of retail revenues), which, based on FY16 SIM scores and revenue data, results in a RoRE range of -0.5% to 0.7%,⁸⁰ shows this measure is important for companies, as the relative nature of the SIM also has significant reputational effects.⁸¹ The conversion of performance into published industry “league tables” provides clear incentives and consequences for poor performance relative to the industry.
- 4.96 Relative financial incentives also provide a more predictable and stable performance range (in RoRE terms). Due to the fact that companies are fitted to a distribution and that rewards / penalties are calculated on the basis of this distribution, the distribution in performance at an industry level can be known with greater certainty in advance.
- 4.97 Given the rationale set out above, and supporting evidence, we consider that relative incentive mechanisms, such as SIM, provide a sharper incentive than absolute targets. However, this type of incentive may be inappropriate for incentivising some types of outcomes. In particular, for outcomes that are to some degree outside of company control or that affect some companies significantly more than others, then a relative measure may not be equitable. There is also a risk with relative incentives that a lack of certainty for companies about the target they are aiming for could dampen performance incentives.

Balance between financing and operational incentives

- 4.98 As shown in Figure 2, in Section 3, the range in financing performance was broadly consistent with the range in totex performance (excluding Dee Valley) in FY16. However, unlike totex performance, which can be influenced by the phasing of expenditure in a single year of a price control, financing performance is not influenced by similar decisions. The level of financing outperformance in AMP6 will likely increase as company debt matures and is refinanced at a lower cost, and as RPI increases above the current levels (which was assumed to be 2.8% at PR14).⁸²

⁷⁸ The risk based review at PR14 could also be considered a relative assessment.

⁷⁹ See, for example, United Utilities, *Developing Performance Measures and Incentives*, August 2016, p. 5.

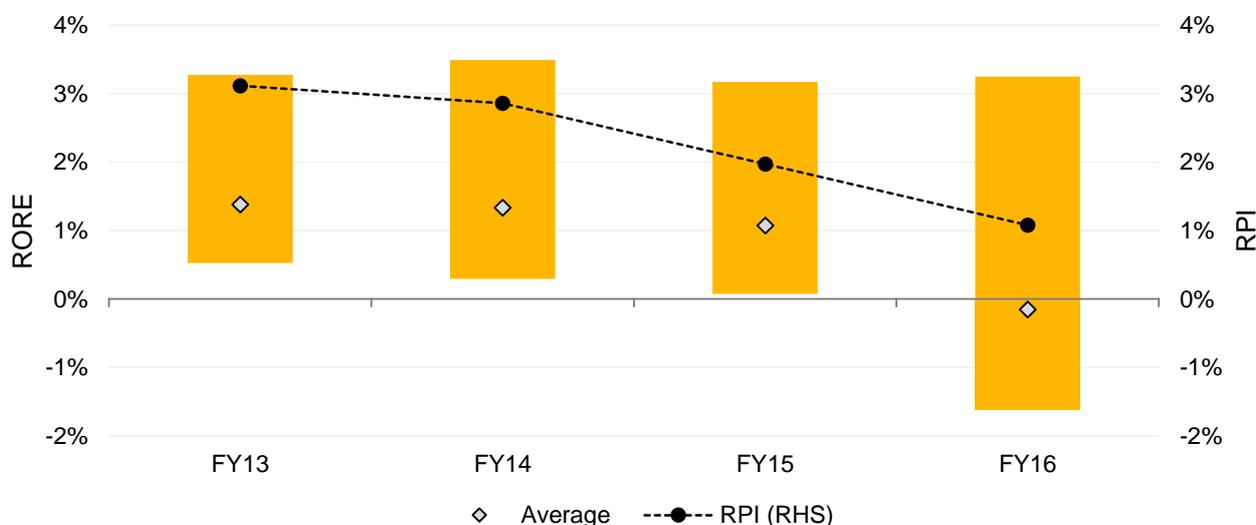
⁸⁰ In order to calculate this range we applied assumptions regarding the magnitude of penalties and rewards (up to a maximum of -12% to +6% of retail revenues, but quoted on an appointee basis) based on number of deviations from the industry average SIM score.

⁸¹ See, Northumbrian Water, *Improving the outcome and delivery incentive regime*, October 2015, p. 10.

⁸² Companies can also outperform relative to tax allowances. However, tax allowances are calculated based on companies' actual capital structure, so the scope for tax outperformance is relatively small. Outperformance related to tax allowances could be mitigated by applying a true-up mechanism in the future, which would clawback any tax benefits.

4.99 Figure 12 below, shows that in AMP5 all companies consistently outperformed the allowed cost of debt. In AMP5, outperformance was driven by (a) a higher allowed cost of debt (3.6% for WaSCs)⁸³; and (b) RPI inflation above expectations used in Ofwat’s FD. In contrast, FY16 shows that the range of financing outperformance has widened, but companies have, on average, underperformed on the cost of debt (i.e. they have incurred a higher cost of debt than the allowance).

Figure 12: Water company financing performance, FY13 to FY16



Source: PwC analysis, Company data, ONS

Note: Analysis assumes a notional capital structure across all companies. Actual cost of debt of figures sourced from individual company accounts. Real cost of debt figures for each company are calculated using actual RPI to deflate the stated nominal cost of debt set out in company accounts.

4.100 At PR14, Ofwat viewed the potential level of financing out / under performance as +/- 0.7% of RoRE. This range was largely underpinned by variations between the actual and allowed cost of new debt.⁸⁴ However, this is significantly smaller than the outturn range in FY16 of -1.6% to 3.3%, which has been largely driven by outperformance on the embedded cost of debt. Due to this alternative presentation, the strength of financing incentives is currently much higher than the view included in Ofwat’s final determinations.

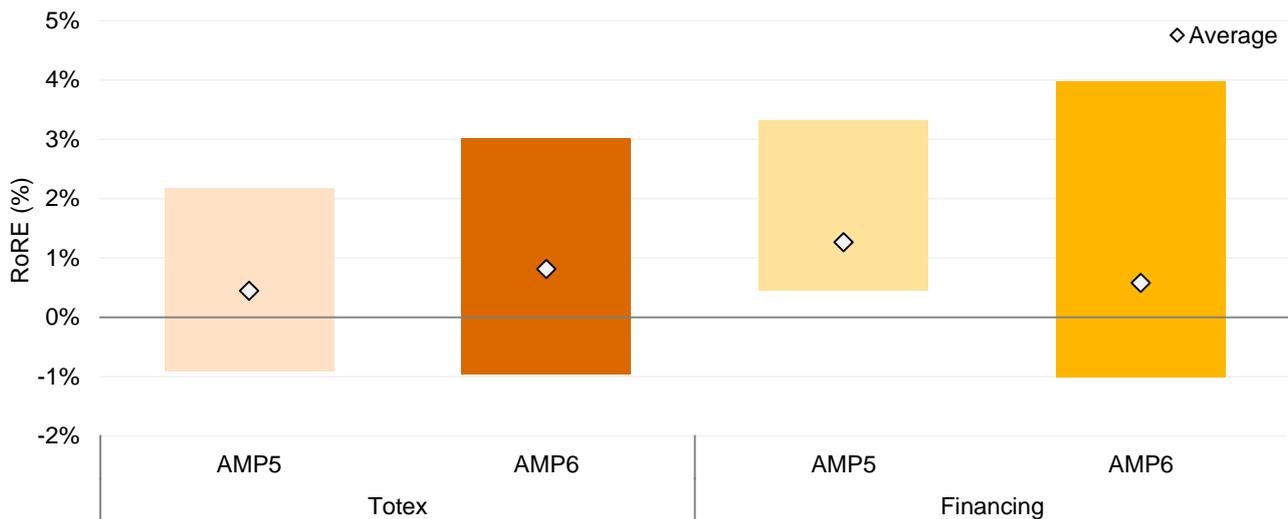
4.101 In order to compare the balance of financing outperformance with other incentives, we compare financing and totex performance in Figure 13 below. Specifically, we have:

- i) Estimated the potential level of totex and financing outperformance (including embedded and new debt) over the *whole of AMP6*, in order to reduce the cost phasing decision on totex outperformance in a single year.
- ii) Calculated totex and financing outperformance (including embedded and new debt) in AMP5 in order to provide a point of comparison.

⁸³ The allowed cost of debt for WoCs at AMP5 was slightly higher – 4.7% for South East Water and Veolia Central, and 4.0% for the remainder of WoCs.

⁸⁴ As the embedded debt costs of the notional company are locked-in for the control period, no forward-looking RoRE variation is driven by this part of debt costs.

Figure 13: AMP5 vs. forecast AMP6 totex and financing performance



Source: PwC analysis, Ofwat data, Company data

Notes: (1) Totex performance includes wholesale *and* retail cost outperformance; (2) See Appendix K for a detailed description of the calculations underlying AMP5 and AMP6 performance; (3) financing performance is actual real cost of debt compared to allowed real cost of debt under a notional capital structure, where refinancing is expected over AMP6 an assumption has been made about future market yields.

4.102 Figure 13 shows that in AMP5 financing performance (0.5% to 3.3%) was significantly higher than totex performance (-0.9% to 2.2%). Similarly, potential totex performance in AMP6 (-1.0% to 3.0%) is narrower than potential financing outperformance (-1.0% to 4.0%). However, the average level of financing outperformance in AMP6 may be lower than at AMP5, as not all companies are likely to outperform.

4.103 The high degree of financing outperformance is likely to be reduced following PR19 through Ofwat’s preferred approach for setting the cost of debt at PR19, which is to apply an indexation approach to the cost of new debt.⁸⁵ This will reduce the scope for financing outperformance, as the allowed cost of debt will more closely reflect actual market conditions within the price control period. We consider this an appropriate approach to rebalance company performance, reducing the degree of financing outperformance to sharpen incentives in other parts of the incentive framework, in particular, on ODIs.

Balance between stable returns and more variable returns

4.104 In Appendix A to C we review in detail the impact of the lower interest rate environment which has persisted for longer than initially expected: “lower for longer”. Specifically, the focus of Appendix A to C is on the impact of lower for longer on the allowed cost of equity. This environment has introduced some methodological challenges, particularly around relying on long-term historical assessments of market returns. In these appendices, we show the current market-based CAPM based cost of equity is significantly lower than that set at PR14. Due to this, the allowed equity return for PR19 will need to be set at an appropriate level that does not over-remunerate companies. The current low interest rate, low return environment has revealed there is a trade-off when setting the allowed return; between taking:

- i) A long-term view, which results in more stable bills, but may over remunerate companies in the current market environment.
- ii) A more market-based approach, which may result in more volatile customer bills over time, but will more accurately reflect companies’ efficient finance costs.

⁸⁵ See Ofwat, Cost of debt consultation, p. 29.

4.105 Table 6 below shows the impact on customer bills resulting from the two approaches set out above.⁸⁶

Table 6: Illustrative impact of historical v. current market

	PR14	Historical	Current market
Total market return (real)	6.75%	6.50%	5.54%
Variation in TMR range		1.0%	3.0%
Regulatory equity (industry, AMP6 average)		£23,653 m	
Allowed return (£m) ⁸⁷	£1,336 m	£1,277 m	£1,048 m
Number of households (m)		c. 24m	
Customer bill impact (£)	£56	£53	£44
Variation in bills due to TMR		£8	£24

Source: PwC analysis

4.106 Table 6 shows that even if a more long-term approach is taken, some decrease in the allowed return would need to be reflected⁸⁸. We consider that a long-term view of TMR could involve variation of 1.0% (through regulatory variation and responding to specific events). In contrast, a more market based approach could result in a 3% variation of the TMR. If we consider the full potential range in TMR under each approach, then the possible variation in customer bills using a market based return would be c. £24, compared to c. £8 under a long-term approach. In the context of the potential level of outperformance against other incentive mechanisms (e.g. against totex and financing), a change in the allowed return of this magnitude is comparatively small.

4.107 The relative magnitude of the impact due to variation in TMR values can be compared with the customer bill impacts set out in Table 10. This table shows the average customer bill change from FY15 to FY16, associated with the beginning of a new price control. Average change between these years across the 18 companies is £12.

Table 7: Average bills in companies' final determinations at PR14

Company	Bill in FY15 (£)	Bill in FY16 (£)	Change (£)
Affinity	165	165	0
Anglian	408	372	36
Bristol (Ofwat FD)	191	164	27
Dee Valley	144	142	2
Dwr Cymru	416	411	5
Northumbrian	368	364	4
Portsmouth	92	92	0
Sembcorp Bournemouth	145	129	16
Severn Trent	315	302	13

⁸⁶ For illustrative purposes we select a long-term historical TMR of 6.50% (which is also consistent with latest CMA precedent from the Bristol Water appeal), for a current market TMR we select an illustrative 5.54% based upon a 8.5% nominal TMR and 2.8% RPI assumption, using the Fisher equation to calculate the real TMR. These figures are not suggested values for each, but are used to demonstrate the impact of bill volatility.

⁸⁷ In order to calculate an allowed return figure, assumptions are used for the real risk-free rate and equity beta. These assumptions are outlined in further detail in Appendix C.

⁸⁸ On the basis of a gradual fall in historical return estimates and bringing the TMR figure into alignment with the CMA's most recent determination on the cost of capital in the Bristol Water appeal.

South East	190	185	5
South Staffordshire	133	131	2
South West	516	494	22
Southern	413	388	25
Sutton & East Surrey	176	173	3
Thames*	350	347	3
United Utilities	388	381	7
Wessex	459	422	37
Yorkshire	353	344	9

* The customer bill impact of Thames Tideway is excluded from the Thames figures in the table above. The customer bill impact for Thames Tideway individually is an increase of £26 by FY20.

Source: Company Final Price Control Determinations, Ofwat

- 4.108 A further policy consideration is whether the interaction between financing incentives and other incentives may mean that equity returns are more variable. If so, there may be less capacity to increase power in other areas of the balance of incentives. In contrast a move to a more market aligned approach may reduce the cyclical market value variation caused by using a historic approach, and may therefore reduce systematic risk, and therefore beta.
- 4.109 Therefore, we consider that a more market-aligned approach is preferable, even if this results in the possibility of slightly higher bill variability across price controls.

Conclusion

- 4.110 ‘Ambitious’ should be a business plan category that is distinct from ‘fast-tracking’. Assessments of ambition should be assessed on an aggregate level and designed to balance the potential benefits to companies, customers and industry-wide externalities.
- 4.111 There are different incentive mechanisms that could be used for incentivising innovation such as ex-ante funding where an industry-wide issue exists, calibration of ODIs, ex-post rewards, and capability assessments. These mechanisms could be combined to form an incentive package on innovation.
- 4.112 The balance between ODIs and totex could be amended as companies can outperform on costs and ODIs simultaneously. The current incentive framework has the effect of skewing potential ODI financial incentives to the downside. Relative incentive mechanisms, such as SIM, provide a sharper incentive than absolute targets.
- 4.113 In the following section, we bring together the various findings and recommendations into potential incentive packages that could inform the eventual PR19 incentive package.

5. Potential illustrations for PR19 incentive regime

- 5.1 This section brings together the discussions of Sections 2, 3 and 4 into three illustrations for the PR19 incentive regime. Although we have put together illustrations under different themes, new illustrations could be formed by combining different elements of each.
- 5.2 The section is structured as follows:
- i) We first outline in detail the characteristics of the three illustrations;
 - ii) We then discuss the key considerations of appraising individual elements of each illustration; and
 - iii) We finish with a more granular appraisal of the illustrations, covering their alignment of stakeholders, practicalities of implementation and risks to customers.

Illustrations

- 5.3 We set out three illustrations in this section, one of which is to retain the current balance of incentives, and two which involve a rebalancing of incentives, we set out each below.

Retain current balance

- 5.4 **Illustration 1:** *retaining the current balance of incentives. This illustration acts as point of comparison for the others, and takes account of Ofwat’s proposed changes on the cost of new debt.*

Rebalance incentives

- 5.5 **Illustration 2 (“sharpening of incentives”):** *is characterised by including some of the most clear cut refinements and would therefore help Ofwat refine incentives without departing significantly from the current regulatory approach.*
- 5.6 **Illustration 3 (“reform of incentives”):** *includes elements that we think have merits and would result in a considerable step-change in the overall balance of incentives; this would require more careful calibration and could result in a greater variation of customer and company outcomes.*
- 5.7 We discuss these illustrations in the remainder of the section.

Retention of current balance – illustration 1

Characteristics

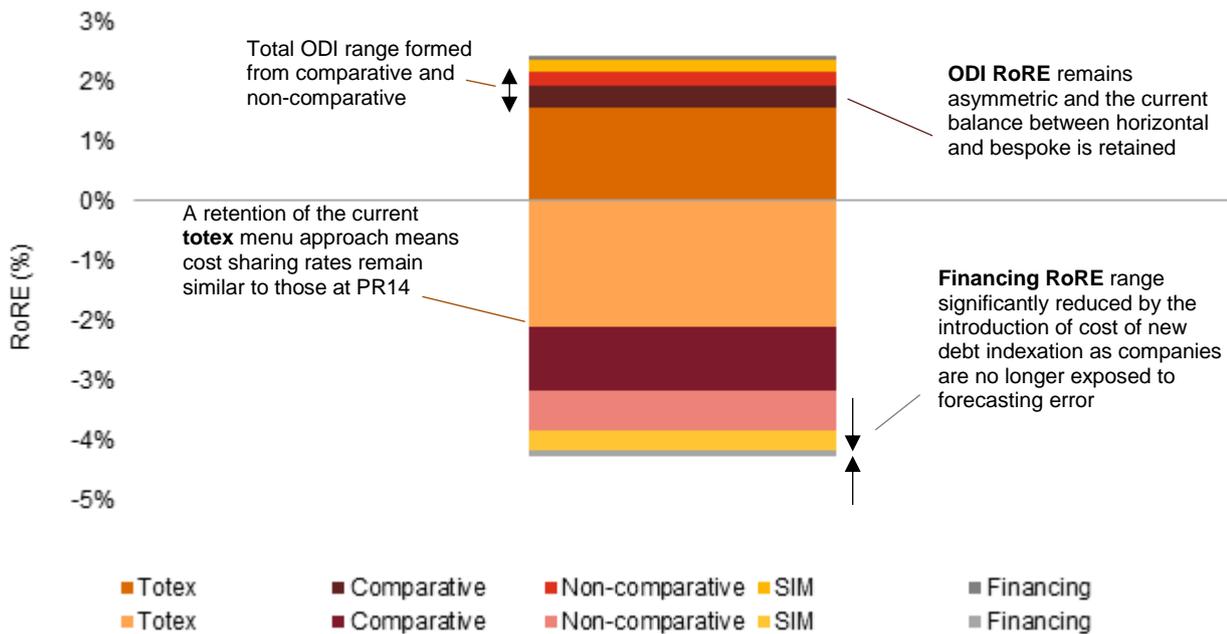
- 5.8 In this subsection we consider an illustration which follows the incentives structures from PR14, modified to reflect key developments in policy that Ofwat has already publicised as likely to be adopted for PR19.
- 5.9 The most relevant development in the balance of incentives considered to date by Ofwat is the cost of debt, where the preferred approach, as set out by Ofwat is the indexation of the real cost of new debt. If this introduction of indexation goes ahead, then there will be an impact on the balance of financing incentives.
- 5.10 In the current price control period, under an ex-ante cost of new debt approach, companies bear the risk of forecasting error. This forecasting error risk currently drives a large proportion of the financing component of the RoRE range.⁸⁹ An indexation approach would remove this forecasting error risk,

⁸⁹ As the embedded debt costs of the notional company are locked-in for the entire control period, no forward-looking RoRE variation is driven by this part of debt costs.

leaving only the residual RoRE variation from companies issuing debt at costs above or below the benchmark.

5.11 This reduction in financing risk is captured in Figure 14 below which sets out a stylised RoRE under illustration 1.⁹⁰ All other elements of the stylised RoRE retain the PR14 balance of incentives.⁹¹

Figure 14: Stylised RoRE for illustration 1



Source: PwC analysis

Considerations for illustration 1

5.12 Placing more weight towards retaining the current balance of incentives would recognise that the current balance still needs more time to take full effect. Some lessons regarding the current balance are unlikely to crystallise until later in the AMP. We consider two examples that illustrate this:

- i) Firstly, with regards to totex, in Section 3 we noted that drawing observations on totex outperformance may be premature as at this stage of AMP6. It is unclear to what extent the FY16 totex outperformance is driven by genuine cost efficiencies as opposed to a deferral of expenditure. If past control period trends are used as an indicator, it would suggest that a material portion of totex outperformance in the first year of the control is associated with deferrals.
- ii) Secondly, with regards to ODIs, the observed balance between penalties and rewards may develop over AMP6, as more improvement works and schemes come to fruition.

5.13 Where rebalancing is proposed, that rebalancing should be cognisant of the relatively small amount of time elapsed since the PR14 incentives were introduced.

5.14 Another consideration for illustration 1 is whether the presentation of RoRE at the company level should capture performance against the industry cost of embedded debt as well as performance against the industry cost of new debt – as embedded debt costs are observable and typically locked-in for the control period this would be exhibited through an adjustment to the base level of RoRE. An advantage

⁹⁰ For the purposes of the stylised RoRE we have attributed 75% of PR14 financing RoRE variation to forecasting error risk. Some residual variation compared to allowance will remain due to the difference between specific issuance yields and the yield on the benchmark used. However, on average, we expected WaSCs to issue at yields similar to that of the benchmark selected, meaning any variation is likely to be small.

⁹¹ RoRE is shown as variability around a base level of return. We retain the P10/P90 concept used in current RoRE framework.

of showing performance against the cost of embedded debt is that it would better reflect the actual balance of incentives at a company-specific level. However, presenting RoRE in this way would not be consistent with a forward-looking view of risk from a notional perspective, and at the industry level, ex-ante, performance against the embedded cost of debt allowance should be neutral.⁹²

- 5.15 As we are presenting illustrations on a notional, industry-level basis we therefore do not adjust base return for any out or underperformance on the embedded cost of debt.

Rebalancing of incentives – illustrations 2 and 3

- 5.16 In Section 3, we found that some incentives were already aligning the interests of customers, companies and investors and working effectively. As a result of this finding, we only consider a subset of incentives for reform. In Table 8 below we set out those incentives which remain unchanged irrespective of the illustration considered.

Table 8: Incentives that are common

Incentive	Rationale for being common
SIM	Notwithstanding the earlier observations from Section 3 that SIM may not provide as strong incentives for those companies who are leading in the SIM rankings; the strong reputational incentives created by the ranking of companies, along with the rewards and penalty structure in place creates an incentive that is already sharp and aligns the interests of investors, companies and customers. If Ofwat adopts an incentive package to encourage ambition, frontier shifting performance in customer service would be part of an ambitious plan.
Retail costs	For neither illustration do we propose that retail cost incentives should change. The efficiency challenge already provides a sharp relative performance benchmark and the RoRE range associated with a relatively small area of costs is already material. We note that retail incentives have not led to significant reductions in bad debt levels to date. However, as highlighted above, the outputs from the AMP6 incentives in retail may need further time to develop.
WRFIM	For neither illustration do we propose that WRFIM should change. This incentive is targeted and only has an impact in more extreme circumstances.
Allowed cost of debt	Irrespective of illustration, cost of new debt indexation shifts the balance away from financial incentives.

Source: PwC analysis

- 5.17 Having set out the incentives that we do not consider require rebalancing, we also discuss a new addition to the balance of incentives which can be applied across all the following illustrations, that of ambition. In Section 4 we set out an option for how ambition could be integrated into the initial review of business plans. Our suggestion we made is that ambition could be given separate categorisation, and, so as to provide sharper incentives for companies to stretch themselves, this categorisation would not be contingent on being ‘fast-tracked’. In other words, companies would not be precluded from this category on the basis of their initial plan not being high-quality.
- 5.18 Following from those incentives that are constant across illustrations, we now move onto to discuss those incentives that do have potential for rebalancing.
- 5.19 We group the rebalancing of these incentives under two illustrations. As set out above, illustration 2 refines the current incentives without departing significantly from the current balance; meanwhile illustration 3 includes elements that would result in a step-change in the overall balance of incentives.
- 5.20 In the table and figures below we summarise the key characteristics of each illustration before discussing each in more detail below.

⁹² There may potentially be a small skew towards outperformance due to the financeability duty of Ofwat.

Table 9: Options for rebalancing

<i>Feature</i>	<i>Illustration 2 – sharpening of current incentives</i>	<i>Illustration 3 – reform of incentives</i>
Innovation	<p>As highlighted in Section 4, some incentives aimed at encouraging innovation may not be effective on a standalone basis. Therefore innovation incentives could be formed from a package of:</p> <ul style="list-style-type: none"> • Capability assessments; • Ex-ante funding (where a common issue is identified); and • Greater involvement with ex-post awards. <p>If an under-supply of innovation were identified, then the introduction of targeted incentives could help address this issue.</p>	<p>Similar to illustration 2, under this illustration we also focus on a package of innovation incentives but with the addition of the following:</p> <ul style="list-style-type: none"> • Bigger potential rewards for significant outperformance of PC levels on ODIs. • Allowing companies to propose longer-term ODI rewards. <p>Again, if an under-supply of innovation had been identified, the introduction of targeted incentives could help address this issue.</p>
ODIs	<p>In Section 4 we set out the potential challenges that could arise from placing greater weight on comparative ODIs and also noted the potential challenges in calibrating more symmetric rewards.⁹³</p> <p>Recognising this, illustration 2 makes limited changes to the current ODIs. Retaining both the current balance between horizontal and bespoke ODIs and the current asymmetry between rewards and penalties. However, based on evidence of a low correlation between ODIs outcomes (i.e. ODI outcomes are not all leaning in one direction), it does increase the incentive rates associated with out/under-performance of commitments levels so the outturn RoRE range is more closely aligned to the FD RoRE range.</p> <p>The result is a strengthened relationship between ex-ante expectations of performance and outturn performance.</p>	<p>Recognising the power of relative incentives identified in Section 3 of the report and the potential incentives to innovate from more market-like rewards (as identified in Section 4), this illustration:</p> <p>Increases the balance towards horizontal ODIs through further standardisation (or through increasing rewards and penalties on these ODIs). And also, rebalances ODIs to be more symmetric, potentially involving an associated reduction allowed return to base return.</p> <p>This illustration also increases incentive rates associated with out/under-performance of commitment levels so the outturn RoRE range is more closely aligned to the FD RoRE range.</p> <p>The combination of these is a much larger reform of current ODIs, and one which may lead to more powerful incentives for companies to innovate.</p>
Wholesale totex	<p>In Section 3 we identified that menus are perceived as a complex regulatory tool that currently lack incentive power (discussed further in Appendix F). In recognition of this, illustration 2, removes the totex menu – replacing it with either a single cost sharing rate, or a cost sharing rate set by Ofwat that is contingent on the initial review of business plans.</p> <p>The result is a simpler regulatory regime that utilises other information revelation devices to protect customers.</p>	<p>As identified in Section 2, menus can play role in reducing asymmetric information. Therefore, despite being complex, it may be undesirable to remove them entirely rather than attempt to reform them (in Appendix F we show what form this reform could take). In recognition of this, illustration 3 rebalances the totex menu with stronger ‘truth telling’ incentives, with more weight placed on initial business plan expenditure forecasts and more powerful incentive rate changes.</p> <p>The result is an updated menu which could address some of the critiques of the current menu model, however, this approach does not address the issue of complexity, and may even increase it.</p>

⁹³ These potential challenges include local customer preferences and companies being penalised despite improving performance in absolute terms.

While Ofwat's allowed cost of equity does currently move to some degree with changing market conditions, irrespective of illustration, the decision on whether to fully follow a current market approach has wider policy implications beyond the balance of incentives.

Allowed cost of equity

Of key importance are: (1) bill stability and intergenerational transfers - where customer tolerance for additional bill variation is sufficient, a current market data approach has the advantage of avoiding intergenerational transfers; (2) the interaction between financing incentives and other incentives may mean that if equity financing is more variable then there may be less capacity to increase power on other incentives; and (3) currently low market interest rates could increase the likelihood of financeability issues occurring at the lower (P10) end of the RoRE range.

- 5.21 To further explore some of the implications of the illustrations set out in Table 9 above, we show in Figure 15 and Figure 17 below stylised RoRE ranges under each and provide associated commentary. In setting out these illustrations, we retain the RoRE framework and the P10/P90 approach adopted at PR14. The suitability of this approach is discussed in the box below.

Box 2: RoRE presentation

A P10/P90 approach is best suited having an observable history of data to which a distribution can be fitted. A challenge at PR14 was that it introduced new features to the balance of incentives such as totex and ODIs – this made calibration of the P10 and P90 figure challenging. In light of these challenges we review the suitability of each element of the RoRE range to a P10/P90 presentation below.

Totex – benefits from the availability of a long-run of historical cost data. Although the incentives of a totex framework did not apply to past periods of expenditure, we can still understand the degree of variation in operating and capital expenditure to guide any assessment of P10 and P90 values. At PR19 Ofwat will also benefit from costs data provided by companies through the AMP6 period.

ODIs – a challenge in calibrating a distribution range of ODIs is that Ofwat cannot observe the effort of company in reaching a given performance level. However, the issue of effort can be assisted through careful calibration of the balance of incentives, so as to ensure that companies are stretching themselves. At PR19 Ofwat will be able to draw upon a large panel dataset of performance against commitments which should assist in establishing a well-evidenced distribution. An alternative approach for ODIs is to show the RoRE impact from maximum and minimum outcomes, however, this approach risks overstating the true risk to shareholders and is not consistent with an approach where caps and collars are removed.

SIM – The nature of SIM is that rewards and penalties are given on a distributional basis. It is therefore well suited to a P10/P90 framework. Furthermore, Ofwat will have accumulated a large SIM dataset by PR19. Company assessments of P10 and P90 outcomes should place some weight on past performance given the apparent stickiness that exists within the SIM rankings.

Financing – The proposed introduction of cost of new debt indexation is likely to remove a large part of financing variation in RoRE terms. This is because forecasting error will be removed from the cost of new debt allowance. The remaining variation will be due to variation in yields at issuance around the benchmark index. Historic data on yields at issuance relative to a given benchmark can be used to guide the calibration of P10 and P90 figures.⁹⁴

Overall, we find that there are merits in retaining the P10/P90 presentation of RoRE ranges. It provides a consistent basis for comparison across companies and it is an approach which can be refined over time as more data becomes available.

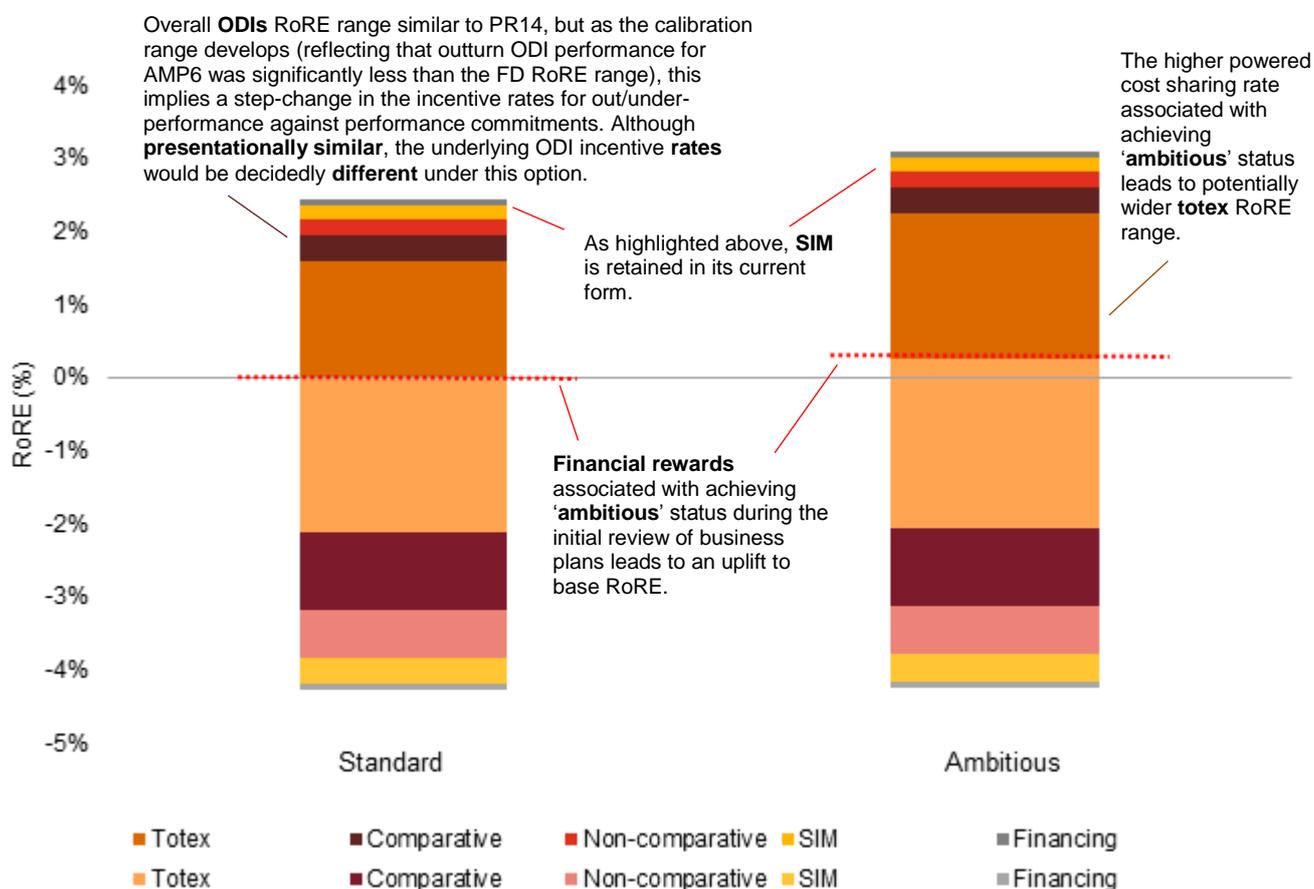
⁹⁴ This discussion assumes that only the cost of new debt is reflecting in the ex-ante RoRE range.

5.22 The stylised RoRE range for **illustration 2** shown in

5.23 Figure 15 below captures:

- i) the financial rewards available to ambitious companies – this is shown as a 0.25% uplift to the baseline RoRE, which is slightly larger than the current financial rewards available from achieving enhanced status (approximately 0.2% uplift);
- ii) the higher powered cost sharing rate available to ambitious companies – this is captured through a symmetric cost sharing rate of 50% under the standard plan, and for a company with an ambitious plan – characterised by ambitious totex efficiency targets – a higher cost sharing rate applies. This could occur through a menu mechanism or through other means. We present a 55% cost sharing rate for the purposes of the illustration. The result is a widening of the totex range around the baseline level of RoRE; and
- iii) the change to ODI incentive rates – the RoRE range for ODIs remains at the PR14 ex-ante level under the increased incentive rates, reflecting that the AMP6 outturn range in FY16 was narrow than the PR14 ex-ante range. The relative balance between comparative and non-comparative ODIs is maintained at a level consistent with observed FY16 values.

Figure 15: Stylised RoRE for illustration 2 ^{95 96}



Source: PwC analysis

5.24 In addition to the standard and ambitious categories set out in Figure 15 above, we also consider how the balance of incentives could change for a sub-standard business plan status. In Section 4, we set out

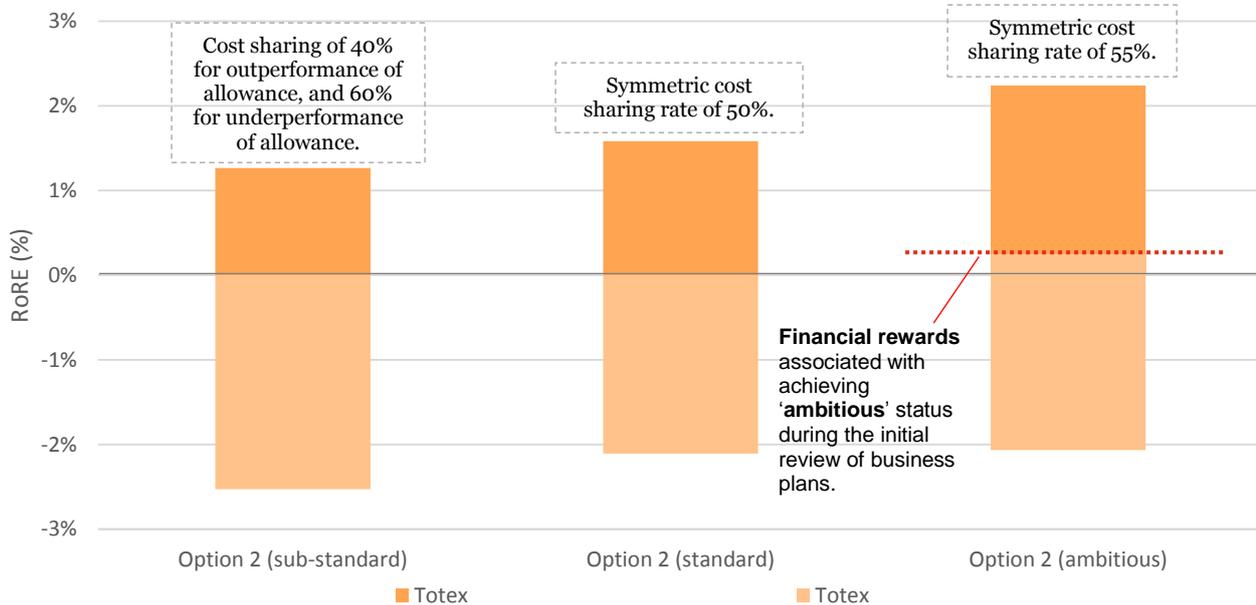
⁹⁵ A RoRE range which extends to -4% could lead to close to zero returns when a lower base return on equity is applied, but a reduction in RoRE variability would result in a weakening in the power of incentives.

⁹⁶ The magnitude of totex RoRE impacts will depend on the interaction between ambitious status and cost sharing rates.

that asymmetric cost sharing may be appropriate for a company with sub-standard status in order to provide additional protection to customers. The impact of an asymmetric cost sharing rate on RoRE is shown in Figure 16 below. The figures presented are based on the ex-ante totex RoRE range at PR14, but adjusted for different cost sharing rates holding all else constant.

5.25 The figure shows that a change from a symmetric cost sharing rate of 50% to a cost sharing rate of 40% for outperformance and 60% for underperformance leads to a P90 RoRE figure of approximately +1.25%, while the P10 figure is approximately -2.5%. This contrasts to the symmetric 50% cost sharing rate range of +1.6% to -2.1%.

Figure 16: Illustrative asymmetric cost sharing impact on totex RoRE

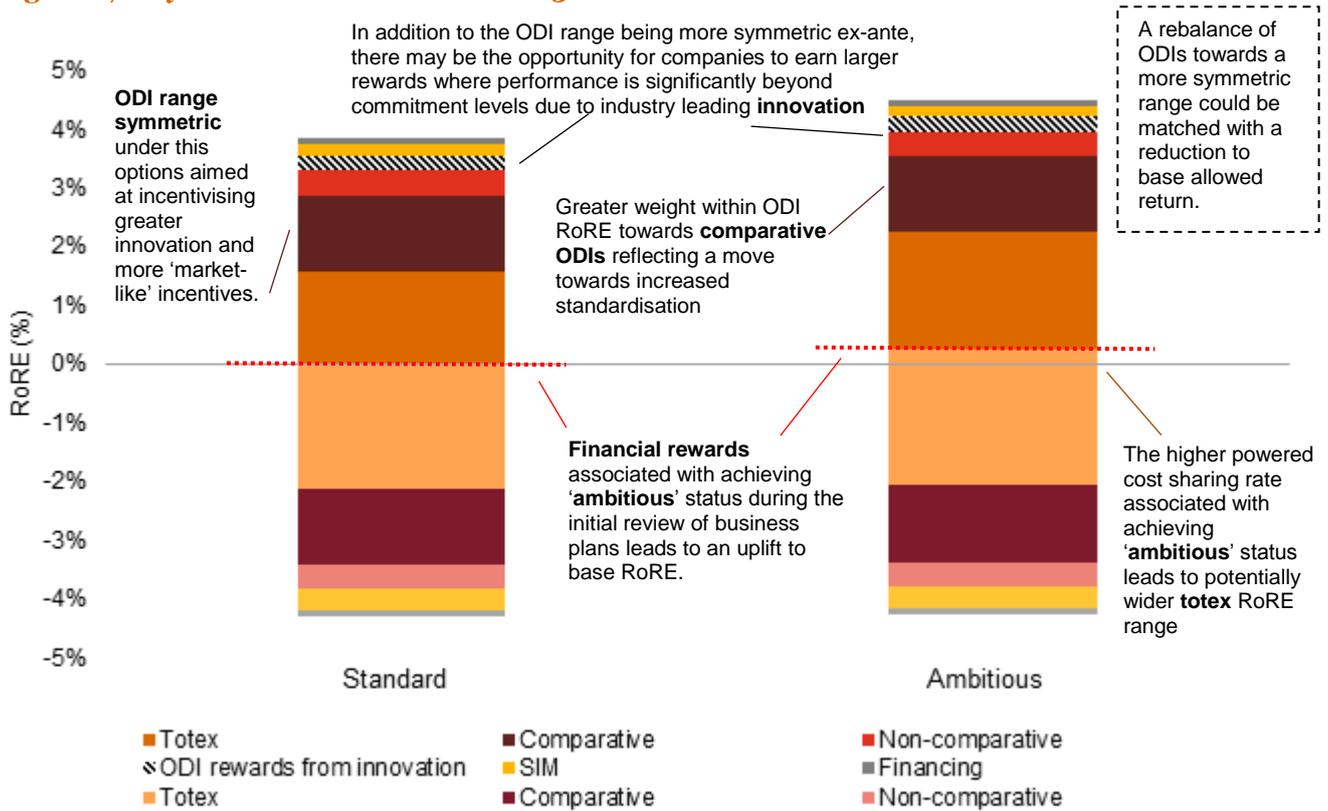


Source: PwC analysis

5.26 The stylised RoRE range for **illustration 3** shown in Figure 17 captures:

- i) the financial rewards available to ambitious companies – as in illustration 2, this is shown as a 0.25% uplift to the baseline RoRE;
- ii) the higher powered cost sharing rate available to ambitious companies – as in illustration 2, this is shown as an increase in a symmetric cost sharing rate of 50% under the standard plan, to 55% under the ambitious plan;
- iii) the change to ODI incentive rates – this is the equivalent to illustration 2;
- iv) the introduction of a symmetric ODI range with more weight placed on comparative ODIs – this is shown by balancing the magnitude of ODI rewards to be the same as the magnitude of ODI penalties at PR14, within this range, the weighting on comparative ODIs is also increased; and
- v) the potential for companies to earn larger, longer-term ODI rewards where innovation has led to industry leading levels of performance – this is shown as an additional uplift to the P90 performance figure on ODIs, and is representative is significantly above commitment levels of performance. This additional potential to earn larger ODI rewards could be facilitated through a removal of caps on some ODIs.

Figure 17: Stylised RoRE for illustration 3



Source: PwC analysis

Considerations when appraising illustrations

5.27 Having summarised the two illustrations in the tables and figures above, we now discuss the key considerations when comparing each. For each element we recap the rationale for the potential rebalancing, the characteristics of each illustration and the considerations that are relevant when appraising each.

Ambition

Rationale for rebalancing

5.28 Section 4 of the report set out the risk that the financial rewards for enhanced companies did not fully align the interests of companies and customers.⁹⁷

Characteristics

5.29 Under both illustrations, it is the aggregate level of ambition that is being captured (rather than ambition at the specific output level). The measurement of ambition is focused on those components that are readily quantifiable and is assessed with reference to the change in a company's own historical ranking as well as performance relative to the rest of the industry.

⁹⁷ These financial rewards were in addition to reputational benefits, procedural benefits and the benefits from the 'do-no-harm principle'.

Considerations when appraising illustrations

- 5.30 There are two key considerations when appraising the introduction of ambition into the initial review of business plans.
- 5.31 First is the magnitude of potential benefits offered to companies for achieving ambitious status. This covers the size of any ex-ante financial rewards – akin to the financial reward provided to enhanced companies at PR14. It also covers the calibration of performance conditional incentives such as ODI incentive rates and totex cost sharing rates. The stronger these incentives, the larger potential protections for customers may need to be.
- 5.32 Second, following from the above, is through what means customers are protected against ambitious plans not materialising into improved outcomes. A high cost sharing in the event of underperformance of allowed totex may offer protection to customers. Other approaches which could lower risks to customers could be ex-ante assessments of the deliverability of plans, and ex-post assessments which could result in claw-backs under clearly specified circumstances. Irrespective of approach, these protections must not defeat the purpose of the incentive, which is to encourage ambition. Careful calibration is therefore required.

Innovation

Rationale for rebalancing

- 5.33 Section 3 of the report concluded Ofwat does not have a specific incentive targeted directly at innovation.

Characteristics

- 5.34 Under illustration 2 innovation is primarily delivered through a package ex-ante schemes and capability assessments with scope for Ofwat to also play a greater role in recognising innovation ex-post.
- 5.35 Under illustration 3, the package set out under illustration 2 is supplemented with greater use of ODIs in encouraging innovation. Under this illustration ODIs are used as a proxy for the rewards that would be available in a competitive market for successful innovation, and there is a commitment to rewards over a longer timeframe.

Considerations when appraising illustrations

- 5.36 When appraising illustrations, in the first instance, a decision is required on whether there is the sufficient need for explicit innovation incentives. For example, such an incentive could be justified where there is a demonstrable issue that the current set of incentives is failing to solve. In the second instance, there is a decision required over how innovation incentives are implemented. An extension to the current toolkit could be the addition of ex-ante funding or ex-post recognition of rewards alongside an ex-ante capability check. A more extensive reform would be to try and mimic the rewards available in a competitive market through the calibration of ODIs, recognising that the rewards for those projects that ‘succeed’ may need to be large.
- 5.37 With regards to ex-post rewards, we note that awards do already exist across the industry in various forms. So while there may be greater scope for Ofwat to contribute to such awards⁹⁸, it could be that the use of an ex-post review of innovation is best delivered by directly linking it to a capability assessment of company business plans. In other words, when reviewing the capability of a company to deliver innovation, a key factor could be the company’s record on innovation over the previous price control.

⁹⁸ Ofwat or industry bodies could also perform an information/ good practice sharing function, for example publishing case studies from winning projects/ initiatives from industry innovation awards.

The advantage of this linkage is that it may avoid the need for any assessment of capabilities to be overly input focussed – an assessment which otherwise could favour larger companies.⁹⁹

- 5-38 With regards to the use of ODIs to further incentivise innovation, there are two key considerations. The first is that there may have to be tolerance of very high rewards on successful innovations to offset the costs of those innovations that did not succeed. The second is that ODI rewards may have to span across control periods, as not all innovation will be suited to a 5-year cycle. Although accurate calibration of ODIs can be challenging, we note that at PR19 Ofwat will have built up a relatively large information set on performance throughout AMP6 – something which was unavailable at PR14.
- 5-39 With regard to ex-ante innovation we recommend that the bar for implementing an incentive should be high. For instance, there would have to be collective agreement that there was a market failure in a particular area that the current incentive regime was not adequately addressing. If the bar for ex-ante funding was set too low then there a risk to customers that companies receive funding for activities that may have taken place anyway in the absence of the innovation scheme.

ODIs

Rationale for rebalancing

- 5-40 The rationale for rebalancing ODIs is threefold. Firstly, the outturn RoRE range for ODIs in FY16 was much narrower than the FD RoRE range (although this is not necessarily surprising given a single year's data and the nature of a P10/P90 approach). Secondly, the asymmetry currently embedded into ODIs may potentially be deterring some innovation (see Appendix J). Thirdly, given the strong incentive power of relative incentives, customers may benefit from increased weight towards comparative ODIs.¹⁰⁰

Characteristics

- 5-41 Under illustration 2 the current balance of ODIs is largely retained. The key change, steeper incentive rates, is in recognition of the outturn RoRE in AMP6 to date being narrower than the FD RoRE range.
- 5-42 Under illustration 3 there is more extensive reform of ODIs, towards greater symmetry between rewards and penalties, and also the scope for ODIs which are outside of the typical price control cycle.

Considerations when appraising illustrations

- 5-43 We find that there are two key considerations with regards to ODIs. The first is whether there should be an extension of comparative ODIs compared to bespoke outcomes. More weight towards this type of incentive would potentially create more competition between companies; this has worked well for other incentives but has some key drawbacks. One drawback is that increased standardisation may fail to account for local customer preferences and also local factors that drive performance, and a second drawback is that an overreliance on relative assessments may unduly penalise a company which is improving but has not significantly improved its ranking relative to its peers. For these reasons we find that any extension of comparative ODIs needs to be carefully assessed against the potential trade-offs with the stated preferences of customers locally.
- 5-44 Our second consideration is whether there should be greater symmetry between rewards and penalties. Greater weight placed on rewards may mimic more closely the incentives of a competitive market. However, a transition to more symmetry would have to consider whether there was a need for offsetting adjustments elsewhere in the price control e.g. to the base level of returns. We note that such adjustments may complicate financeability analysis, and therefore cannot be considered in isolation.¹⁰¹

⁹⁹ We also note that an approach such as this should consider carefully the potential for virtuous/vicious cycles to form, and as such should be based on a mix of historical performance and forward-looking plans.

¹⁰⁰ We note there may be some conflict with localised customer preferences in this area.

¹⁰¹ Although the current ODI RoRE range is asymmetric, the mean outturn performance in FY16 has been close to zero.

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- 5.45 We note that recent company responses to Ofwat’s outcomes consultation also covered similar issues. While some companies were in favour of increased ODI power and symmetry, there were some responses against these proposals. In particular, responses against these proposals highlighted that:
- i) The current ODI system is in its infancy and should be given longer to have an effect before amendments are considered – companies also highlighted that frequent changes to the incentive regime could increase investor uncertainty and raise the cost of capital.
 - ii) Increased power and asymmetry of ODIs could lead to less predictability in charges and be counter to the stated preferences of customers.¹⁰²

Wholesale totex

Rationale for rebalancing

- 5.46 The totex menu is recognised as a complex element of the price control. Meanwhile, the power of the incentives it creates is relatively low. The rationale for rebalancing is either for the benefit of simplicity or for the benefit of increasing incentive power.

Characteristics

- 5.47 Under illustration 2 – the removal of menus - greater reliance is placed on other information revelation devices, primarily the initial review of business plans (i.e. the procedural, reputational and financial incentives that achieving fast-tracked and ambitious status provide).
- 5.48 Under illustration 3 – the reform of menus – the emphasis is on retaining menus but increasing their power to incentivise efficient expenditure forecasts (see Appendix G for a more granular discussion of menus).

Considerations when appraising illustrations

- 5.49 There are two key considerations when appraising the totex menu. The first is whether other information revelation devices in the initial review of business plans are sufficient to encourage efficient expenditure forecasts. If it is concluded that they are, then the removal of menus is likely to sharpen the balance of incentives. This conclusion is likely to involve a degree of subjectivity as it is hard to measure the extent of the benefits companies derive from the procedural and reputational benefits of being fast-tracked.
- 5.50 The second consideration is through which channel the reform of the menu should be made. On the one hand, reform could focus on the long-term rewards available to companies through the menus – this assumes management make decisions on a long-term basis. On the other hand, reform could focus on the additional income parameter of the menu, which provides greater cash-flows to the business in the short-term – this places more weight towards shorter-term incentives. In either case, we find that for menus to provide greater incentives for efficient expenditure forecasts in initial business plans a ‘final’ menu choice post-FD should not be granted – for a full discussion of menus see Appendix G.

¹⁰² However, as outturn ODI ranges are narrower than the ex-ante ranges, this suggests that increasing incentive rates might not actual lead to more variation in bills relative to PR14 expected levels.

Appraisal of illustrations

Table 10: Appraisal of illustrations

Incentive	Illus. #	Alignment of customer, company and investors	Practicalities of implementation	Risks to customers
Ambition	1, 2 and 3	<p>The calibration of rewards for ambition needs to weigh both the private benefit to companies and the net benefit to customers (including wider customer benefits from frontier shifting performance).</p> <p>Where ambitious status is awarded for performance relative to the industry and relative to a company's own historical performance there is greater potential for customers' interests to be aligned with companies and investors.</p>	<p>Implementing an assessment of ambition will be simplest for the quantifiable elements of business plans. However, these area should not receive all the weight in reaching a conclusion.</p> <p>In order to calibrate the scale of rewards for ambitious companies, the size of externality benefits to customers industry-wide from frontier shifts will need to be understood.</p> <p>Furthermore, to work in the interests of customers more broadly, more weight may have to be placed on the expenditure forecasts from initial company business plans.</p>	<p>A key risk is that ambitious plans do not materialise into outputs. Mitigants to this risk are discussed in Section 4.</p> <p>Equity issues may also arise where ex-ante financial rewards for ambition are funded by one set of customers while the benefits of a more stretching upper quartile efficiency challenge are enjoyed more widely.</p>
	1	<p>Where there are no incentives specifically targeted at encouraging innovation, alignment will be concentrated on innovations that are cost reducing over a five year time horizon.</p>	<p>None relative to current incentives.</p>	<p>None relative to current incentives.</p>
	Innovation	2	<p>Where a common issue across the industry is identified then an ex-ante scheme could better align companies with the interests of customers.</p>	<p>The size of any ex-ante fund and the specific award criteria used would need to be defined. However, this could be informed by approaches in place in other industries.</p>
3		<p>More market-like rewards could help deliver more innovation for customers but may require a high willingness-to-pay for the innovations which succeed (to counterbalance the probability of failure).</p>	<p>The calibration of rewards and penalties on ODIs to the likely probability of success and failure from innovation may involve some trial and error.</p>	<p>There is potentially a conflict between customer preferences and rebalancing towards more rewards. There are also risks from mis-calibration of incentive rates.</p>

ODIs	1	As the outturn for ODIs in FY16 is indicating a much narrower range than the PR14 RoRE range would suggest, currently there may be less weight towards ODIs than customers would prefer.	None relative to current incentives.	That there is insufficient weight on outcomes, leading to poorer service quality.
	2	Where incentive rates are increased, the outturn range for ODIs is likely to be better matched with the ex-ante RoRE expectation from PR14 – but continued customer engagement is required to assess whether this range is still matched to customer preferences.	Resetting incentive rates for many ODIs could be a complex undertaking, especially if non-linear incentive rates are proposed.	There is a risk that the outturn range over AMP6 as a whole is wider than the FY16 range meaning that an upward calibration of incentive rates over-strengthens incentive power relative to intended levels.
	3	Illustration 3 may better align the long-term interests of customers to that of companies and investors, but this approach would require careful calibration against customers' willingness-to-pay. Or, if there was deemed to be a market failure (for instance known behavioural biases in customers responses), then there may still be a role for the regulator to apply a different ODI structure to the stated preference of customers. At the company level there may be a trade-off between a preference for more market-like rewards and the costs of additional ODI complexity.	Three dimensions under illustration 3 may be challenging to implement due to potential for movement in risk sharing between companies and customers: (1) whether rewards would be fully symmetric with penalties; (2) the maximum time period over which ODIs could be set; and (3) standardisation issues from greater weight on comparative ODIs.	There are material calibration risks in setting up ODIs in this manner for the first time.
Totex	1	In Section 2, we highlighted the financial strength of incentives to reduce costs. However, the complexity of menus may mean there is only weak alignment between customers and companies on initial business plan expenditure forecasts.	None relative to current incentives.	None relative to current incentives.
	2	The removal of menus reduces complexity but to ensure the interests of customers are aligned with companies other information revelation devices will need sufficient strength to reduce asymmetric information challenges.	Alternative cost sharing arrangements will be required to replace the sliding scale in the current menu. The strength of other information revelation devices may need to increase.	That the asymmetric information advantage of companies could increase – leading to less downward pressure on expenditure forecasts.
	3	Reform of the menu may better align the interests (short and long-term) of companies with customers and increase the incentive power around submissions.	Reforming the menu is complex and requires careful consideration. For example there is no 'right' answer on how powerful the cost sharing incentive should be.	Does not address the issue of complexity.

Conclusion

- 5.51 Overall, based on FY16 data, we tentatively find that there is evidence in favour of rebalancing the current incentives in place. In some cases this could involve increasing the strength of existing incentives (e.g. incentives rates on ODIs or the slope factor in menus). Such rebalancing could incentivise companies to increase their focus on outcomes that aligned with the interest of customers.
- 5.52 The precise merits and drawbacks of the illustrations outlined above will depend on the development of Ofwat's methodologies for PR19. In particular, they will depend on:
- i) the development of the initial review of business plans;
 - ii) the operation of cost assessments;
 - iii) the result of the outcomes and cost of debt consultations; and
 - iv) the weight placed on current market data when setting the cost of equity (see Appendices A to C).
- 5.53 However, irrespective of these developments, the appraisal set out in this section should help guide Ofwat's future policy decisions regarding the balance of incentives.
- 5.54 Wherever rebalancing occurs, Ofwat will need to be mindful that any increased incentivisation requires careful calibration and the possibility that there will be higher variability in company performance. Given the analysis of variability of returns set out in this chapter for illustration 2, we do not think that a rebalancing will markedly change the risk profile of the sector, this should assist in ensuring that the sector continues attract to a range of finance. For illustration 3, where reforms are more substantial Ofwat should be mindful of overlaps between incentives and the potential interlinkages between increased uncertainty and required returns.

Appendix A – Assessing the continued validity of CAPM

In this appendix we assess the validity of the Capital Asset Pricing Model (CAPM), reviewing its critiques alongside a set of alternative approaches. We conclude with a recommendation on whether CAPM remains a valid approach for estimating the cost of equity at PR19.

A review of CAPM critiques and alternative approaches

Use of the CAPM remains the core regulatory approach for setting the cost of equity in UK regulation. This is because of its academic heritage, relative ease of calculation and ability to provide investor transparency regarding the calibration of the allowed returns. This view was recently confirmed by the UK Regulatory Network:

“The Capital Asset Pricing Model (CAPM) is used as the primary approach in estimating the cost of equity and has been reinforced by some regulators with other evidence including transaction evidence and comparison with other regulated sectors.”¹⁰³

Use of the CAPM also allows a consistent comparison of relative returns across regulated assets. However, the CAPM model has a number of long-standing criticisms. Three common criticisms are that:

- The model is not empirically accurate when fitted to observed returns;¹⁰⁴
- There are missing explanatory factors from the baseline model;¹⁰⁵ and
- The assumptions underlying the model are not closely matched to actual investor behaviour.

Despite these criticisms, there is a dearth of widely supported alternatives. We have undertaken a brief review of alternative approaches. Below we set out four potential alternatives to the CAPM framework, and outline whether they are appropriate substitutes for the current approach.

1. **Fama French three-factor model** – One alternative specification of CAPM is the Fama-French Three Factor Model. Fama and French (1992) found that size, and book-to-market ratios add to the explanation of expected stock returns provided by market betas and hence developed the Fama-French Three Factor Model. The formula for the model is as follows:

$$R_i = \beta_i \cdot EMRP + s_i E(SMB) + h_i E(HML)$$

Where:

R_i is the return on equity capital

$EMRP$ is the equity market risk premium

β_i the sensitivity of security i to EMRP

$E(SMB)$ is the extra return expected for small capitalisation companies

s_i is the sensitivity of security i to E(SMB)

¹⁰³ UKRN (2016), “*Cost of Capital – Annual Update Report: 2015-16. Information Paper*”

¹⁰⁴ Tests of the CAPM from literature frequently reject the model statistically. Regression outputs find that the intercept is greater than the average risk-free rate, and the coefficient on beta is less than the average excess market return. This is true in studies by Douglas (1968), Black, Jensen and Scholes (1972), Miller and Scholes (1972), Blume and Friend (1973), Fama and MacBeth (1973), Fama and French (1992), and Fama and French (2004).

¹⁰⁵ Another empirical test explored in literature is to analyse whether market betas sufficiently explain expected returns. If this is not the case, then there could be other explanatory variables missing from the CAPM model. It was hypothesised that ratios involving stock prices have information about expected returns missed by market betas. For example, Basu (1977) showed that when common stocks are sorted on earnings-price ratios, future returns on high P/E stocks are higher than predicted by the CAPM.

$E(HML)$ is the extra return expected for companies with high book-to-market ratios
 h_i is the sensitivity of security i to $E(HML)$

However, subsequent academic evidence on company size as an explanatory variable has shown that there is a lack of consensus on the direction of impact. Additionally, the relevance of book-to-market ratios, a proxy for financial distress, is limited for a regulated industry such as water because of Ofwat's financeability duty.¹⁰⁶

More recently, Fama and French (2014) set out a 'five-factor' model which also includes parameters for profitability and investment patterns. Where 'profitability' captures the difference between returns on diversified portfolios with robust and weak profitability, and 'investment patterns' captures the difference in returns between portfolios of stocks with low and high investment firms. While the authors say the five-factor model performs better than the three-factor model, when applied to a regulated sector such as water and sewerage there are reasons to suspect the impact of these additional terms are immaterial. Firstly, allowed return on regulatory equity is set using an industry-wide cost of equity, restricting any variation in ex-ante profitability. And secondly, investment patterns are likely to be similar across the set of regulated companies as compared to the stock market as a whole.¹⁰⁷

2. **The addition of a skewness factor** – Where a regulated business faces asymmetric risks, the CAPM framework can be augmented with an additional skewness factor.¹⁰⁸ This expanded form of the CAPM has conceptual and empirical support as investors typically require a premium for investing in businesses with profile of potential returns which are skewed to the downside. However, our analysis of UK utilities undertaken for the CAA found limited empirical evidence for adjusting the CAPM for UK utilities.¹⁰⁹ Where downside risks are present our earlier work suggested these can be appropriately considered when setting cost performance targets.
3. **Arbitrage Pricing Theory (APT)** – APT is a multi-factor model using fundamental economic variables, such as interest, inflation and business outlook, which are considered to be important in determining how sensitive a stock is to market risk factors. The formula for the model is as follows:

$$R_i = RFR + (B_{i1}K_1) + (B_{i2}K_2) + \dots + (B_{in}K_n)$$

Where:

R_i is the return on equity capital

RFR is the risk free rate

K_1, \dots, K_n is the expected risk premium associated with each unit of risk factors 1 to n

B_{i1}, \dots, B_{in} is the sensitivity of the security i to each of the n risk factors

As an alternative model, some studies have shown APT may give a better explanation of investment returns in industries, but there is also general consensus that APT is complex and lacks transparency as theory does not specify what the systematic factors are.

4. **Qualitative beta** – In a more recent study by Fernandez (2014), the assumption around investor's expectation of homogeneity is challenged. Fernandez describes CAPM as an 'uninformed opinion' because whilst it is possible to determine the investor's expected beta for a company and his expected market risk premium, it is not possible to determine the expected beta and the expected equity market

¹⁰⁶ Consistent with the issues highlighted, Vo (2015) explored the application of the Fama-French approach to the Australian market, concluding that the adoption of this model into public policy is problematic.

¹⁰⁷ For example, while the Thames Tideway Tunnel is a very large investment, it is being delivered by an appointed infrastructure provider.

¹⁰⁸ This augmentation of the standard CAPM approach with a skewness parameter is discussed in Harvey and Siddique (2000), 'Conditional Skewness in Asset Pricing Tests', The Journal of Finance, volume LV, no. 3, pp. 1263-1295

¹⁰⁹ PwC (2013), 'Cost of capital for UK Designated Airports: Paper on the split cost of capital and skewed returns – prepared for the Civil Aviation Authority', April 2013.

risk premium for the market as a whole. As investors do not have homogeneous expectations, Fernandez states that we cannot determine these parameters.

Fernandez instead suggests the use of a “common sense beta”, which is a qualitative assessment of the beta value. Companies are assessed on a series of attributes and the risk each attribute has. Each attribute is qualitatively assessed for its contribution to risk and summed to form a value for weighted risk. This is then multiplied by a parameter to reach an equity beta value.¹¹⁰ Table 11 below shows a stylised example of this qualitative beta calculation.

Table 11: Qualitative beta assessment

Weight	Parameter	Risk					Weighted risk
		Low	Average	Substantial	High	Very high	
15%	Management	1					0.15
25%	Assets					5	1.25
5%	Strategy				4		0.20
15%	Op. Leverage				4		0.60
20%	Fin. Leverage		2				0.40
10%	Liquidity					5	0.50
5%	Access to funds			3			0.15
5%	Stable cash flow			3			0.15
100%	Beta of equity = 3.4 x 0.5 = 1.7						3.40

Source: PwC, Fernandez (2014)

This approach is not well suited to regulation, as a single allowed return is required for the estimating of industry wide prices. The implementation of an investor specific cost of equity would not be consistent with the notional approach adopted by Ofwat. Moreover, there is a high degree of subjectivity in determining the parameter used to calculate an equity beta point estimate (shown as 0.5 in the example above).

Having considered the four alternatives above, we find that there is no clearly preferable alternative to the current CAPM approach used by Ofwat and other UK regulators. However, from recent literature we do find support for using investor surveys as a complement to CAPM outputs.

Support for use of investor surveys - Recent academic work from Barberis et.al (2015) lends support to the use of actual investor expectations, to complement the findings from rational expectations models such as CAPM. Specifically, Barberis et.al (2015) conclude that:

“Survey evidence suggests that many investors form beliefs about future stock market returns by extrapolating past returns: they expect the stock market to perform well (poorly) in the near future if it has recently performed well (poorly). Such beliefs are hard to reconcile with existing models of the aggregate stock market. We study a heterogeneous-agent model in which some investors form beliefs about future stock market price changes by extrapolating past price changes, while other investors have fully rational beliefs. We find that the model captures many features of actual returns and prices. Importantly, however, it is also consistent with the survey evidence on investor expectations. This suggests that the survey evidence does not need to be seen as a nuisance; on the contrary, it is consistent with

¹¹⁰ This precise value used for this parameter determines the range within which beta outputs can vary. For example, if this parameter is set equal to 0.5, the lowest weighed average risk score possible is 1, and highest weighed average risk score possible is 5, then the possible beta range is 0.5 to 2.5.

the facts about prices and returns and may be the key to understanding them." [Emphasis added]

As using a mix of actual investor beliefs can help models capture features of actual returns, we find that this research lends support to regulators using outputs from investor surveys as a cross-check on CAPM outputs.

Conclusion

We do not find academic support for alternative approaches to the current CAPM approach typically used by UK regulators. Rather, we find that CAPM approach remains valid, but that a broader range of evidence can and should be used to calibrate both the inputs to and the outputs from the CAPM calculation. Consistent with the findings above, market based information, such as transactions and investor surveys provide a complementary cross-check to CAPM calculations.

Appendix B – The cost of equity in a ‘lower for longer’ era

Almost a decade since the global financial crisis, the Bank of England base rate remains ultra-low. The prospect of major central banks keeping the cost of borrowing low via their short-term interest rate decisions for a prolonged period of time is typically referred to as ‘lower for longer’.

As current market expectations indicate that the PR19 cost of equity is likely be set within this prolonged period of lower interest rates, it is important to understand the potential impacts of this lower for longer era on the cost of equity. Both here, and in Appendix C, we investigate these potential impacts. In this appendix we outline:

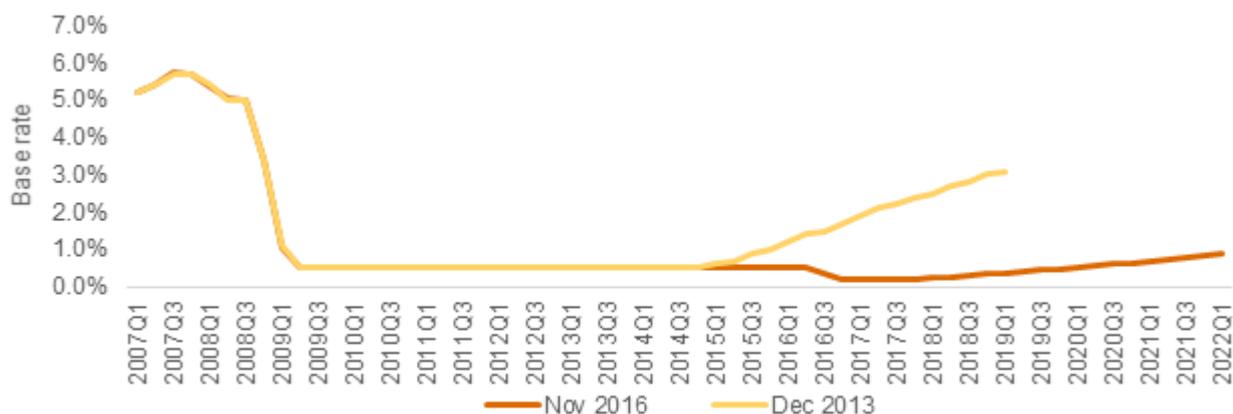
- The financial market context to the lower for longer era;
- Potential reasons for current ultra-low interest rates;
- The implications and relevance of a lower for longer era on current practice for setting the cost of equity;
- The approaches that are best suited to estimating equity returns in a lower for longer context;
- The contrast between historical and current market approaches to setting the total market return assumption; and
- The wider policy implications of the approaches used to estimate equity returns in this situation.

Appendix C then builds upon the findings from this appendix and provides estimates for the nominal and real cost of equity at PR19 based on prevailing market data.

Financial market context to the lower for longer era

As set out above, the lower for longer era is characterised by the current period of ultra-low short-term interest rates. The extension of expectations for lower interest rates can be seen in the history of OBR base-rate projections. Figure 18 below shows the base rate forecast at the time of the December 2013 Economics and Fiscal Outlook and contrasts this to the base rate forecast from November 2016.¹¹¹ This forecast shows the base-rate is expected to remain below 1.0% through to Q1 2022; representing a very significant softening of the rate outlook since December 2013.

Figure 18: OBR base rate forecasts

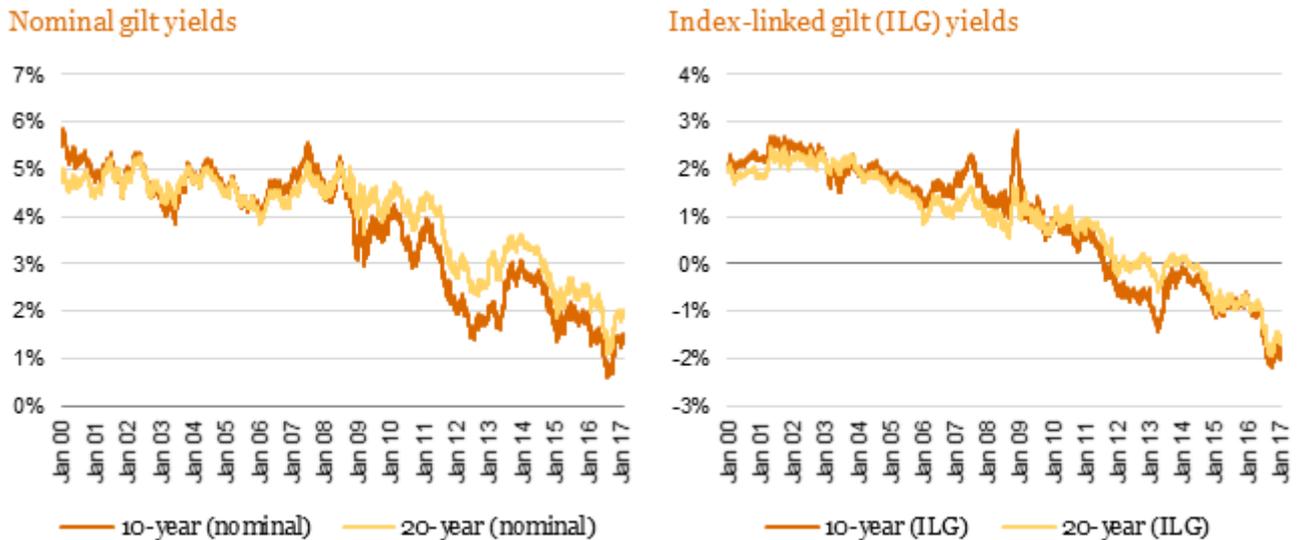


Source: OBR Economic and Fiscal Outlook

¹¹¹ Ofwat’s PR14 risk and reward guidance was published shortly after the OBR’s December 2013 forecast was cast.

These market expectations of lower short-term market interest rates, combined with the Bank of England's Quantitative Easing policies, have significantly impacted longer-dated UK gilt yields. This is shown in Figure 21 below. Having temporarily risen in 2013, UK gilt yields remain very low by historical standards. Recent yields on 10-year gilts have been close to 1.0%, while yields on index-linked gilts of the same maturity have recently been below -2.0%, but are currently slightly above this level.

Figure 19: UK gilt yields, 2000 to 2017



Source: Datastream, Bank of England

Consistent with the OBR forecasts set out above, expectations for interest rate rises have been gradual, as implied by gilt yields. This expectation can be captured by the difference between yields on longer-term gilts (e.g. 10-year yields) and shorter-term gilts (e.g. 2-year); where larger differences indicate a stronger expectation of rate rises. As Figure 20 shows, in 2010, expectations of rate rises were relatively strong, falling away through 2012 and resurging towards the second half of 2013. But since then the expected profile for future rate rises has significantly softened.

Figure 20: Slope of UK yield curve, 2010 to 2017



Source: Datastream

More widely, the term “lower for longer” has been applied to a range of advanced economies as their interest rates have also remained ultra-low. Recently, there has been some divergence between short-term interest rates across advanced economies, particularly in the US, where expectations of future growth have strengthened relative to that of the UK. However, this change to short-term rates in the US has not been accompanied by much movement in the long-end of the yield curve. This is because there are many potential reasons for rates to remain lower in the longer-term e.g. many advanced economies face the prospect of aging populations (see

subsection below for further discussion). Nevertheless, our focus here is on economic and financial conditions of the UK as these are the conditions that are most relevant to setting the cost of equity for the water sector in England and Wales.

Given the financial market environment and outlook for the UK set out above, the PR19 cost of equity will likely be set following a prolonged period of low interest rates. This contrasts to earlier regulatory determinations e.g. PR14 where the market evidence suggested that low interest rates were likely to come to an end. Therefore it is necessary to consider what the potential implications of this might be and whether the current approach needs to adapt. After reviewing the potential reasons for ultra-low interest rates, the next section will look at how cost of equity has previously been set and whether this is still appropriate in a period of extended low interest rates.

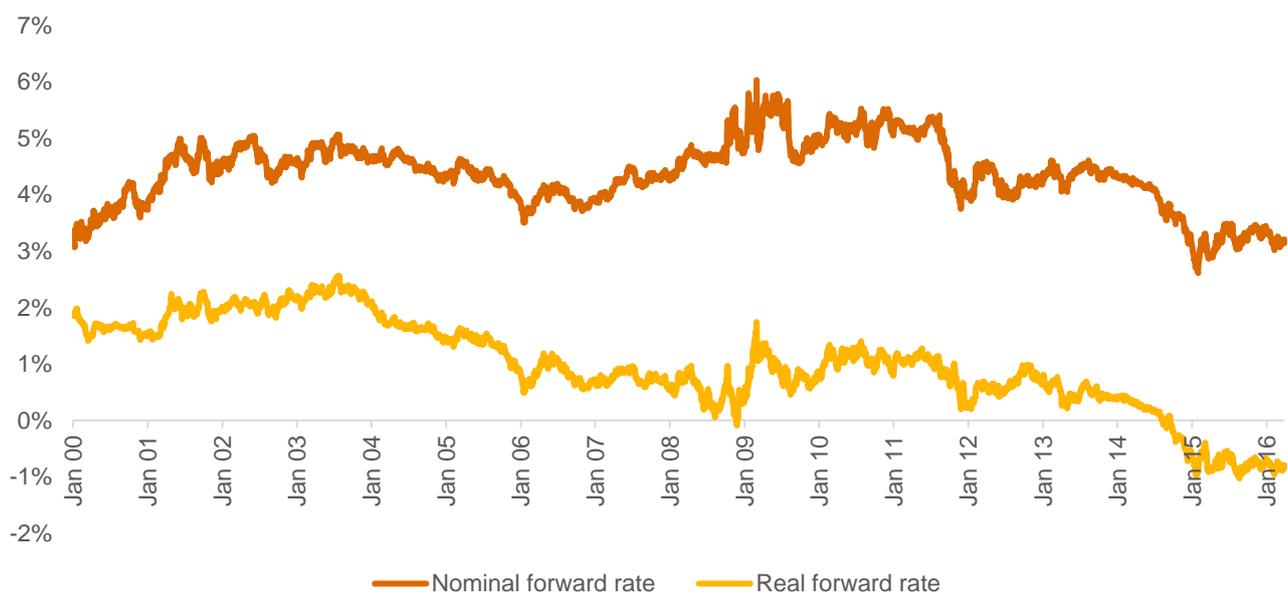
Potential reasons for ultra-low interest rates

It is helpful to understand the reasons for these current ultra-low interest rates. This is because regulators may chose different policies depending on whether ultra-low interest rates are merely cyclical or whether ultra-low interest rates represent a permanent structural change from historic norms.

Current ultra-low short-term interest rates are a monetary policy response to the financial crisis, the weak economic growth which followed and the need for structural recovery. However low long-term interest rates are driven by a broader range of factors.

Figure 21 below presents the evolution of the 10 year forward 10 year gilt rate. This represents the current market expectation of 10 year gilt rates in 10 years' time, and therefore provides a guide to the future direction of long-term interest rates (but is influenced by demand and supply conditions for Gilts, including the Bank of England's quantitative easing programme).

Figure 21: Evolution of the 10 year forward 10 year gilt rate ("10x10")



Source: Datastream and PwC analysis

Figure 21 demonstrates that the reduction in real interest rates from around 2% to below 1% pre-date the global financial crisis and continued a trend which began a number of decades previously¹¹². While there was volatility during the financial crisis, the expectations of future real interest rates remained around 1% until mid-2011. Similarly, expectations for future long-term nominal interest rates remained around 5% until mid-2011. This suggests that there was little change to the expectations of future long-term interest rates around the time of

¹¹² BIS (2003), "Long Term Interest Rates and Monetary Policy"

the global financial crisis; in other words the global financial crisis was initially perceived as having a (large) cyclical effect.

This picture changes from 2011, when expectations of future real interest rates started falling. This trend has continued until 2017, with a particular fall around the end of 2014. Expectations for future nominal rates have followed the same pattern, showing that it is the underlying real interest rate which is driving future expectations of nominal rates rather than changing expectations for future inflation.

The reduction in real interest rates is considerable by historical standards, matching the reduction from 2003 to 2007. This has been studied extensively and a number of factors have attributed to the decline in the real risk-free rates. These are:

- **Quantitative Easing (QE)** policies by the Bank of England specifically target long-term interest rates. These were introduced in January 2009 and over the period March 2009 to January 2010, £200 billion of assets were purchased, mostly long-dated Gilts. Subsequent waves of Quantitative Easing were announced in July 2012 (up to £375bn) and August 2016 (up to £435bn). Bank of England research has suggested that initial QE announcements successfully reduced long-term interest rates by around 1%¹¹³, but subsequent rounds had diminished effects.¹¹⁴ It is striking that the first wave of QE reduced long-term interest rates, but not the 10 year future 10 year rate (in Figure 23), again suggesting that initial market expectations around QE were that it was a temporary feature.
- **Expectations of future growth** may be linked to the real rate of interest. There are macroeconomic models which, in equilibrium, equate the real rate of interest to the real rate of economic growth¹¹⁵. Weak economic recovery, with a poor productivity performance has led some to reduce their expectations of future economic growth^{116 117}. However, current UK economic growth (1.8% for 2016¹¹⁸) is close to historical economic trends (2.1% for 1980 to 2016¹¹⁹) and consensus forecasts of future UK economic growth (2.0% for five years out¹²⁰). So there must be more long-term, fundamental reasons behind the scale of the reductions to the real risk-free rate.
- **An aging population** may reduce productivity and economic growth over the medium to longer term. Such trends are slow moving and more apparent in countries like Japan with an older population and lower inward migration – Japan has experienced very low interest rates for around two decades. Therefore these are unlikely to fully explain the significant reductions in the expectations for the real risk-free rate in the UK recent years.
- **A lower propensity to invest** may reduce the demand for money, which would depress the natural interest rate. Some economists have suggested that the rate of innovation and the absorption of new technology may be in decline, following a period of strong technical progress since the industrial revolution.¹²¹ Such views are consistent with weak investment post-crisis, but rarely supported into the longer term when the pipeline of emerging technologies are considered. The benefits of digitalisation of the economy are also in their infancy.

¹¹³ Joyce et al (2011) estimate that the Bank of England's first wave of asset purchases from March 2009 to January 2010, which involved purchasing a cumulative £200 billion of medium- to long-term UK government bonds, led to an average fall in 5 to 25-year gilt yields of about 100 basis points.

¹¹⁴ Haldane (2016) "QE: the story so far" Staff Working Paper No. 624

¹¹⁵ Ramsey, F.P. (1928), "A mathematical theory of saving", *Economic Journal*, 38, 152, pp543–559. Cass, D. (1965), "Optimum Growth in an Aggregative Model of Capital Accumulation", *Review of Economic Studies*, 37 (3), pp233–240.

¹¹⁶ For example Nouriel Roubini's posts available at www.project-syndicate.org

¹¹⁷ Summers, L. (2013), Remarks at the IMF Fourteenth Annual Research Conference, 8 November. Summers, L. (2014), "U.S. economic prospects: Secular stagnation, hysteresis, and the zero lower bound", *Business Economics* 49(2).

¹¹⁸ ONS, "Second estimate of GDP: Quarter 4 (Oct to Dec) 2016", 22 February 2017

¹¹⁹ Source: ONS series ABMI. Over the period 1960 to 2016 the average growth rate of UK GDP has been 2.5%.

¹²⁰ Consensus Economics, Survey Date October 10, 2016

¹²¹ Gordon, R.J. (2012), "Is U.S. economic growth over? Faltering innovation confronts the six headwinds", NBER Working Paper No. 18315, Cambridge, MA. Gordon, R.J. (2014), "The demise of U.S. economic growth: Restatement, rebuttal and reflections", NBER Working Paper No. 19895, Cambridge, MA

- **A higher propensity to save** was attributed as a significant factor driving the lowering of global interest rates in the mid-2000s¹²². This has been driven by increasing lifespans (relative to retirement ages), a peak of populations in their mid-life savings period (the “baby boomer” generation), with particularly strong trends in Emerging markets and China where there is less welfare state provision. These savings trends are potentially magnified by the growing financial interconnectedness of China with the rest of the world,
- **Shifts in the demand for safe assets and supply of safe assets** provide one reason which may be faster moving than some of the economic factors listed above. Indeed QE is one specific example. A lower global interest rate can be explained by increased demand for safe assets and/or reduced supply of safe assets. Increased demand for safe assets may come from investors during periods of elevated uncertainty, pension funds seeking low risk assets to meet long-term liabilities and/or sovereign states investing trade surpluses. Some studies have suggested the supply of safe assets has fallen following the financial crisis when securitisation markets became impaired.¹²³

There are further potential reasons why expectations for future real risk-free rates have fallen ranging from increasing inequality to the relative fall in the price of capital goods¹²⁴. In conclusion, all of these factors may play a role. What is striking is that most of these reasons point to long-term impacts. Some may unwind over time (such as the impact of the “baby boomer” generation and savings rates in China), but any unwinding is likely to be gradual.

We therefore conclude that current low long-term interest rates are likely to persist for the foreseeable future. Low interest rates are also likely to underpin low returns across all other asset classes.¹²⁵ This is consistent with much market commentary, which has focussed on both low interest rates, but also low returns across all asset classes. This sentiment is captured in the 2016 Credit Suisse Global Investment Returns Yearbook, a McKinsey report on the outlook for investment returns, recent Blackrock advice to its clients and valuation expert Professor Aswath Damodaran:

“As we continue to live in a low-return world, bond returns are likely to be much lower and there is no reason to believe that the equity risk premium is unusually elevated. Consequently, the real returns on bonds, equities and risk assets in general seem likely to be relatively low.”¹²⁶

“Our analysis suggests that over the next 20 years, total returns including dividends and capital appreciation could be considerably lower than they were in the past three decades. This would have important repercussions for investors and other stakeholders, many of whom have grown used to these high returns”¹²⁷

“The prospect of an extended period of low returns – and its potential effect on retirement – is an emerging challenge. BlackRock is one of 35 financial industry firms included in a consensus capital markets forecast compiled by Horizon Actuarial Services that suggests average annual returns for U.S. equities and bonds may be more than 3% lower than their averages for recent decades.”¹²⁸

¹²² Bernanke, B.S. (2005), “The global saving glut and the U.S. current account deficit”, Sandridge Lecture, Virginia Association of Economists, 14 April.

¹²³ Caballero, R. and E. Farhi (2014), “On the role of safe asset shortages in secular stagnation”, in C. Teulings and R. Baldwin (eds), *Secular Stagnation: Facts, Causes and Cures*, A VoxEU eBook, London: CEPR Press.

¹²⁴ International Center for Monetary and Banking Studies (ICMB), “Low for Long? Causes and Consequences of Persistently Low Interest Rates” October 2015

¹²⁵ For water stocks specifically, there is a strong historic correlation between equity prices and gilt prices. As such water stocks are sometimes referred to as ‘bond proxies’. This means that water stocks are higher, and therefore their implied cost of equity is lowest, when bond yields are also lower.

¹²⁶ Credit Suisse Research Institute, “Credit Suisse Global Investment Returns Yearbook 2016”.

¹²⁷ McKinsey Global Institute (2016), “Diminishing returns: Why investors may need to lower their expectations”, May 2016

¹²⁸ Blackrock (2016), “Long-term thinking in a low return world” October 2016

“For investors in the US and Europe who yearn for the normality of decades past, I am afraid that normal is not returning. We have to recalibrate our assumptions about what is normal (for interest rates, risk premiums, inflation and economic growth) and pay less heed to rules of thumb that were developed for another market (US in the 1900s) and another time.”¹²⁹

Implications of lower for longer on current practice for setting the cost of equity

Given the relevance of the current era of lower interest rates for longer, and likely impact on broader asset returns, we now explore the implications for setting the cost of equity, for regulatory purposes. Specifically, this subsection:

- Recaps current regulatory practice used in setting the cost of equity;
- Implications of a lower for longer era on the approach to estimating cost of equity; and
- Considers the role of current market approaches to set the cost of equity.

Regulatory practice in setting the cost of equity

Regulatory practice has been to use the Capital Asset Pricing Model (CAPM), to set the cost of equity. The CAPM formula applied is as follows:

$$R_i = RFR + \beta_i \cdot EMRP$$

Where:

R_i is the cost of equity

RFR is the risk free rate

$EMRP$ is the equity market risk premium

β_i the factor by which the $EMRP$ is multiplied to reflect the risk associated with a particular equity. β_i is equal to 1 for the market portfolio.

(TMR is the total market return which is the sum of RFR and $EMRP$)

In setting the cost of equity, UK regulators have tended to take more of a through-the-cycle view of required returns.¹³⁰ This involves the calibration of the cost of equity towards long-run historical averages for parameters such as the RFR , $EMRP$ and TMR . In the past regulators have appraised both the individual components of the RFR and $EMRP$ and the TMR in aggregate. Such an approach smooths out any short-term, cyclical variations and supports investor confidence by providing long-term stable returns on their long-term investments.

The justification of regulators for this approach has typically been that short-term market figures represent ‘temporary’ or ‘exceptional’ market conditions that will reverse as return expectations converge to longer-term mean values. These longer-term mean values have been informed by studies of long-run historical market returns. Two key studies which are often cited are Smithers & Co. (2003) and the CMA’s final determination for NIE.¹³¹ As noted by Wright and Smithers (2014), in contrast to the use of more current market evidence:

“the methodology originally set out in Smithers & Co’s 2003 report (Mason, Miles & Wright, 2003) to a consortium of UK regulators, and employed fairly consistently since then, [is] that the real market cost of capital should be assumed constant, on the basis of data from long-term historic averages of realised stock returns.”¹³²

¹²⁹ aswathdamodaran.blogspot.co.uk/2015/04/dealing-with-low-interest-rates.html

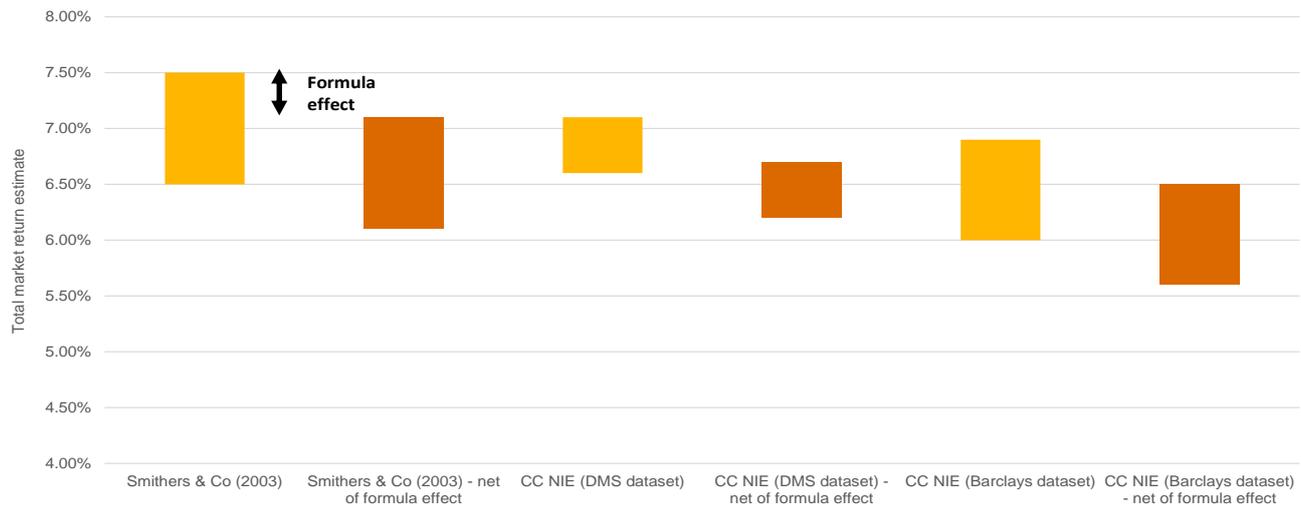
¹³⁰ There is some degree of variation in allowances due to market distortions; for example at PR09 a figure towards the top end of the proposed cost of equity range was selected due to market uncertainty.

¹³¹ For example, we note that the CMA’s analysis in the final determination for NIE prompted a consultation from Ofgem on their approach to setting equity returns.

¹³² Wright and Smithers (2014), ‘The Cost of Equity Capital for Regulated Companies: A Review for Ofgem’.

The conclusions of these studies are captured in Figure 22 below: ¹³³ ¹³⁴ ¹³⁵ ¹³⁶

Figure 22: Historical TMR estimates



Source: Smithers & Co, CC

Evidence of regulators setting a through-the-cycle cost of equity can be found in their use of historical equity return averages, and the relatively narrow range for EMRP and TMRs that have been chosen by UK regulators in the past. As shown in the table below point estimates of the TMR parameter in recent determinations have not varied outside a 6.25% to 7.25% range (real terms).¹³⁷

Table 12: Recent regulatory TMR estimates

Regulator	Applied to:	Year	Real TMR point estimate ¹³⁸
CC	Bristol Water	2010	7.0%
CAA	NATS	2010	7.0%
Ofcom	WBA	2011	6.4%
UREGNI	NIE	2012	7.0%
Ofgem	Gas Distribution and Transmission	2012	7.25%
UREGNI	NI Water	2012	7.0%
ORR	Network Rail	2013	6.75%
Ofcom	Business connectivity	2013	6.3%
CC	NIE	2014	6.5%

¹³³ Smithers & Co. (2006), in a later report for Ofgem on the cost of capital did not alter their view of a 6.5% to 7.5% range for TMR. However, Wright and Smithers (2014), concluded that a downward adjustment of 0.4% could be applied to their 6.5% to 7.5% range to account for changes to the RPI formula effect.

¹³⁴ The equity returns presented here are on an arithmetic average basis, consistent with the view of Smithers & Co (2003) that this was the most suitable basis for expected returns. Averages from geometric returns are lower than their arithmetic counterparts, for example, the long-run Barclays geometric average for real equity returns is 5.0%, while the equivalent for the DMS dataset is 5.4%. The CMA in their determination for NIE also noted that “*The simplest approach is to calculate the arithmetic average of historical returns... Since annual returns have been highly variable this approach requires looking at a long run of historical data.*” (para 13.139)

¹³⁵ The ranges for the CC NIE holding period returns analysis depict the range in which 80% of observations from Table 13.7 of the NIE final determination lie.

¹³⁶ The formula effect refers to the differences in the CPI and RPI driven by the different formulae used to construct the indices. The formula effect increased in 2010 due to methodological changes made by the ONS, and as such we adjust figures from historical studies to reflect this change.

¹³⁷ And since 2013 the range has been tighter still.

¹³⁸ The TMR is a component of the cost of equity. Each regulator has combined the TMR with activity specific betas in order to calculate the appropriate cost of equity.

CAA	Designated airports	2014	6.25%
Ofcom	Telecoms	2014	6.3%
UREGNI	NI Water	2014	6.5%
Ofgem	Electricity distribution	2014	6.5%
Ofwat	Water	2014	6.75%
Ofcom	Business connectivity	2015	6.3%
CMA	Bristol Water	2015	6.5%
UREGNI	NI Gas distribution	2016	6.5%
TMR range (2010 to 2016)			6.25% to 7.25%
TMR range (2013 to 2016)			6.25% to 6.75%

Source: final determinations by UK regulator.

Across a longer time-frame (back to PR94), we find that the TMR estimates from Ofwat exhibit more variation than the TMR range set out above, but do not depart too far from the historically guided ranges discussed (see the table below). This suggests that some weight has also been placed on current market developments.¹³⁹

Table 13: Ofwat TMR estimates

Price review	Total market return point estimate (real)
PR94	7.0%
PR99	6.25% ¹⁴⁰
PR04	7.7%
PR09	7.4%
PR14	6.75%

Source: Ofwat final determinations

In summary, a cornerstone of current regulatory practice in setting the cost of equity, including the RFR, EMRP and the TMR, has been to assume that divergences between current market conditions and long-term average are ‘temporary’ or ‘exceptional’ in nature. This assumption is visible in the relatively narrow range of point estimates selected by regulators for TMR.

However, where the divergence between current market conditions and long-term averages persists, which is the case in a lower for longer era, there is a likelihood that reliance on long-term approaches could overstate required returns for a considerable period. We discuss this challenge to current regulatory practice in the subsection below.

Implications of a lower for longer era on the approach to estimating cost of equity

1. Setting TMR as a primary assumption

When estimating the cost of equity, the market parameters of RFR and EMRP are required. The sum of these two parameters is the TMR. There are two approaches that can be used when estimating the cost of equity, the first is to ‘build-up’ to a TMR through individually estimating the RFR and EMRP, the second is to ‘decompose’ an estimated value for TMR into RFR and EMRP components. In other words, for the first approach the TMR is a by-product, but for the second approach it forms an integral part of the cost of equity estimation. In ‘normal’

¹³⁹ A key consideration for PR09 is that it was set at a time of significant macroeconomic uncertainty surrounding the global financial crisis. This was specifically factored into the allowance made.

¹⁴⁰ Inferred from published range of 5.5% to 7.0%

financial and economic conditions both approaches should deliver consistent results and UK regulators have historically used both approaches.

Smithers & Co (2003) argued against the first approach of ‘build-up’, as highlighted by Wright and Smithers (2014), their original work pointed to, “*the lack of any historical stability in the risk-free rate, and hence in estimates of the market equity premium.*”¹⁴¹ Adding that recent events affecting risk-free rate yields (e.g. quantitative easing) had, “*simply added to the weight of evidence against this approach.*”

We concur with the observations of Smithers & Co. and find that an approach which adds a constant (or relatively stable) estimate of EMRP to RFR would produce a relatively volatile TMR value – and hence a relatively volatility cost of equity allowance. For example, using DDM analysis (discussed later in this section) we find that direct estimates of the TMR are more stable than the sum of the RFR and a fixed EMRP – even where the EMRP is set such that the average TMR is the same under both approaches. This is shown in the table below. Furthermore, we also find that the minimum value for nominal TMR from the TMR build-up approach is extremely low, 6.3% in nominal terms – a figure which is hard to justify when cross-checked against other evidence sources. We therefore prefer direct estimation of the TMR on the basis of its relative stability.¹⁴²

Table 14 Relative stability of TMR approaches

Nominal terms (2000 to 2016)	TMR Direct	TMR Build-up
Average	9.4%	9.4%
Standard deviation	1.1%	1.3%
Minimum	7.6%	6.3%

Source: PwC analysis

Furthermore, as set out by Damodaran (2016)¹⁴³, the combination of an EMRP calibrated to historical data with a current RFR relies on the supposition that the EMRP has a low correlation with changes in risk-free rate. Where there is a stronger correlation, the addition of a largely unchanged EMRP to a changing RFR will be inconsistent with the available empirical evidence. Therefore, if there is relationship between RFR and EMRP, there should be less weight placed on historical EMRP figures – particularly when applied to a current market RFR figure which is a long way from historical averages.

Following the approach of Damodaran for the US market, we investigate the relationship between the implied equity risk premium (taken from DDM analysis) and the risk-free rate. As set out in the Figure below, our analysis of the relationship between EMRP and RFR for the UK market shows that there is a negative correlation over the period 2000 to 2016. We also note that this correlation strengthened over the 2010 to 2016 period.¹⁴⁴

This finding is consistent with the work of the Bank of England, who find that, “*the post-crisis fall in interest rates has not been accompanied by anything like the same reduction, it appears, in the cost of equity... this rise in the ERP has been working vigorously against the fall in risk-free rate.*”¹⁴⁵ Further corroboration is provided by Robert Barro who has shown how disaster risk – low-probability catastrophic events – can generate both low risk-free rates and a high equity premium.¹⁴⁶

¹⁴¹ See Wright and Smithers (2014), ‘The Cost of Equity Capital for Regulated Companies – A Review for Ofgem’.

¹⁴² The same average is achieved by adding the average EMRP for the whole period to each spot RFR figure for the ‘TMR build-up’. Over 2000 to 2016 the average implied EMRP was 5.7% and the average RFR was 3.7%.

¹⁴³ See Damodaran (2016), ‘Equity Risk Premiums (ERP): Determinants, Estimation and Implications – The 2016 Edition’.

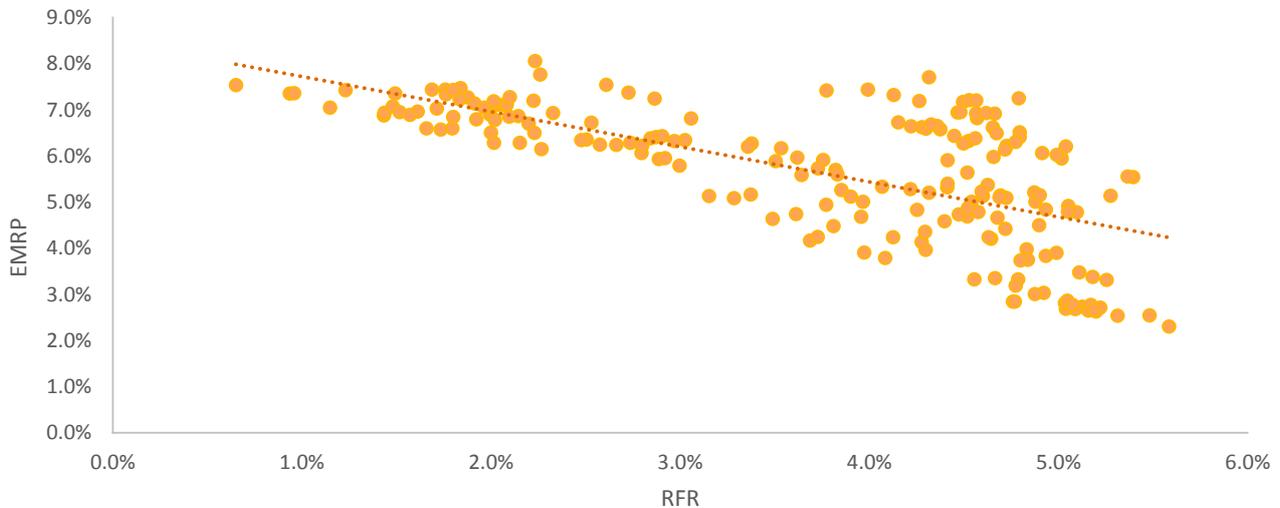
¹⁴⁴ The relationship had a gradient of approximately -0.76 for the period 2000 to 2016, for the period 2010 to 2016 the equivalent figure was approximately -0.88

¹⁴⁵ Martin Taylor (2016), Speech – ‘Banking in the tundra’, Speech given by Martin Taylor, External Member of the Financial Policy Committee, Bank of England, 25th May 2016.

¹⁴⁶ Barro, R. (2006), ‘Rare disasters and asset markets in the Twentieth Century’, *Quarterly Journal of Economics* 121(3), pp. 823-866. Barro, R. (2009), ‘Rare disasters, asset prices, and welfare costs’, *American Economic Review* 99(1), pp. 243-264.

A further finding of the analysis in Figure 23 (and the analysis of the DDM below) is that reductions in the risk-free rate are not perfectly offset by increases in the equity risk premium (and therefore the TMR is not constant). So while the TMR is less volatile using this approach, it is not a constant concept. In this regard we disagree with the earlier Smithers study (2003) which envisaged a broadly constant figure for the TMR.

Figure 23: Relationship between risk-free rate and EMRP from implied DDM (2000 to 2016)



Source: PwC analysis, Datastream

In summary, we find that in addition to the stability benefits of using a TMR approach (rather than a build-up approach), applying a historically estimated EMRP to a current market RFR may yield poor estimates of required total market returns due to the relationship between the two. This means we have a methodological preference for focussing on the TMR as a primary assumption, and then decomposing into consistent RFR and EMRP assumptions.¹⁴⁷

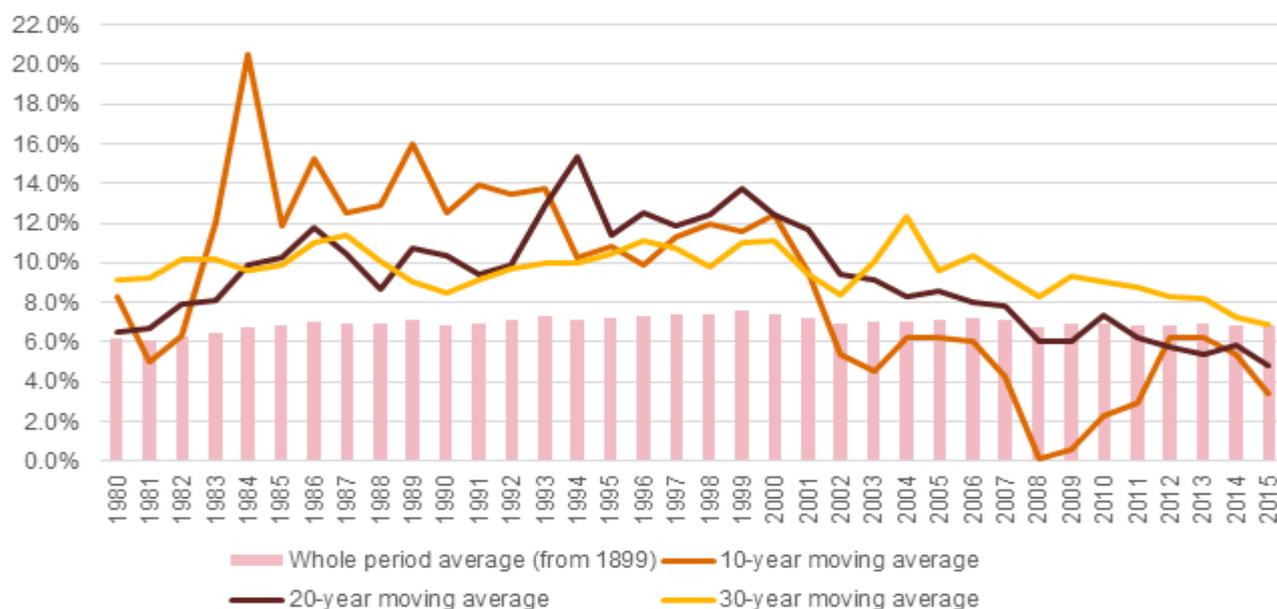
2. Use of historic averages

As set out above, current market interest rate conditions, and as a consequence returns, are expected to diverge from long-run historical averages for an *extended* period of time, covering multiple control periods. This lower for longer era therefore presents new challenges in estimating the appropriate cost of equity.

The second challenge relates to the use of historical averages. A critical disadvantage of historical approaches is that, by their nature, they cannot fully capture the characteristics of an extended period of exceptionally loose monetary policy. This is because the evolution of long-term averages is very gradual, failing to capture shorter-term dynamics, or structural breaks. This effect is demonstrated in Figure 24 below, where long-term moving averages of historic equity returns have fallen, as a consequence of low equity returns in recent history, but are falling at a slow pace. This is particularly true for the very long term averages.

¹⁴⁷ By consistent we mean that the RFR is determined on a current-market basis where the TMR has also been set on that basis.

Figure 24: Moving arithmetic averages of historic real equity returns



Source: Barclays equity gilt study, PwC analysis

This means that historical approaches are not necessarily a good guide to future returns given that the history of equity returns does not contain a comparable period of ultra-low interest rates. Such an approach can result in return assumptions which are materially different from current return expectations during a substantial portion, or even a whole 5 year price control.

What is therefore required is investigating techniques which can better match return assumptions to current financial market expectations. In the next subsection we review different approaches for assessing the TMR assumption. We then consider some of the advantages, disadvantages and policy implications of placing greater emphasis on current market assessment of required returns. Prior to that, as a point of reference, we set out the values the TMR, RFR and cost of equity could take under a historical, through-the-cycle approach:

TMR

Under a historic approach using long-run averages, the balance of empirical evidence supports a TMR figure close to 6.5%. In the CC’s final determination for NIE, the TMR range estimated on the basis of long-run historical datasets was 6.0% to 7.0%.¹⁴⁸ Some of this evidence is captured in Figure 22 above. While the TMR based on this approach is not fixed, it only evolves slowly, and we find that the most recent evidence continues to support a point estimate within this range. For example, the average arithmetic equity returns since 1899 according to the Barclays Equity Gilt Study dataset is 6.8% in real terms. Deducting from this a 0.3% figure in order to account for the change in the formula effect, we calculate a real, long-run, equity return of 6.5% - this is consistent with the figure used in Table 6 of Section 4. In nominal terms, a historical TMR is therefore approximately 9.5%.

RFR

Under a historic approach, the RFR methodology would consider a long-run of gilt yields – consistent with long-run equity returns data used in calibrating a historic TMR. Using historic averages from the end of 2016 back to 2000¹⁴⁹, the average yield on 10yr conventional (nominal) gilts has been approximately 3.7%, meanwhile the equivalent yield on 10-yr index-linked gilts has been approximately 0.9%.

¹⁴⁸ CC (2014), ‘Northern Ireland Electricity Limited price determination’, final determination, para 13.141.

¹⁴⁹ We use historical averages for the risk-free rate going back to 2000 partly due to data availability and because the real risk-free rate (index-linked bond returns) have shown marked long-term reductions, so a very long-term average will be less representative of future required risk-less returns.

Cost of equity

Retaining the gearing and asset beta assumptions from PR14 (see Appendix C for further discussion), we use an equity beta of 0.8 in estimating the cost of equity. On a real terms, RPI basis, we therefore calculate the real cost of equity would approximately be 5.4%, using a historical approach. This is lower than the PR14 real cost of equity, reflecting the slightly lower TMR point estimate used, and the continued decline in government bond yields that has taken place.

Approach to estimating equity returns in a “lower for longer” era

A cost of equity that is set with reference to current market-data driven estimates differs from the historical approach described above. Current market evidence on the cost of equity that can be used to calibrate the cost of equity incorporates both short-term market dynamics as well as long-run market expectations.¹⁵⁰

In assessing which current market approaches are most suited to calibrating the TMR we review five alternative sources and/or methods, using current data to provide illustrations of current figures for the TMR derived.

1. Dividend discount model (DDM)¹⁵¹

A DDM approach can be used to estimate a market implied TMR figure. DDM is a long established technique and is undertaken by a range of market analysts as well as the Bank of England – for example the CC’s 2014 determination for NIE sourced the Bank of England’s DDM analysis for the UK when arriving at their estimate for TMR.¹⁵² A multi-stage DDM model has the advantage of capturing both short-term expectations of future dividend growth as well as long-term expectations of future dividend growth, making it suited to the dynamics of a lower for longer scenario.¹⁵³

Recent academic work has found that the predictive power of market implied approaches such as this when fitted to actual returns are higher than competing methodologies¹⁵⁴. Specifically, using data for the US market, Damodaran found the technique with the best predictive power of actual returns over the following 5-years was recent averages of implied outputs such as DDM. A 2015 working paper by the Bank of England also found a similar result, which is that DDM can significantly forecast returns.¹⁵⁵

The main drawback of DDM analysis is the judgement required in selecting future dividend growth expectations assumptions¹⁵⁶. However, a sensitivity analysis can be performed to reach a range of outcomes.

The outputs from our monthly DDM analysis are shown in Figure 25 below. The TMR spot rate for December 2016 is 8.3% (in nominal terms), while the 5-year average of DDM outputs has been 8.8%. As cited above, recent academic work has found that averages of DDM type outputs e.g. a 5-year average, can have better predictive power than other approaches, however, the spot rate has the advantage of containing the most up to date market information. Therefore, estimates are helpful, but we caution against relying on any particular spot estimate given the inherent volatility of these approaches.

¹⁵⁰ For example, outputs from Dividend Discount Models or analysis of Market-to-Asset Ratios (MARs)

¹⁵¹ Also referred to as the Dividend Growth Model and the Gordon Growth Model

¹⁵² See Figure 13.6 of the CC’s final determination for NIE. The analysis shown by the CC was conducted in real terms and we note that it exhibited a similar profile to our own analysis set out above.

¹⁵³ For technical detail regarding the methodology and data used in our DDM analysis please see Appendix D

¹⁵⁴ See Damodaran (2016), ‘Equity Risk Premiums (ERP): Determinants, Estimation and Implications – The 2016 Edition’; this report covered the US market for the period 1960 to 2015. ‘Competing methodologies include corporate bond spread based multiples and historical average risk premiums.

¹⁵⁵ Chin and Polk (2015), ‘A forecast evaluation of expected equity return measures’, Working Paper No.520

¹⁵⁶ The detailed assumptions used in our DDM are set out in Appendix D.

Figure 25: Monthly DDM outputs, 2000 to 2016



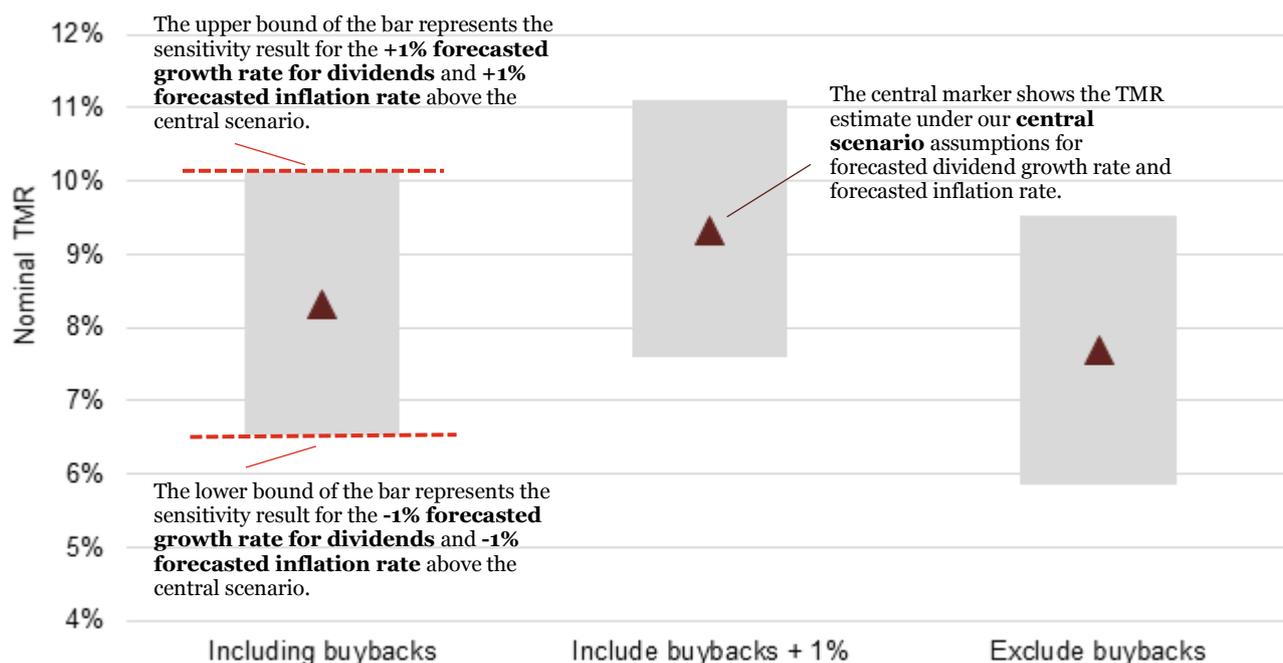
Source: PwC analysis, Datastream, Consensus Economics, Bank of England, PwC analysis

The analysis above shows the current level of implied TMR is low by historical standards, similar to those levels in both 2009 and 2000. It also shows that TMR estimates have been falling gradually since 2014; during 2012 and 2013 TMR estimates were frequently above 9%, but are now consistently below 9%. This downward trend is consistent with evidence from infrastructure investors, specifically, a similar required return analysis by HICL infrastructure which shows that total implied infrastructure returns have been falling since 2011 and that for the UK, the figure at 31st March 2016 was 7.5%, down from 7.8% the year before.¹⁵⁷

DDM outputs can be sensitive to the choice of inputs, so we have also conducted sensitivity analysis around the base case figures presented in Figure 25 above. This analysis tests the sensitivity of the TMR to three inputs (1) the real growth rate of dividends; (2) forecast inflation; and (3) share buybacks. The outputs of this analysis are shown in Figure 26 below.

¹⁵⁷ HICL Infrastructure, ‘Introductory Presentation – HICL Overview, the Investment Adviser & Recent Performance’, Summer 2016.

Figure 26: DDM spot output sensitivities



Source: PwC analysis

The three bars in Figure 20 above each represent a different sensitivity to the buybacks assumption in the DDM model.¹⁵⁸ The left-hand bar is based on our central share buyback assumption, the middle bar is based on the central assumption uplifted by 1% and the right-hand bar shows the outputs with zero share buybacks. In addition, the height of each bar represents the minimum and maximum outputs from the analysis where the forecast growth rate for dividends is allowed to vary by +/-1%, and the forecast inflation rate used in the analysis is also allowed to vary by +/-1%. The central marker shows the TMR estimates under our central scenario.

For example, the range from the sensitivities in the different growth scenarios including buybacks (the left-hand bar) ranges from approximately 6.5% to 10%. From this sensitivity analysis, we can also see that where buybacks have been included, under the central scenario, the nominal TMR estimate is around 8.3% whereas when buybacks have been excluded, under the central scenario, the nominal TMR estimate is lower at around 7.7%.

2. Inferred cost of equity from RCV premia

RCV premia (otherwise referred to as market-to-asset ratios or MARs) provide another point of reference in calibrating the cost of equity in a lower for longer era. There are two sources of RCV premia which we can use, (i) data from private transactions; and (ii) observed values from stock market data for listed companies on a frequently traded basis.¹⁵⁹

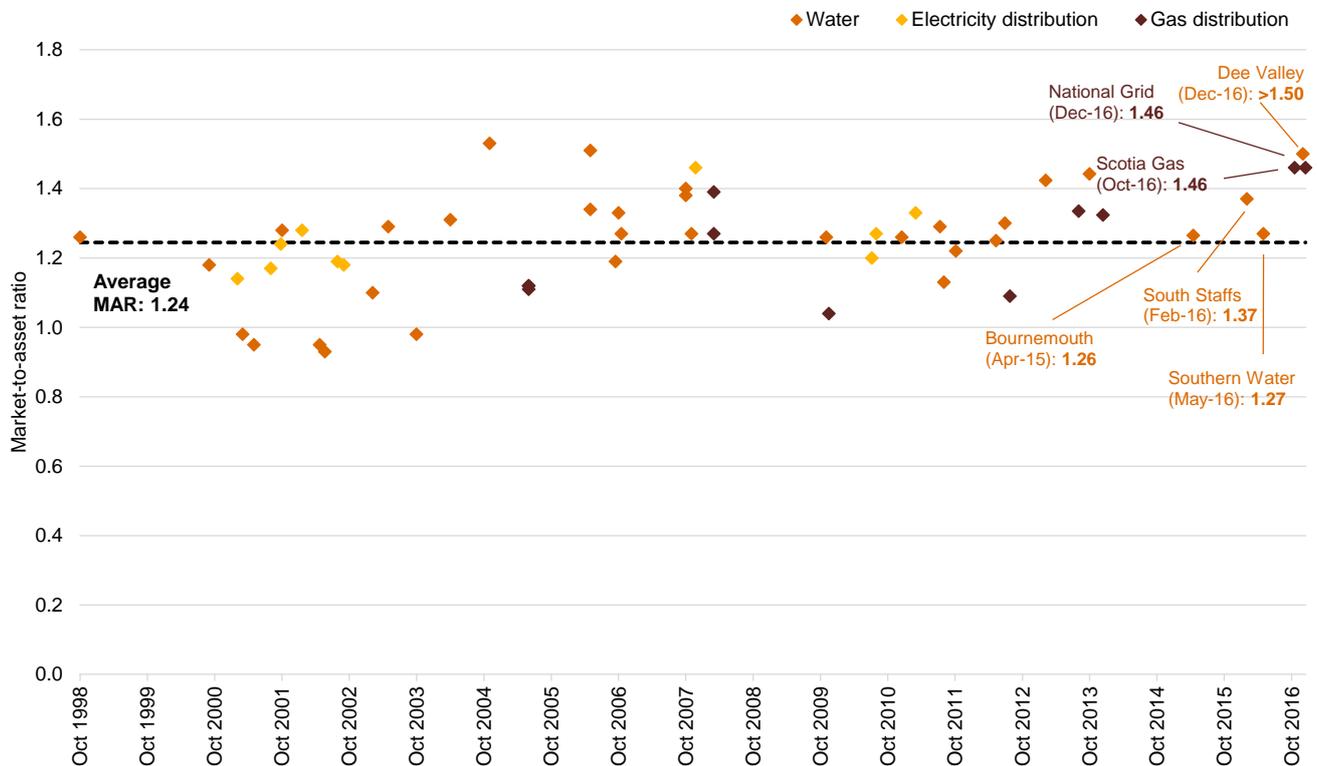
Using the former method, we have collected data from transactions of UK regulated utilities for the period 1998 – 2016 and calculated an average MAR of 1.25. We consistently find that MARs are above one, and that for

¹⁵⁸ Share “buy-backs” are an alternative method for companies to remunerate shareholders, i.e. in addition or instead of dividends. The implication of this for the DDM analysis is that stock buybacks also need to be included with dividends to calculate the overall cash return for investors, otherwise an important component of shareholder returns may be excluded from the analysis.

¹⁵⁹ For a company with the same level of outperformance projected and the same financing structure, there may still be a difference between the RCV premia from public (stock-market) and private transactions. This is because different types of investor will have differing preferences for risk and return. For example, the average investor in a listed company may have a higher discount rate, consistent with shorter average holding periods.

more recent transactions, the MARs have been above the long-term average, for example the RCV premia for two recent gas distribution transaction have been approximately x1.46. Towards the beginning of the period there were a few exceptions to transactions with MARs below one including, Welsh Water in May 2001, Southern Water in April 2002, and Wessex Water in May 2002. However, since 2004 the RCV premia for water and energy distribution has been consistently above one.

Figure 27: Market-to-asset ratio for UK regulated utilities, 1998-2017 ^{160 161}



Source: PwC Valuations, Macquarie

Note: Average MAR shown excludes multiples for South Staffordshire and Dee Valley for which there is greater uncertainty over the ratio value.

There could be two major factors driving the magnitude of recent RCV premia. The first is an expectation of outperformance relative to regulatory allowances e.g. cost or financing outperformance. The second is that the cost of equity allowed by the regulator is in excess of the required return of investors. In the absence of adequate assumptions regarding outperformance of regulatory allowances embedded in these private transactions we cannot disentangle the individual impact of these two factors.

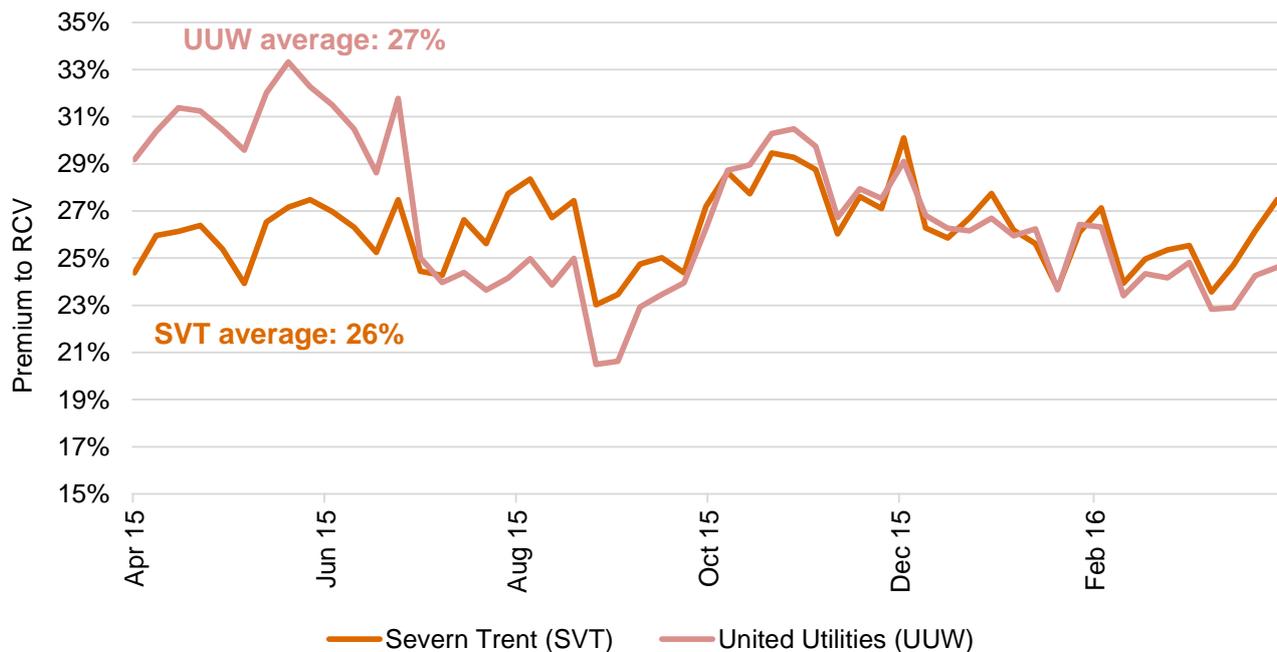
For listed companies, we can calculate RCV premia over time (see Figure 28 below).¹⁶² These show that the market value of water companies has recently been consistently higher than the RCV. However, unlike private transactions, there is more information available regarding investor assumptions about future outperformance – allowing the impact of requiring a lower rate of return to be isolated.

¹⁶⁰ Note on South Staffordshire Group ratio: global investment firm KKR sold its 25% stake in South Staffordshire Group – parent company of South Staffs and Cambridge Water – to Mitsubishi Corporation (“MC”) for £103.5m. Based on publically information available we have estimated a transaction implied EV/RCV multiple range of 1.22-1.52 (with centre point of 1.37 shown). This multiple range was derived based on the segmental analysis we performed in order to estimate the value of South Staffordshire non-regulated business valuation (estimated to be c. 35%-50% of EV).

¹⁶¹ Dee Valley multiple is sourced from Macquarie’s January 2017 report: “UK Utilities – The re-inflation trade: what public equity doesn’t get, private equity does”.

¹⁶² Pennon group plc is excluded due to the size of their non-regulated waste recycling and recovery business.

Figure 28: Implied premium to RCV, April-15 to Mar-16



Source: PwC analysis, Datastream

The advantage of this approach to inferring investor required returns is that it is grounded in market data and the expectations of market analysts – who are closely aligned to the investor community. The drawback of the approach is that there are differences in views of expected company outperformance and we are limited to the 2 pure-play listed water companies. As this approach does require such assumptions, we do not recommend that it is used in isolation, but is used as a complement to the DDM approach discussed above.

Our methodology for estimating the TMR implied from RCV premia is as follows:

1. Estimate the current trading premium to RCV based on market-capitalisation data (the analysis presented here was conducted at FY16 year-end).
2. Calculate the nominal present value of expected outperformance based on analyst expectations (covering totex, ODI, SIM and financing outperformance).
3. Deduct the present value of expected outperformance from the current trading value of the firm, and recalculate the RCV premium net of expected outperformance.
4. Infer current investor discount rates by calculating the discount rate required to reach an RCV premium of zero.¹⁶³
5. Given the current investor discount rate which has been inferred, apply a RFR and equity beta assumption to infer a TMR. This enabled broader comparison to other sources of information.

As set out in step 5 above, a RFR and equity beta assumption are required in order to reach an estimate of TMR. Consistent with PR14 we continue to use an equity beta assumption of 0.8, and for the RFR we use nominal inputs of 1.5% and 3.0% (see Box 3 for further details).

¹⁶³ This assumes there are no other material sources of value. Other potential drivers of value are non-regulated income, optimism bias, valuation of potential future opportunities and flight to safety effects – for these reasons this analysis should be done over multiple time periods rather than a single point in time in order to smooth out the effects of drivers such as these. With regards to non-regulated sources of income, we find these are very small for both SVT and UUW. As there remains some potential for other sources of value, this suggests the RCV premia approach should be used to calibrate the lower end of return requirements.

Based on these equity beta and RFR assumptions the RCV premia analysis produced the estimates of TMR set out in Table 15 below. The (nominal) TMR range produced from this analysis is 7.6% to 8.1%.

Table 15: RCV premia based estimates of TMR

Nominal terms	SVT		UU	
	Estimate low risk-free rate	Estimate high risk-free rate	Estimate low risk-free rate	Estimate high risk-free rate
Market-to-RCV ratio FY16 end		1.27		1.24
Premium attributable to outperformance ¹⁶⁴		0.15		0.14
Adjusted Market-to-RCV ratio		1.12		1.10
Cost of equity (inferred)	6.7%	6.7%	6.8%	6.8%
Equity beta (assumed)	0.8	0.8	0.8	0.8
RFR (assumed)	1.5%	3.0%	1.5%	3.0%
EMRP (calculated)	6.4%	4.6%	6.6%	4.8%
TMR	7.9%	7.6%	8.1%	7.8%

Source: PwC analysis, Capital IQ, Analyst reports, Datastream

Historically, transaction evidence shows that the RCV premia for M&A transactions have been higher than the RCV premia implied from listed companies.¹⁶⁵ On average, the additional premia in M&A transactions relative to the prevailing listed figure is approximately x0.2. If this additional premia is solely attributable to difference in M&A investor discount rates, then we find that the implied nominal TMR range could be as low as 5.5% to 6.0%.¹⁶⁶ However, there are several reasons why the additional premia is unlikely to solely reflect differences in discount rate. Firstly, there may be scope for greater outperformance through synergies; and secondly, there may be additional intangible value from aspects such as limited merger opportunities and having a controlling equity stake.

Furthermore, more recently, listed RCV premia appear to have converged to some extent with M&A transaction premia. Therefore, a historically guided additional premia of x0.2 may overstate the current differences between the transaction types. As a result, we find that 5.5% to 6.0% is likely to extend somewhat beyond a plausible lower bound for TMR. Nonetheless, a TMR implied by a blend of M&A transactions and listed company transactions may still lie below the 7.6% to 8.1% range based on listed company evidence alone.

The inferred cost of equity provides a benchmark for a regulator when setting the cost of equity, but this analysis can also be used to infer a TMR value, using assumptions for equity beta and risk-free rate. However, (adjusted) RCV premia could also be explained through a combination of lower beta and a higher TMR. We note that Wright and Smithers (2014) attributed energy transaction premiums to the investor beta being lower than the value selected by Ofgem, stating that:

“We are not in a position to comment on the strength of the evidence for a valuation premium. But we trust it will be evident that in our view, if there is a valuation premium, this does not reflect an incorrect assumption on the market cost of equity... most obvious alternative explanation [for the premium] – that was indeed pointed out in our earlier analysis for Ofgem is that it has arisen from Ofgem’s decision to assume a value of the CAPM

¹⁶⁴ Based on a sample of analyst report expectations.

¹⁶⁵ For instance see Macquarie – ‘UK water: the big splash’ – September 2016, or Credit Suisse – ‘UK Water – Revisiting the equity risk’ – July 2016.

¹⁶⁶ As produced by adding x0.2 to the FY16 end listed company premia set out in Table 17

“beta” close to one, despite strong evidence that it is much closer to around one half, thus artificially raising the cost of equity.”¹⁶⁷

Notwithstanding this point, we consider it is unlikely that premia can be fully attributed to a mis-calibration of beta, particularly for the water sector where there is beta data available from listed companies. However, irrespective of the combination of beta and TMR, the RCV premia analysis can be used to directly inform the cost of equity and again illustrates the importance of calibrating the overall cost of equity rather than its individual components.

In order to reach the inferred cost of equity figures shown in the table above (and by extension the inferred TMR figures) we have used an outperformance assumption.¹⁶⁸ Given that this assumption is subjective and will differ between different company analysts we consider in the table below some sensitivities around this figure. Specifically, we set out the implied cost of equity in nominal terms under a range of outperformance assumptions for a given market-to-asset ratio.

Table 16: cost of equity sensitivity to outperformance

Cost of equity (nominal)	Market-to-asset ratio								
	x1.00	x1.10	x1.20	x1.24	x1.27	x1.30	x1.40	x1.50	
Premium attributable to outperformance	x0.00	8.5%	6.9%	5.8%		4.9%	4.1%	3.5%	
	x0.05	9.5%	7.7%	6.3%		5.3%	4.5%	3.8%	
	x0.10	10.7%	8.5%	6.9%		5.8%	4.9%	4.1%	
	x0.14				6.8%				
	x0.15					6.7%			
	x0.15	12.3%	9.5%	7.7%		6.3%	5.3%	4.5%	
	x0.20	14.5%	10.7%	8.5%		6.9%	5.8%	4.9%	
	x0.25	17.8%	12.3%	9.5%		7.7%	6.3%	5.3%	

UU FY16 end

SVT FY16 end

Source: PwC analysis

Note: 8.5% nominal cost of equity is approximately equivalent to the PR14 real cost of equity of 5.65% (applying RPI of 2.8%)

The table shows that the inferred cost of equity is sensitive to the outperformance assumption adopted. For example, for a market-to-asset ratio of x1.30, the cost of equity with outperformance of x0.15 is 6.3%, while it is 0.6% higher, at 6.9%, for outperformance of x0.20. Using this approach, a range of outperformance assumptions that take account of differences in analysts’ views can therefore be adopted to generate an implied cost of equity, or implied TMR, range.

3. Competitive tender transaction data

Regulated projects, such as the Thames Tideway Tunnel (TTT), can also provide an indication for the cost of equity required by investors in the regulated water sector. The weighted average cost of capital (WACC) for this project was determined through a bidding process (of which the bid WACC was a part), in which private companies wishing to be appointed the infrastructure provider for the project submitted bids for their expected WACC. The outcome of this was a bid WACC of 2.497%.

¹⁶⁷ See Wright and Smithers (2014), ‘The Cost of Equity Capital for Regulated Companies – A Review for Ofgem’.

¹⁶⁸ Outperformance here refers to cumulative outperformance across totex, financing, ODIs and SIM.

From this bid WACC and with assumptions about the other variables in the cost of capital, it is possible to estimate an implied cost of equity. CEPA performed this analysis with the variables and assumptions listed below:

- Gearing – long term gearing level of around 57.5%¹⁶⁹ and short term gearing, up until the first price review that TTT is subject to in PR29, of 30% to 40%.¹⁷⁰ We also show a cost of equity at 62.5% gearing consistent with the notional gearing level used at PR14.
- Average cost of debt – CEPA noted that this is more difficult to estimate because it will depend on the provider's, (Bazalgette Tunnel Limited) assumptions of the future costs, hence they have modelled a range of cost of debt scenarios. The results of the analysis are presented in the table below:

Table 17: TTT cost of equity estimates

Element	Case 1	Case 2	Case 3	Case 4
Cost of debt	0.5%	1.0%	1.5%	2.0%
Cost of equity at 62.5%	5.8%	5.0%	4.2%	3.3%
Cost of equity at 57.5% gearing	5.2%	4.5%	3.8%	3.2%
Cost of equity at 30% gearing	3.4%	3.1%	2.9%	2.7%

Source: CEPA analysis¹⁷¹, PwC analysis

The range of implied cost of equity for the TTT ranges from 2.7% to 5.2% depending on the cost of debt and gearing assumptions used. This varies quite significantly from Ofwat's PR14 5.65% cost of equity, even when using the upper scenario of 57.5% gearing and 0.5% cost of debt, which suggests required returns for new build projects in wastewater are currently low.

However, the TTT bid WACC may not be directly comparable to the PR14 industry cost of equity due to being a large stand-alone construction project (involving building a tunnel under London) with a government support package for the project (and other bespoke regulatory mechanisms in place for the TTT). Taking these into account, Oxera calculated an implied cost of equity of 5.5%, closer to the Ofwat PR14 estimate. Their calculation involved making an adjustment by adding 50 basis points to the bid WACC to account for the liquidity allowance that TTT received as part of the revenue building blocks, and assumed a gearing of 62.5% with a cost of debt of 1.5%.¹⁷²

Nonetheless, this data point supports the view that required equity returns in the UK water sector are certainly no more than the PR14 allowance from Ofwat.

4. Survey data

One method for obtaining information on both the TMR and the EMRP is to survey investors on the returns they require. The challenge with the use of surveys is obtaining a broad and representative amount of survey participants with a consistent understanding of the survey question. Since investors also use a range of historic analysis and market-based measures to inform their views of expected returns, survey techniques should mirror more fundamental analysis (as set out above).

¹⁶⁹ Infrastructure News (August 19th 2015), 'Thames Tideway financial close due later this week' suggests a long term gearing level of c.57.5% is appropriate.

¹⁷⁰ CEPA briefing note (25th August 2015), 'Thames Tideway Tunnel – Cost of capital' suggest a range between 30-40% is appropriate – assuming that equity is drawn down first, then over a seven to ten-year construction period and until the first price review that TTT is subject to in PR29.

¹⁷¹ CEPA briefing note (25th August 2015), 'Thames Tideway Tunnel – Cost of capital', p.4

¹⁷² Oxera (2015) "Agenda: The Thames Tideway Tunnel: returns underwater?", September 2015

A 2017 survey of discount rates (TMR) applied by practitioners, investors and academics in the UK found that the mean value of the TMR was 8.1% - very similar to the spot TMR estimates from the DDM analysis above ¹⁷³.

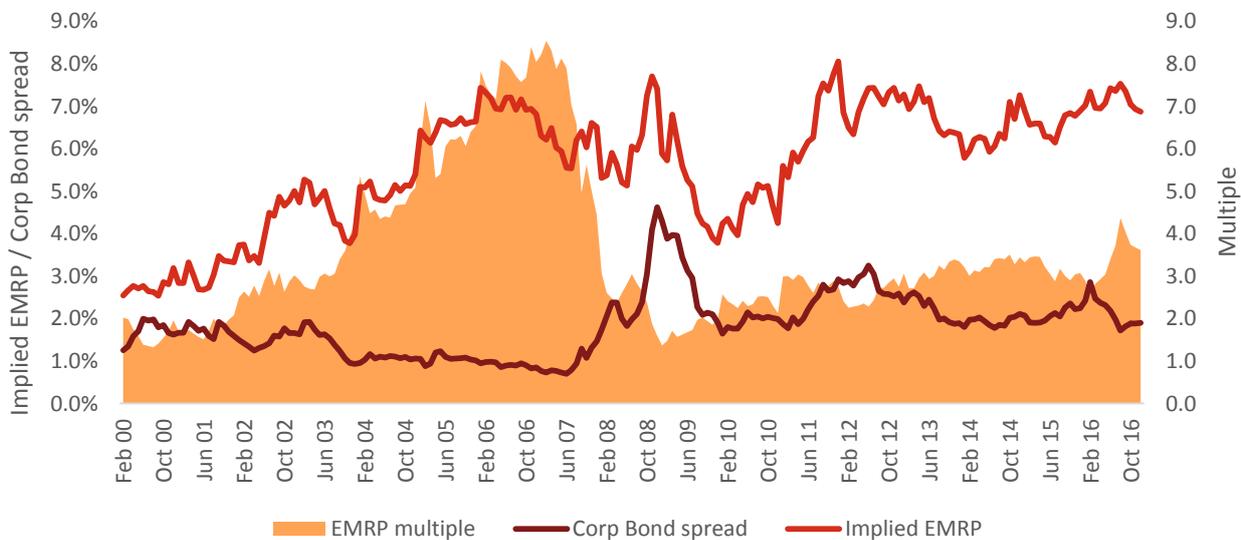
A slightly different form of survey data is provided by surveys of investment consultants. An example is Horizon Actuarial Services who survey 35 investment advisors¹⁷⁴. This particular survey covers the US market with a full spectrum of return assumptions, so the most instructive insight to take from this is the rate of change in those assumptions. The mean assumption for large cap long-term equity returns was 8.9% (nominal) in 2012, and by 2016 this had fallen to 8.1% (nominal).

5. Multiple of corporate bond spreads

Damodaran (2016) discusses the use of this approach.¹⁷⁵ It supposes that because corporate bonds and equities are both risky assets, over time they should exhibit risk premiums relative to one another that are consistent with their relative fundamental risk differences. If the spread associated with this fundamental risk difference can be observed and is relatively stable, then the estimation of EMRPs could be as simple as applying a multiple to corporate bond spreads.

To test this relationship for the UK market in the figure below, we compared corporate bond spreads (shown by the dark line) against implied EMRP outputs over the period 2000 to 2016 (shown by the lighter red line) and calculated the multiple of the EMRP outputs relative to the corporate bond spreads (shown by the shaded orange area).

Figure 29: Multiple of corporate bond spread approach



Source: PwC analysis

The output shows that the EMRP multiple has not been stable and can change significantly from year to year. Specifically, the multiple of EMRP over corporate bond spreads grew dramatically over the period 2003 to 2007 before rapidly declining. We therefore conclude that developing a ‘rule of thumb’ based approach that is a fixed multiple of corporate debt spreads is likely to be unreliable.

Contrasting historical and current market approaches

Above we set out five possible current markets approaches which can be used to estimate TMR. In the table below we summarise some advantages and disadvantages with these approaches compared to historical approaches.

¹⁷³ Fernandez, Pablo and Pershin, Vitaly and Fernández Acín, Isabel, Discount Rate (Risk-Free Rate and Market Risk Premium) Used for 41 Countries in 2017: A Survey (April 17, 2017). Available at SSRN: <https://ssrn.com/abstract=2954142>

¹⁷⁴ Horizon Actuarial Services. “Survey of Capital Market Assumptions, 2016”

¹⁷⁵ See Damodaran (2016), ‘Equity Risk Premiums (ERP): Determinants, Estimation and Implications – The 2016 Edition’

Table 18: Comparing approaches for estimating the cost of equity

Approach	Advantages	Disadvantages
Historical (long-term historic averages)	Offers bill stability for customers and return stability for investors – aligning the interests of both groups.	Can create intergenerational transfers if deviations from longer trends spans across control periods.
	Readily observable, and requires few judgements.	The backward-looking nature of this approach cannot fully capture the characteristics of an extended period of exceptionally loose monetary policy.
Current market data on required returns	Better matching of regulatory return assumptions to market return expectations.	Could introduce greater bill volatility for customers.
	Less risk of intergenerational transfers.	Possibly greater estimation challenges using market data and range of techniques/sources.
	The multitude of approaches provides scope for triangulation of estimates.	Typically greater judgement involved.

Source: PwC

We therefore find that historical approaches are not necessarily a good guide to future returns given that the history of equity returns does not contain a comparable period of ultra-low interest rates. As a result, current market approaches are better suited to a lower for longer era, but there are risks to this approach which require careful consideration. Firstly, current market approaches may not always align as well as they do currently, so difficult judgments may be required in future when current market evidence is contradictory. However, this is similar challenge faced by regulators in many other judgemental areas. In these situations, our recommendation is that regulators should seek to identify their best estimate of the correct assessment, however imprecise, rather than opt for an assessment which may be more precise, but precisely wrong. Maintaining the use of a historical approach in the current lower for longer era appears to fit the latter case: it is a more precise method, but demonstrably inappropriate in the current market environment. Secondly, current market approaches exhibit greater short-term variability, therefore, a balance needs to be struck between spot estimates and recent historical averages. Thirdly, employing current market approaches creates wider policy considerations regarding the balance between intergenerational equity and bill stability. We discuss this third point in greater detail in the subsection below.

Wider policy considerations of the cost of equity approach

A key policy consideration associated with a current market approach is the potential impact on bill stability. The impact of current market approach on bill stability can be seen by contrasting the TMR ranges under a DDM approach versus a historical approach. For example, the DDM analysis produced nominal TMR outputs from approximately 8% recently to 11% in the period 2005-2007, a range of 3.0%. Meanwhile, the historical approach set out by Smithers & co. focused on a narrower range of 1.0%.

In the table below, we set out an example of the potential impact of each approach on customer bills.¹⁷⁶

¹⁷⁶ For illustrative purposes we select a long-term historical TMR of 6.50% (which is also consistent with latest CMA precedent from the Bristol Water appeal), for a current market TMR we select an illustrative 5.54% based upon a 8.5% nominal TMR and 2.8% RPI assumption, using the Fisher equation to calculate the real TMR. These figures are not suggested values for each, but are used to demonstrate the impact of bill volatility.

Table 19: Illustrative impact of the potential TMR estimation approaches on customer bills

	PR14	Historical	Current market
Illustrative level of total market return (real)	6.75%	6.50%	5.54%
Variation in TMR range		1.0%	3.0%
Regulatory equity (industry, AMP6 average)		£23,653 m	
Allowed return (£m) ¹⁷⁷	£1,336 m	£1,277 m	£1,048 m
Number of households (m)		c. 24m	
Customer bill impact (£)	£56	£53	£44
Variation in typical customer bill due to variation in TMR values		£8	£24

Source: PwC analysis

From the table above, we can see that as a result of switching to a market based return, bills in the short to medium term could be approximately £9 lower (£44 compared to £53). The permanence of this bill reduction will depend on future market movements. However, the additional bill volatility from placing more weight on a current market based TMR is approximately £16 higher than the historical approach (£24 compared to £8). The net benefits to customers from this transition will therefore require careful consideration.

Conclusion

Based upon our review above, we conclude that there is sufficient information to support estimation of required total market equity returns using current market sources. Of the techniques set out above, the first three provide helpful empirical insights into current market returns and surveys can be helpful where they capture views from a sufficiently wide and representative investor group.

In addition, we consider that the TMR range produced from this approach should be combined with a forward-looking RFR. This RFR should be based on long-term gilts – consistent with the long-term investment horizon for equities.

¹⁷⁷ In order to calculate an allowed return figure, assumptions are used for the real risk-free rate and equity beta. These assumptions are outlined in further detail in Appendix C.

Appendix C – Estimating the cost of equity in a lower for longer era

Having set out our preferred methodology for calculating the cost of equity, in this appendix we provide an updated indicative nominal and real cost of equity range for the UK water sector. This builds on our analysis and conclusions from Appendix A and Appendix B. In the following section we:

- Briefly discuss the ranges we employ for RFR and TMR;
- Assess competing approaches for reaching an asset beta estimate;
- Set out an indicative nominal cost of equity range using the estimates we discuss above;
- Explain the impact of inflation (both RPI and CPI) on the cost of equity; and lastly;
- Set out an indicative real cost of equity range.

Total market return (TMR)

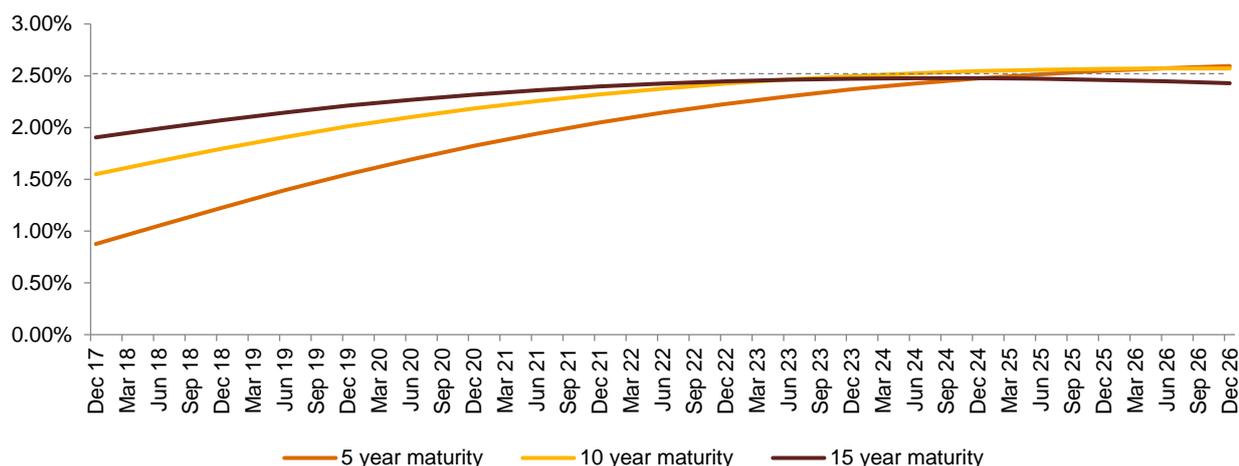
In Appendix B we set out a range of market data which can be used to support a calculation of the TMR. In conclusion, we find that current market approaches support the use of an **8.0% to 8.5% range** in nominal terms. However, we note that this range will move in line with market data and market expectations between now and PR19. Further, even if the overall TMR remains constant, a change in its composition, for instance the balance between the risk free rate and market risk premium, the cost of equity would be impacted.

Risk-free rate (RFR)

Consistent with the current market approaches set out above, our central estimate for the RFR uses forward-yields as implied by current nominal gilt yields¹⁷⁸. Figure 30 below shows the forward curve for a variety of gilt maturities, across both the 10-year and 15-year maturities, forward yields show that a central RFR estimate is likely to be close to 2.5% over AMP7.

¹⁷⁸ Under the CAPM approach to calculating the cost of equity, the risk-free rate represents the return on an asset that has returns that are perfectly uncorrelated with movements in the market portfolio. In practice, such an asset does not exist and thus the true risk-free rate is not observable. In practice, the yields on “safe”, liquid, financial instruments, which are considered to have negligible default risk, are generally used as approximations of the risk-free rate. In the UK it is generally accepted that the yield on UK government bonds (gilts) can be used as a proxy for the risk-free rate.

Figure 30: Forward yields for nominal gilts (December 2016)



Source: PwC analysis, Bank of England

In order to account for the inherent uncertainty in forward yields we also consider a wider assumption range for the RFR. Given that recent nominal gilt yields have been close to 1.5%, a RFR of 1.5% would provide for no upward trend in yields between now and mid-AMP7, we therefore consider this a lower bound figure. We note that this is more consistent with evidence from forward yields for index-linked gilts – the yield curve for index-linked gilts is flatter across all maturities than for nominal gilts.¹⁷⁹ For the upper-bound, we consider a scenario where rate expectations in AMP7 are similar to those experienced in 2013 and 2014, when markets were signalling that rate rises were imminent, suggesting a RFR of closer to 3.0% mid-AMP7.

In order to take account of the inherent uncertainty in projecting future gilt yields from forward rates we consider a RFR of **1.5% to 3.0%** (this range is also used to infer TMR figures from RCV premia).

Asset beta

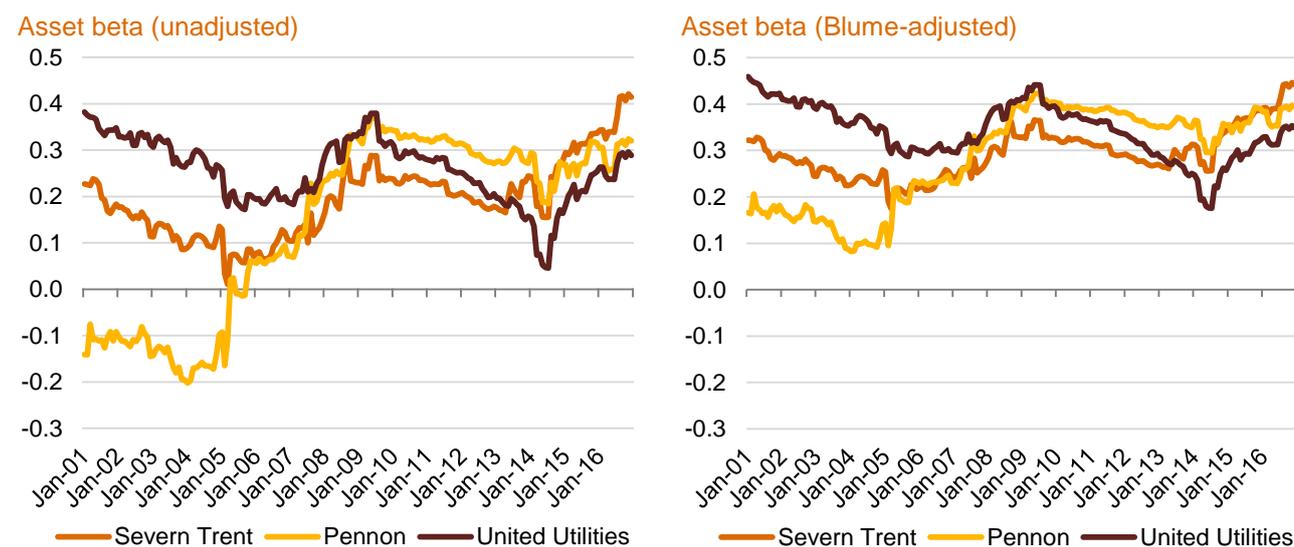
There is no single agreed upon methodology for calculating betas. We therefore review a number of approaches for estimating beta. Specifically we review, unadjusted beta estimates, Blume-adjusted beta estimates, Vasicek-adjusted beta estimates and the application of a Kalman-filter to beta estimates.¹⁸⁰

We begin with a review of unadjusted asset beta estimates relative to those that have been Blume-adjusted. A Blume adjustment weights the calculated equity beta towards a value of one before de-levering to reach an asset beta. On the other hand, an unadjusted asset beta is calculated by de-levering the ‘raw’ equity beta to obtain an asset beta. The outputs from these two techniques are shown in Figure 24 below.

¹⁷⁹ Unlike nominal gilts, index-linked gilts yields do not reflect RPI inflation risk. Where evidence from nominal gilts is used a small deduction for an inflation risk-premium can be justified.

¹⁸⁰ In all instances, the beta estimates shown are based on monthly total returns data of the listed WaSCs and of the FTSE All-share index.

Figure 31: Unadjusted and Blume-adjusted asset beta estimates, 2001 to 2016



Source: PwC analysis, Datastream

Over the period observed, raw equity beta estimates for listed WaSCs have typically been below 1.0, therefore, the effect of the Blume adjustment has been to increase the equity beta and also the resulting asset beta. In the 2015 determination of Bristol Water, the CMA preferred the unadjusted approach, stating that:

“we have not applied a Blume adjustment (unlike Ofwat) since, as in CC10, we do not consider that the evidence suggests that water companies’ betas converge to one (nor would one necessarily expect this for regulated companies).”¹⁸¹

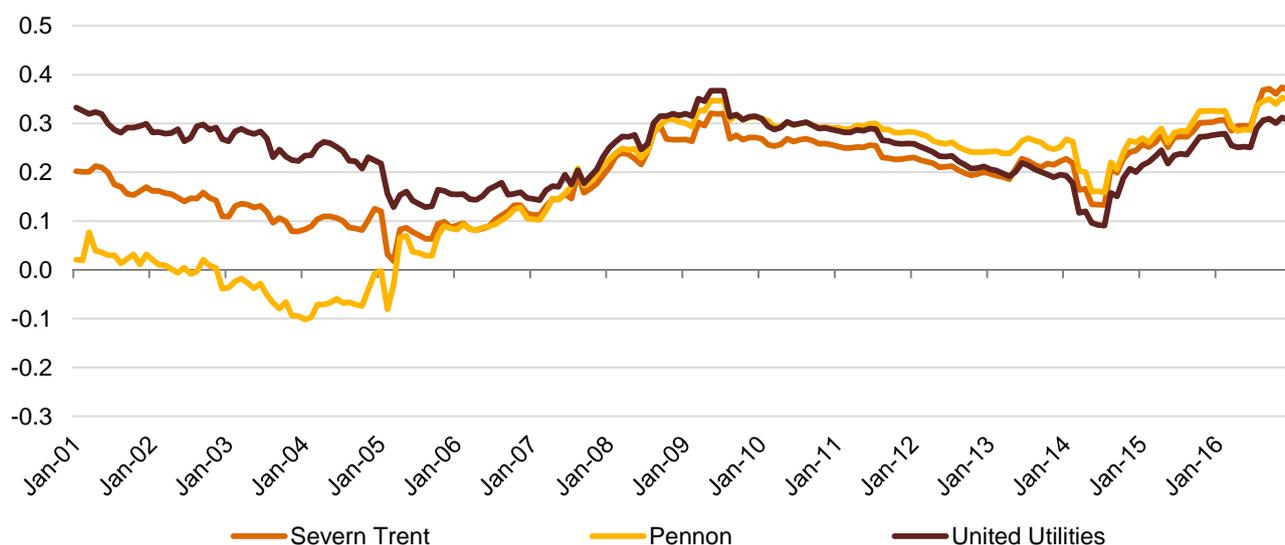
Following the approach of the CMA but updated for recent data we find that the average asset beta of the listed WaSCs is now above 0.3, but on a five year average basis is approximately 0.25. For Blume adjusted asset beta estimates, the current spot figures are closer to 0.4 but between 0.29 and 0.36 on a five-year average basis.¹⁸²

An alternative approach is to use Vasicek adjusted betas. The Vasicek adjustment weights individual company betas towards the industry average equity beta. Where the weight towards the average grows stronger as the standard error of the individual company beta regression increases. In other words, more precise regression estimates of equity beta are given more weight. The outputs from this approach are clustered in a narrower range, and on a current spot basis are on average close to 0.35 while on a five-year average basis are closer to 0.25. The outputs of this analysis are shown in Figure 32 below.

¹⁸¹ CMA (October 2015) *Bristol Water plc: A reference under section 12(3)(a) of the Water Industry Act 1991*, Final determination, Appendix 10

¹⁸² This analysis maintained the PR14 approach of using a debt beta of zero.

Figure 32: Vasicek adjusted asset beta estimates, 2001 to 2016



Source: PwC analysis, Datastream

Lastly, we consider whether the application of techniques such as a Kalman filter could improve beta estimation. We find that applying a Kalman filter approach to estimating beta provides a more stable beta spot estimate and may be a more accurate forward-looking approach if a structural break is thought to have occurred. However, if the beta used in the cost of equity calculation is based on a longer-term view of beta (i.e. not a spot estimate), then the additional value of applying a Kalman filter is not clear. NERA’s paper supports this saying “in certain conditions, it provides a useful check on results obtained using rolling-window OLS.”¹⁸³

Overall, we find that there are relatively small differences between competing beta approaches in recent years, and note that there is a degree of judgement involved in the setting of beta. Although we find that asset betas have increased since PR14, it may be too soon into AMP6 to propose an adjustment to the 0.3 assumed industry asset beta. We therefore retain this figure for the purposes of our analysis.

Nominal cost of equity

Combining the figures presented above, we calculate a nominal cost of equity that is applicable to the current low interest rate environment as ranging from **6.7% to 7.4%**. This is shown in Table 14 below.

Table 20: Nominal cost of equity under a lower of longer scenario ¹⁸⁴

	PR14	Low	High
Gearing		62.5%	62.5%
Total market return (nominal)		8.0%	8.5%
Risk-free rate (nominal)		1.5%	3.0%
EMRP		6.5%	5.5%
Asset beta		0.30	0.30
Equity beta		0.80	0.80
Cost of equity (nominal)	8.6%	6.7%	7.4%

Source: PwC analysis

¹⁸³ NERA (2016), ‘Estimating Equity Beta: What can a Time-Varying Approach Add?’

¹⁸⁴ We have not reviewed the suitability of a 62.5% notional gearing assumption and therefore maintain the PR14 value. The PR14 nominal cost of equity applied the fisher equation to the 5.65% allowed cost of equity using the PR14 RPI assumption of 2.8%. The ‘low’ and ‘high’ scenarios are set with respect to RFR and TMR, the EMRP is an output from these assumptions.

Estimation and application of inflation

At PR19, Ofwat has indicated that a portion of the RCV will be indexed to RPI, while the remaining portion will be indexed to CPI/CPIH.

In order to convert the nominal cost of equity presented above into both RPI real terms and CPI/CPIH real terms, a point estimate for each is required. In this section of this appendix we will present:

- Sources of evidence on inflation;
- An indicative estimate of inflation at PR19, and
- An application of inflation to a nominal cost of equity.

Source of evidence on inflation

For both CPI and RPI there are a number of sources of evidence available which can be used to estimate and inflation point estimate. These sources are set out in Table 21 below.

Table 21 Inflation evidence sources

Inflation index	Source	Type	Description
CPI	Bank of England	Forecast	Bank of England inflation report
	HM Treasury	Forecast	HM Treasury survey of forecasters
	OBR	Forecast	OBR economic and fiscal outlook
	Consensus	Forecast	Consensus Forecasts
	Actual trends	Actual	CPI trends sourced from the ONS
RPI	HM Treasury	Forecast	HM Treasury survey of forecasters
	OBR	Forecast	OBR economic and fiscal outlook
	Consensus	Forecast	Consensus Forecasts (only available for RPI-X)
	Actual trends	Actual	RPI trends sourced from the ONS
	Implied inflation	Actual	Bank of England yield curve data
CPI and RPI	Wedge between indices ¹⁸⁵	Actual	Based on ONS data

We now summarise the key outputs across the evidence sources listed above.

Forecasts

As shown in the table above, forecasts for both CPI and RPI are available from multiple sources. Consensus Economics and HMT are both based on polls of multiple forecasters, meanwhile the OBR and Bank of England forecasts are independent view from the respective organisations.¹⁸⁶ Below we set out current forecasts from all of these sources.

¹⁸⁵ There is a structural break in the wedge between RPI and CPI due to the change in the formula effect in 2010.

¹⁸⁶ PwC is a contributor to the HMT survey of forecasters.

Table 22: Current forecasts for CPI and RPI

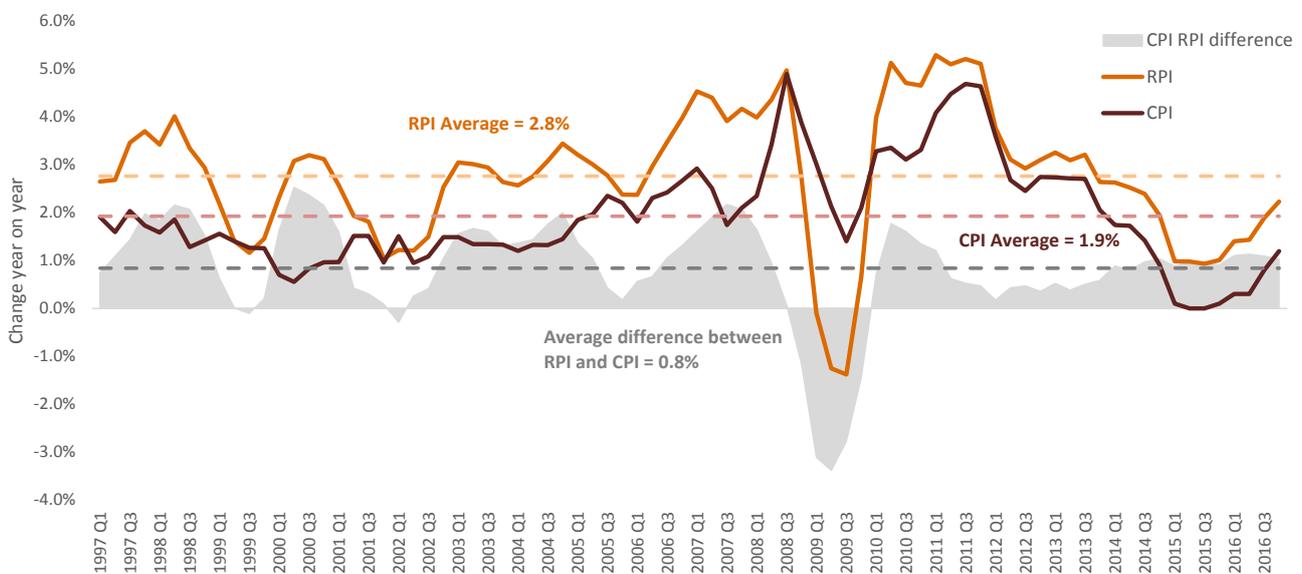
	Source	2017	2018	2019	2020	2021	2022-2026
CPI	HM Treasury	2.6%	2.8%	2.3%	2.1%	1.9%	-
	OBR	2.3%	2.5%	2.1%	2.0%	2.0%	-
	Consensus	2.3%	2.3%	2.2%	2.2%	2.2%	2.0%
	Bank of England	2.0%	2.7%	2.6%	2.4%	-	-
RPI	HM Treasury	3.5%	3.4%	3.2%	3.2%	3.3%	-
	OBR	3.2%	3.5%	3.2%	3.1%	3.2%	-
	Consensus (RPI-X)	3.0%	3.2%	3.2%	3.2%	3.1%	2.8%

Source: HMT, Bank of England, Consensus Economics, OBR

Actual trends and RPI-CPI wedge

Actual trends can provide useful historical context when selecting a point estimate for CPI and RPI. Figure 33 below sets out trends in inflation since the Bank of England’s independence in 1997.

Figure 33: Trends in RPI and CPI



Source: ONS

As shown, average RPI has been 3.3%, while CPI has averaged 2.6%. Another useful reference point is the average wedge between RPI and CPI, which has averaged 0.8% over the period. This historical relationship can help guide the calibration of CPI and RPI on a forward-looking basis.¹⁸⁷

Implied inflation

Another source of evidence – which is only available for RPI due to a lack of CPI indexed debt – is expectations of future RPI inflation inferred from gilt yields. Specifically, the difference between nominal and index-linked gilts. These expectations, as derived from longer-dated gilts are shown in Figure 34 below.

¹⁸⁷ This wedge is driven by a combination of the formula effect and the different compositions of RPI and CPI. The calibration of the wedge on a forward-looking basis also needs to monitor the potential impact of proposed changes to RPI in 2017. Specifically, the proposal to update the housing components of RPI for the new UK house price index introduced by the ONS. Although the Bank of England has commented that the change is unlikely to materially impact holders of index-linked gilts, they did note that the proposal was a fundamental change to RPI.

Figure 34 Implied RPI expectations from gilt yields



Source: Bank of England

As shown, current estimates from 10-year gilts are close to 3.0% while the equivalent figure for 20-year gilts are close to 3.4%.

An indicative estimate of inflation at PR19

We have previously recommended that Ofwat place most weight on the long-term RPI estimates calculated from market data. This is because a longer-term inflation estimates are consistent with the long-term financing of water companies. However, we note that the CMA placed more weight on shorter-term projections of inflation in their 2015 determination for Bristol Water. Specifically they commented that:

*“Use of a longer-term RPI ... would give little weight to projections of real financing costs on nominal fixed-rate debt over the relevant period, and might result in a divergence between allowed and actual financing costs over multiple periods. On the other hand, the use only of short-term RPI projections, as suggested by Bristol Water, risks giving insufficient weight to underlying trends in the real cost of debt over time ... a stable approach to the cost of capital over regulatory periods is consistent with investors making long-term financing decisions”.*¹⁸⁸

*Adding that, “On balance, we considered it appropriate to estimate a real cost of debt for a notional company based on RPI assumptions using a narrow range from five- to ten-year projections. Latest market data indicated that a suitable assumption for a ten-year notional RPI would be 2.7%.”*¹⁸⁹

Longer-term market evidence on RPI from gilts currently suggests that a figure of 3.0% or higher could be appropriate. However, combining this evidence from the table of forecasts above, we find that expectations of above target inflation in the short to medium is likely to be elevate these values. On a longer-term basis, more consistent with the 2019-2024 period under consideration, we find that CPI is expected to be on target at 2.0% and that RPI-X is expected to be 2.8%. Given the historical wedge of 0.8% between RPI and CPI, and RPI-X of 2.8% in a lower for longer environment where mortgage interest payments are stable is likely to be consistent with RPI of approximately 2.8%, we conclude that CPI and RPI point estimates of 2.0% and 2.8% respectively are suitable for indicative PR19 estimates.

¹⁸⁸ CMA (2015) Bristol Water Final Determination, para. 10.61

¹⁸⁹ CMA (2015) Bristol Water Final Determination, para. 10.62

The application of inflation to a nominal cost of equity

In order to calculate a real cost of equity, we require an approach which is consistent with Ofwat's current methodology for the cost of equity but allows for a real cost of equity in both RPI and CPI terms.

The start point for both RPI and CPI real terms cost of equity is the nominal cost of equity set out above (6.7% to 7.4%). To inform the approach to deflating the cost of equity to real terms we consider three possible approaches in the table below. Approach 1 retains all components of the cost of equity in nominal terms, calculates and nominal cost of equity and then deflates this nominal cost of equity figure at the end. Approach 2 estimates the EMRP using the nominal TMR and nominal RFR, and subsequently applies the EMRP that's been calculated to a real RFR when calculating the real cost of equity. Approach 3 estimates the EMRP using the real TMR and the real RFR, and subsequently applies the EMRP that's been calculated to a real RFR when calculating the real cost of equity.

Table 23: Approaches to deflating the nominal cost of equity¹⁹⁰

	Approach 1	Approach 2	Approach 3
Description	Apply inflation adjustment to calculated nominal cost of equity using all nominal components.	Calculate EMRP using nominal components and apply inflation adjustment to nominal risk free rate only.	Apply inflation adjustment to nominal risk free rate and nominal TMR and calculate EMRP using these real components.
When adjusting for inflation we apply the Fisher equation			
Gearing	62.5%	62.5%	62.5%
Asset beta	0.30	0.30	0.30
Equity beta	0.80	0.80	0.80
RPI	2.80%	2.80%	2.80%
Total market return (TMR)	8.00% (nominal)	8.00% (nominal)	5.06% (real)
Risk-free rate (RFR)	1.50% (nominal)	-1.26% (real)	-1.26% (real)
Equity market risk premium (EMRP)	6.50% (nominal)	6.50% (nominal)	6.32% (real)
Cost of equity (nominal)	6.70%	n/a	n/a
Cost of equity (real, w.r.t. RPI)	3.79%	3.94%	3.79%
CPI	2.00%	2.00%	2.00%
Total market return (TMR)	8.00% (nominal)	8.00% (nominal)	5.88% (real)
Risk-free rate (RFR)	1.50% (nominal)	-0.49% (real)	-0.49% (real)
Equity market risk premium (EMRP)	6.50% (nominal)	6.50% (nominal)	6.37% (real)
Cost of equity (real, w.r.t. CPI)	4.61%	4.71%	4.61%

Note: Figures presented a based on nominal 8.0% TMR and nominal RFR of 1.5%

¹⁹⁰ We have not reviewed the suitability of a 62.5% notional gearing assumption and therefore maintain the PR14 value.

The table shows that approach 1 and approach 3 both produce the same real-terms cost of equity. Under approach 2, where the EMRP is calculated using nominal components, but a real risk-free rate is used for calculating the real terms cost of equity, the approach leads to a higher overall real cost of equity.

We find that approach 1 and 3 are consistent with Ofwat's current methodology, which derives an EMRP using a real risk-free rate and a real TMR. Furthermore, we find that these approaches from a valuation perspective are consistent in NPV terms between an investment that uses a nominal WACC and a non-inflating asset base and an investment that uses a real WACC and an inflating asset base. For these reasons we recommend that Ofwat avoids approach 2 as under this approach there is a mismatch of real and nominal figures.

Had the table above been presented on the basis of an 8.5% nominal TMR and a 3.0% nominal RFR – consistent with a nominal cost of equity of 7.4% - the real cost of equity with respect to RPI would have been 4.47% and with respect to CPI 5.29%.

Conclusion

Overall, we find that a cost of equity calibrated to interest rates which have been and are set to continue to be lower for longer could range from 6.7% to 7.4%. This range is only indicative though and may move between now and PR19 depending on the development of the macroeconomic environment and the market outlook. In RPI terms we calculate that this is a real cost of equity of 3.8% to 4.5%, and in CPI terms we calculate that this is a real cost of equity of 4.6% to 5.3%.

Appendix D - Dividend discount model

The dividend discount model (DDM) is a common approach used to calculate the intrinsic value of an asset. It is a form of discounted cash flow (DCF) model and equates equity value to the present value of future dividends. In its simplest form it is expressed as follows:

$$V_0 = \sum_{t=1}^{\infty} \frac{D_t}{(1 + k_e)^t}$$

Where:

- V_0 is the intrinsic value
- D_t is the dividend value at time t
- k_e is the cost of equity

Varying layers of complexity can be added or removed from the version of the model set out. For example, the model can be amended to reflect a single period (perpetuity) model, a multi-stage model with a terminal value, or a multi-stage model with no terminal value can also be used. In addition, in multi-stage models the growth rate in dividends can also be amended.

Once an appropriate model has been specified, and given a known value for the parameter V_0 , one can solve for the cost of equity that is required to ensure that the present value of future dividends is equal to V_0 . We can then disaggregate the cost of equity into its constituent parts. Based on a CAPM formulation of the cost of equity of:

$$k_e = R_f + \beta_e(EMRP)$$

Where:

- R_f is the risk-free rate
- β_e is the equity beta
- $EMRP$ is the equity market risk premium

Where R_f and β_e are known, we are able to infer a value for the EMRP. This is what is termed as the “implied EMRP” estimate. It is defined as an ex ante (forward-looking) approach because it is based on expectations of future cash flows. We use this approach to estimate an EMRP for the UK using data on the FTSE All-Share index.

In formulating our implied EMRP estimates, we use a multi-stage DDM model, in which equity value is specified as:

$$V_0 = \frac{D_0(1 + g_s)^1}{(1 + k_e)^1} + \frac{D_0(1 + g_s)^2}{(1 + k_e)^2} + \frac{D_0(1 + g_s)^3}{(1 + k_e)^3} + \frac{D_0(1 + g_s)^4}{(1 + k_e)^4} + \frac{(D_0(1 + g_s)^5 + TV)}{(1 + k_e)^5}$$

Where:

- g_s is the expected short-term (5-year) growth rate
- TV is a terminal value calculated as:

$$TV = \frac{D_5(1 + g_l)}{(k_e - g_l)}$$

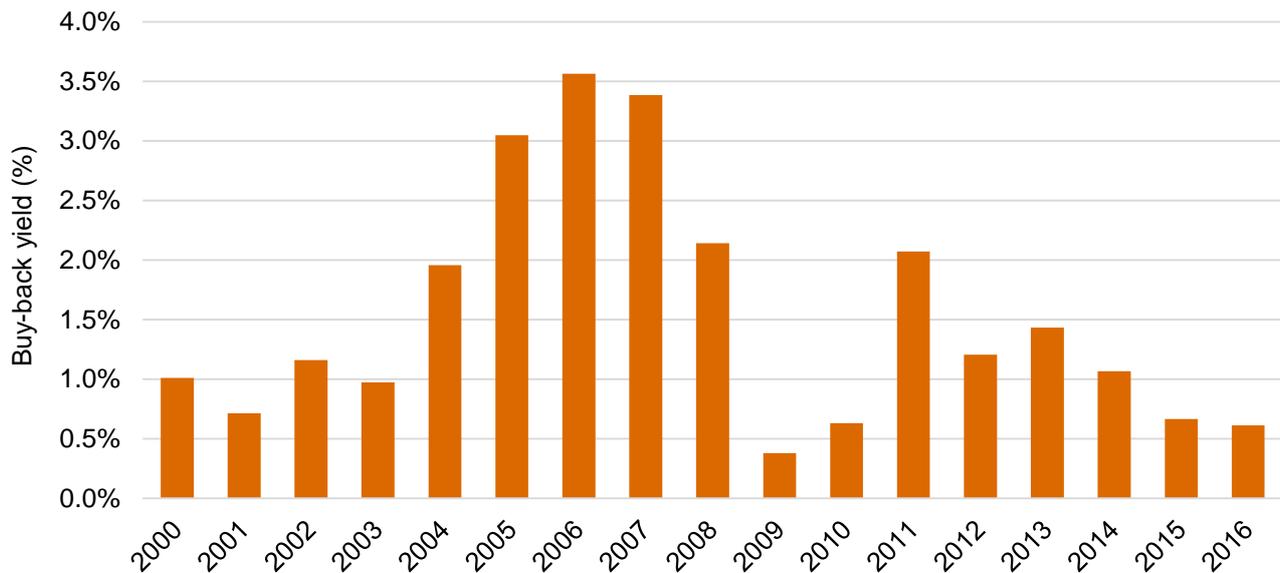
Where:

- g_l is the expected long-term growth rate

The dividend (D_0) in the formula above is calculated as the initial market value of the FTSE All-Share index multiplied by the observed “cash yield”, where the cash yield is made up of (i) a dividend yield; and (ii) a buy-back yield. The dividend yield represents the value of periodic cash dividends received by equity holder. Buy-backs are an alternative method for companies to remunerate investors, in which the company repurchases the equity from them, therefore making up another form of cash return for investors. The buy-back yield used in

our analysis is based on the value of actual buy-backs on the FTSE All-Share over time and is shown in Figure 35 below.

Figure 35: FTSE All-Share buy-back yield, 2000 to 2016



Source: PwC analysis, Capital IQ

The expected short-term and long-term growth rates (g_s and g_l , respectively) are nominal growth rates calculated from forecast real GDP growth rates and forecast inflation. Given that we are applying this DDM approach to the market as a whole, i.e. the entire FTSE All Share, we consider GDP growth serves as a reasonable proxy for expected dividend growth. Our GDP growth assumptions for the most recent 5-years in the model are set out below:

Table 24 Nominal GDP growth assumptions

Nominal GDP growth	Oct 2012	Oct 2013	Oct 2014	Oct 2015	Oct 2016
Compounded average short-term growth	4.2%	4.8%	4.6%	3.6%	3.7%
Long-term growth rate	4.0%	4.1%	4.2%	4.3%	4.0%

Source: Consensus Economics

Note: October editions of Consensus Economics contain both short and long-term projections for inflation and real GDP growth.

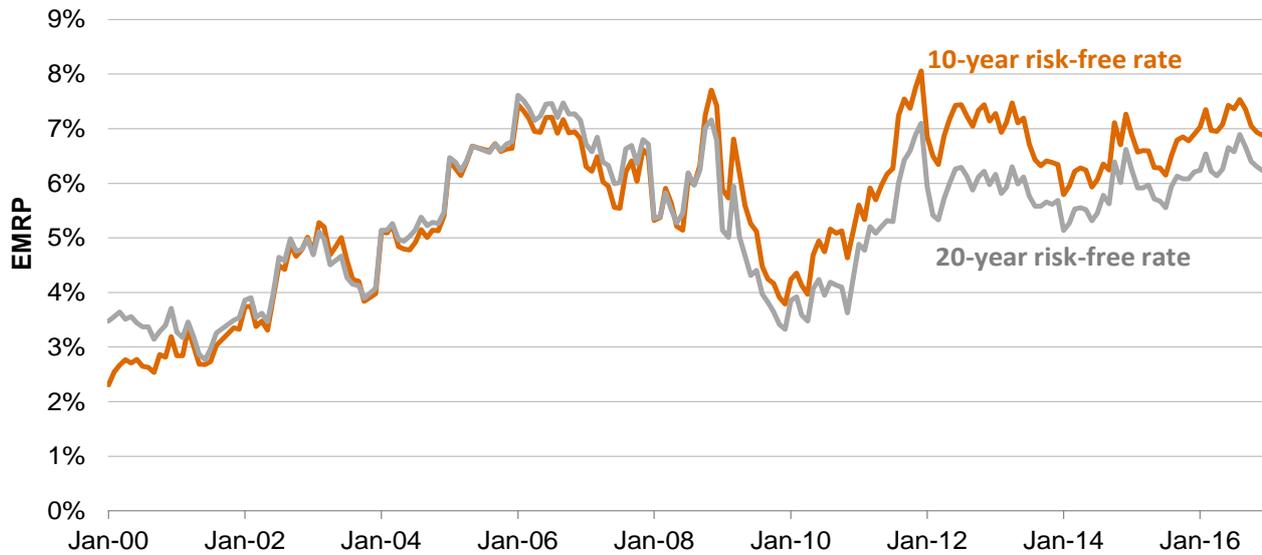
Whether this is a reasonable assumption was considered by the CMA in its final determination for Northern Ireland Electricity¹⁹¹. The CMA noted empirical evidence which suggests that the real growth in dividends has not matched real GDP growth, for example growth in dividends from 1980 had averaged 1.6% compared to 2.3% for real GDP growth. This may be explained by new companies (as opposed to existing companies) gaining a greater share of economic growth, or it may be explained by changes the way shareholders earn returns (with share buy-backs discussed above being an alternative). However, in the longer-term it would be difficult for investor earnings to grow at a different rate to the broader economy without a material shift in the structure of the economy and the distribution of income shares between capital, labour and government. Were the expected growth in dividends to follow historical experience then our DDM estimates could be a slight overestimate.

We infer the EMRP under two assumptions for the risk-free rate – (i) the spot-yield on 10-year UK nominal government bonds; and (2) the nominal spot rate on 20-year UK nominal government bonds that use the 10-year government bond as the risk-free rate. Given we are considering the market as a whole, the equity beta is, by definition, equal to one and therefore, the cost of equity can be expressed simply as: $k_e = R_f + EMRP$.

¹⁹¹ CC (2014), 'Northern Ireland Electricity Limited price determination', final determination, para 13.154.

Given values for all inputs besides the EMRP, we are able to solve for the EMRP that equates the intrinsic value of the FTSE All-Share to its actual value on a given date. This process is repeated on a monthly basis in order to calculate a time-series of the implied EMRP. The output of this analysis is shown in Figure 36 below.

Figure 36: Implied EMRP using DDM approach, 2000 to 2016



Source: PwC analysis

Appendix E – Incentive overview

In this appendix we provide an overview of the current incentives in place for the companies regulated by Ofwat.

Risk Based Review (RBR) of business plans

PR14 initiated a significant change to business planning expectations with a move away from prescriptive business plans. Ofwat adopted a RBR approach, which placed the responsibility and accountability for business plans with company Boards. In December 2013, all companies submitted five-year business plans that set out their proposed prices for customers and the level of service they expected to deliver for those prices.

Ofwat reviewed each business plan by testing for high quality in four key areas:

- **Outcomes:** The key proposed deliverables for current and future customers and the environment as well as the incentives associated with delivering them.
- **Costs:** Wholesale and retail costs in delivering the identified outcomes.
- **Risk and reward:** How the company proposes to balance the risk and the associate rewards for bearing those risks between customers, the environment, investors, and the company itself.
- **Affordability and financeability:** The expected impact on customers' bills and the company's ability to maintain financial sustainability.

Also considered was each company's performance against its business plan for the previous control period and the level of assurance provided by the Board.

Ofwat conducted separate tests for each element of companies' business plans (household retail, non-household retail, water wholesale, and sewerage wholesale) as well as additional tests at the whole-company level. Based on this assessment, companies were placed in one of three categories – Enhanced, Standard, or Resubmission.

There were a number of reputational, financial and procedural incentives created to encourage companies to develop high quality business plans as summarised in the table below.

Table 25: Summary of business planning incentives

Benefit	Summary
Reputational benefits	Ofwat's assessment and status were published providing companies with enhanced status and both public and investor recognition for the high quality of their plan.
Procedural benefits	Companies with an enhanced plan received an early draft determination (30 April 2014 vs. 29 August 2014 for most non-enhanced companies) providing more time to prepare representations, plan the delivery of capital plans and allow for earlier procurement of contractors. Two non-enhanced companies (Northumbrian and Dŵr Cymru) received an earlier draft determination on 30 May 2014 as their plans were high quality, but not sufficiently so to achieve enhanced status. The scrutiny with which plans are assessed and the associated regulatory burden is lower for companies submitting high quality plans.
Financial benefits	Companies designated enhanced status were eligible for an initial reward which could either be recovered in full during 2015-20 or added to the RCV and recovered over time. Enhanced companies could also access an enhanced costs sharing menu with a menu rate 5% above the standard menu (which is applied symmetrically). The enhancement process also included a "do no harm" principle, which meant that enhanced companies were protected from further changes to Ofwat's approach that would otherwise lower the value of the regulatory allowances. Through this principle, enhanced companies benefitted from a higher cost of capital (3.7%) than that included in non-enhanced company final determinations (3.6%).

Source: PwC

For companies that prequalified as enhanced, this status, and associated benefits, could only be secured if they also accepted Ofwat's guidance on risk and reward.

Weighted average cost of capital (WACC)

Ofwat sets an industry WACC for a notionally financed company. This comprises a notional cost of equity for a company (which is estimated using a CAPM approach) and a notional cost of debt (for an efficiently financed company).

- i) At PR14 a single cost of equity figure was used for all companies i.e. there were no company specific adjustments.
- ii) For the cost of debt, Ofwat estimated the notional figure as a weighted average of the cost of embedded debt (75%), and the cost of new debt (25%). In estimating the cost of embedded debt, a mixture of water company actual financing costs and benchmark bond indices were used. For the cost of new debt, allowances were based on benchmark bond indices and forward yields from market evidence. Ofwat then applied some company specific adjustments that took account of actual company structure.

By setting a notional cost of debt allowance with reference to bond indices Ofwat provides incentives for companies to outperform the index used to determine the allowance. In other words, efficient financing is rewarded through an ex-ante allowance based on benchmarks.

Totex Incentive Mechanism (TIM)

Wholesale totex is subject to menu regulation and cost sharing. See Appendix G for more detail regarding the operation of menus.

After the Final Determination, companies were invited to select a menu sharing rate. This rate sets how any outperformance or efficient additional costs that will be shared between customers and shareholders. For example, for a menu sharing rate of 50%, totex outperformance of £10m would lead to the company retaining £5m. The remaining £5m of outperformance would be retained by customers through reconciliation adjustments.

Outcome Delivery Incentives (ODIs)

Companies are currently asked to propose a set of outcomes, a measure associated with each, and a level of performance against each measure that they would commit to deliver. Coupled with outcomes are ODIs, which are rewards and penalties linked to company performance against their commitments. For more detail regarding the structure of ODIs see Appendix I.

ODIs apply to the wholesale and household retail price controls. Additionally, there are scheme specific ODIs. For non-household retail, the Guaranteed Standards of Service (GSS) will be used as a backstop form of protection – from 2017 onwards market forces are expected to drive positive outcomes.

There are three types of ODI, which are set out below:

- i) *Reward & penalty* - where the company is penalised for underperformance but rewarded for outperformance.
- ii) *Penalty only* - where the company is penalised financially for underperformance.
- iii) *Non-financial* - typically reputational in nature.

Where rewards and/or penalties apply, these are taken by companies as either adjustments to revenue or adjustments to the RCV. Companies could also choose whether to take rewards and penalties during AMP6 or at the end of AMP6. Three companies chose in-period ODI payments.

Service Incentive Mechanism (SIM)

The Service Incentive Mechanism (SIM) focuses on the quality of customer service and customer experience of contact with companies, and is assessed comparatively against other water companies. SIM is a consistent incentive for household customer service across both AMP5 and AMP6. It will apply to all companies in AMP6.

For companies that clearly performed above average, rewards were set at up to 0.5% of regulated turnover, and for companies that clearly performed below average, penalties extend up to 1% of regulated turnover. Performance is measured in two parts, one qualitative and one quantitative.

- i) *Qualitative* - Qualitative customers service assessments (as provided by survey scores) account for 75% of overall SIM score. Individual survey scores for billing, water and waste performance are combined into an overall survey score.
- ii) *Quantitative* - Quantitative customers service assessments (as tracked by contacts and complaint volumes) account for the remaining 25% of overall SIM score.

Water trading incentives

PR14 introduced a number of incentives to encourage companies to manage their water resources more efficiently in the short term through water trading. Differing incentives were established for exporters (sellers) and importers (purchasers):

- i) **Export incentive:** For all new qualifying exports, exporters are allowed to retain 50% of the full discounted economic profit for the forecast life of the export (that is, profits over and above the normal return on capital invested). The incentive is paid retrospectively and is capped at a maximum value of 100% of the economic profit for the years the export operates in 2015-2020.
- ii) **Import incentive:** Importing companies receive an import payment of 5% of the costs of the import. Import incentive payments are subject to a cap of 0.1% of the importer's water activity turnover in any year of the control period.

The incentives only apply to relevant price regulated companies and companies have to demonstrate that its export and/or import complies with an Ofwat-approved Trading and Procurement Code before the relevant incentive payment is made

Export incentives have been used in previous control periods (with a different structure) but the import incentives were new for PR14. The import incentive was developed to overcome existing behavioural biases and initial costs associated with developing appropriate processes and experience of effective water trading contracting. As these costs and barriers are expected to decline over time the import incentive was not committed to beyond the end of the 2015 to 2020 control period.

Abstraction Incentive Mechanism (AIM)

The Abstraction Incentive Mechanism (AIM) was established at PR14 to encourage companies to reduce the environmental impact resulting from the abstraction of water from environmentally sensitive sites. For the 2015-2020 control period, AIM is operating as a reputational incentive that seeks to encourage companies to abstract from more sustainable sources by reporting and ranking their performance. Companies which abstract large volumes from the most sensitive sources will be ranked at the bottom of the market-wide reporting and incurring a reputational penalty.

During the current control period AIM is also designed to improve the quality and availability of data relating to abstraction from sites with a risk of environmental damage. At PR14, Ofwat outlined that financial incentives may be implemented from 2020 to support the initiative once sufficient data has been obtained.

Wholesale Revenue Forecasting Incentive Mechanism (WRFIM)

In AMP5, revenue over/under recovery was reconciled at the end of the price control period through the revenue correction mechanism (RCM).

For AMP6, the wholesale revenue forecasting incentive mechanism (WRFIM) replaced the RCM. The WRFIM aims to incentivise accurate revenue forecasts across the AMP. There is the potential for financial penalties for companies with more than a 2% difference between their recovered and 'adjusted allowed revenues'. 'Adjusted allowed revenues' include adjustments which reflect previous over/under recovery.

Appendix F – Approach to incentives in other industries

In this appendix we set out the supporting information for Table 2 in Section 3 of the report. We begin with the energy sector, followed by, Australian Water, Healthcare, Rail, Financial Services and then finally, Telecoms.

Energy

This section provides an overview of the latest price control framework in the UK energy sector, a review of its RoRE expectations and performance, and a comparison to the balance of incentives in the water sector. We then evaluate business plan incentives, before finally reviewing Ofgem’s approach to innovation. Innovation is an area that is not directly targeted by Ofwat, although totex and ODIs are tools that provide some incentive for companies to innovate (see Box 1 in Section 4 for examples of innovation in the water and wastewater sector).

Overview

In its latest price controls, Ofgem introduced its new RIIO (Revenue= Incentives + Innovation + Outputs) framework. The RIIO model applied to gas distribution companies and electricity and gas transmission companies from 1 April 2013 and to electricity distribution companies from 1 April 2015. RIIO is designed to drive the delivery of a low carbon, sustainable energy sector at a lower cost than under the previous framework.

Balance of incentives

Similar to Ofwat, Ofgem uses RoRE as a measure of company performance. We can therefore compare the balance of incentives in energy in the same fashion as we did for water.¹⁹² The figures below sets out the RoRE performance and expectations for the RIIO price control for GB gas distribution networks (RIIO-GD1) and for National Grid electricity and gas transmission networks (part of RIIO-T1).¹⁹³ We observe the following key themes from company performance in GD1 and T1:

Significant totex outperformance, particularly in GD1

Figure 4 shows that all companies outperformed in 2015/16 compared to the totex allowance set in the 2013 final proposal (FP).¹⁹⁴ The industry *average* RoRE totex outperformance was 2.9% compared to the expected 0.0%.¹⁹⁵

This follows a similar pattern to water sector performance in FY16, although water companies have underperformed as well as over performed.

Wide totex range

The contribution of totex performance to the RoRE range in FY16 was 3.5% and the forecasted range 5.0%. This is significantly wider than other incentives such as output incentives, which have narrower ranges of 0.6% and 1.6% for FY16, and final proposal values respectively.¹⁹⁶

¹⁹² However, Ofgem’s RoRE framework does not include an assessment of financing performance.

¹⁹³ We focus on GD1 and T1 as these price controls have richer data available on performance to date. The ED1 price control did not commence until 2015.

¹⁹⁴ Ofgem’s “Final Proposals” are equivalent to Ofwat’s “Final Determinations”

¹⁹⁵ Ofgem’s RoRE measurement at Final Proposals (FPs) was based on a view across the entire 8-year control period. Subsequent annual reporting of RoRE, by Ofgem and companies, also takes an 8-year view made up of actual performance and revised forecasts for the remainder of the period.

¹⁹⁶ Ofgem describes their RoRE range in the final proposals as presenting the upside and downside of potential returns for each GDN. Ofgem highlighted that these ranges had been developed through assessing a mixture of historical performance and projected plausible values.

A similar pattern is observed for the water sector where the totex incentive range is much wider than for outcome delivery incentives and other incentives such as RBR and WRIFM. This suggests regulators in both sectors place more emphasis on cost performance.

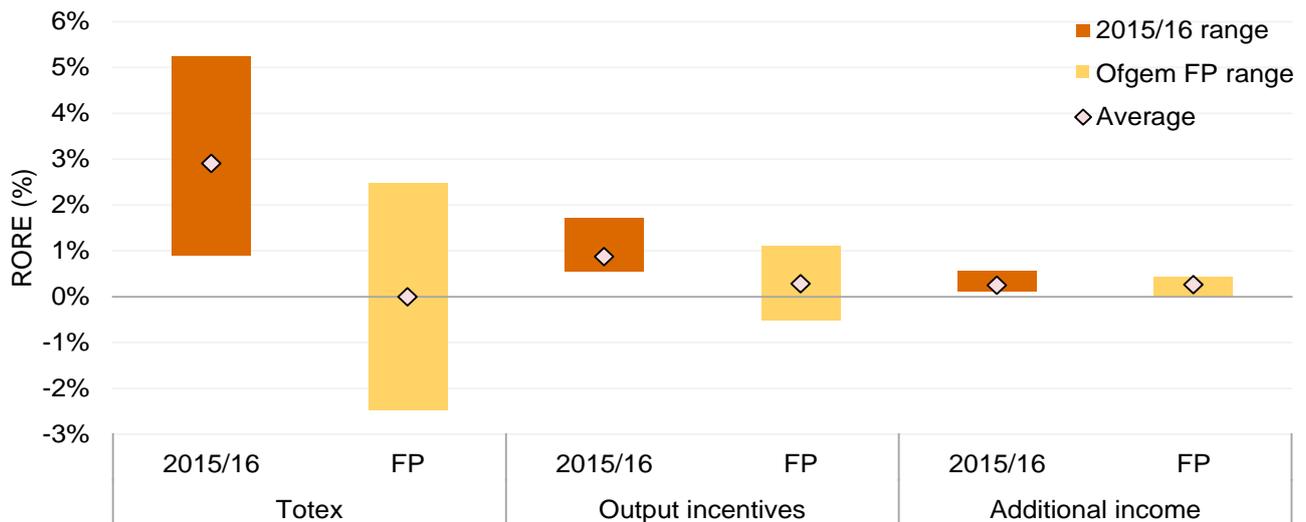
Outperformance across the industry across different incentives

FY16 performance shows only outperformance, with industry average RoRE above zero for all three incentive categories in GD1. This differs to the final determination values, which show symmetric forecasts between under and over performance, for totex in particular.

This is different to the water sector which currently shows a variety of under and over performance. A further difference to the water sector is that in GD1 the ODIs are not capped.

Overall, there seems to be some similarities between the performance of businesses in the energy and water sector, in particular the balance between totex and other incentives. This means there are potential lessons to be learnt from this sector following their outcomes.

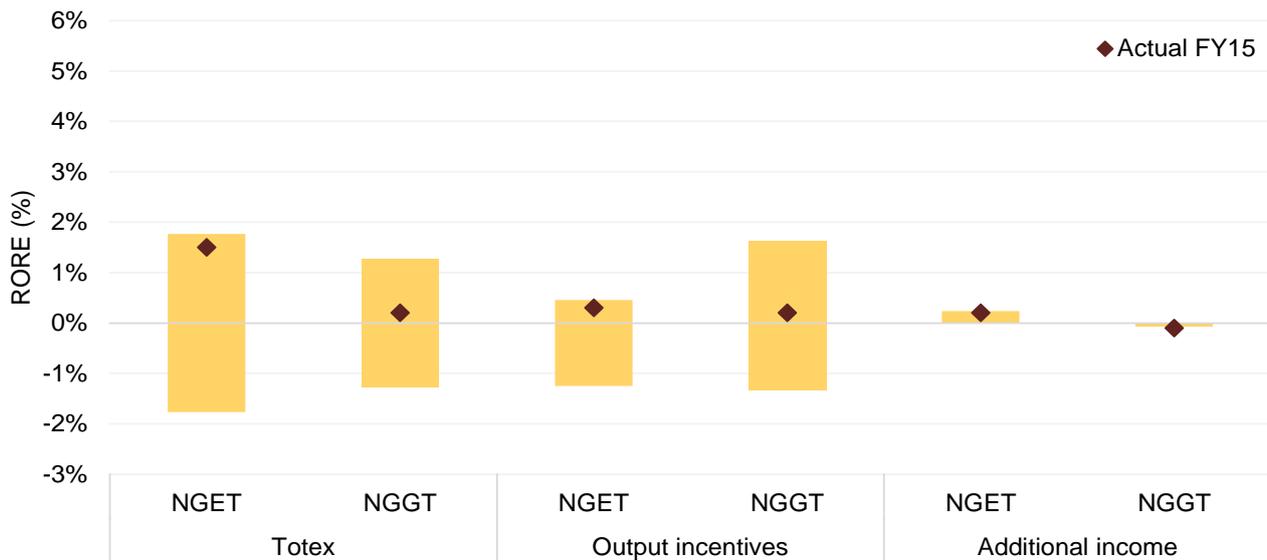
Figure 37: RIIO-GD1 incentives



Source: Ofgem, GDN regulatory reports, GD1 final proposals financial model

Note: RoRE data for Wales and West Utilities is based on 2014/15 data as the company has not published data for 2015/16. However, 2015/16 data was available for the remaining seven GDNs.

Figure 38: RIIO-T1 incentives



Source: Ofgem, T1 regulatory reports, GT1 and ET1 final proposals financial model

Note: Data based on Ofgem FY15 annual report for T1, FY16 annual report was not available at data cut-off as it was for GD1.

Business plan incentives

One area that can be compared between the water and energy sector is in how regulators have incentivised businesses to submit high quality, well evidenced plans.

Under the RIIO framework, Ofgem applied a proportionate approach to its review of business plans for distribution and transmission companies. Companies that produced high quality business plans were ‘fast-tracked’ receiving an early settlement and those that did not meet the established criteria faced greater regulatory scrutiny.

To be fast-tracked businesses must meet all criteria in five areas:

- Process: Has the distribution / transmission network followed a robust process?
- Outputs: Does the plan deliver the required outputs?
- Resources (efficient expenditure): Are the costs of delivering the outputs efficient?
- Resources (efficient financing): Are the proposed financing arrangements efficient?
- Uncertainty & risk: How well does the plan deal with uncertainty and risk?

This is somewhat comparable to the RBR incentive used by Ofwat in PR14 which also rewarded plans which had carefully considered outcomes, costs, the balance between risk and rewards, and the firm’s affordability and financing. The benefits of becoming an ‘enhanced’ company were reputational, financial and procedural.

The review of business plans is to ensure that plans are well-justified with robust evidence and a strong development process in line with minimum requirements rather than encouraging ambition.

RIIO further adopts the following approach to incentivise the development of new ideas and improvements beyond business as usual.

Innovation – Network Innovation Stimulus

A key development of the RIIO framework was the introduction of the Network Innovation Stimulus. RIIO saw the roll out of a number of targeted incentive mechanisms to encourage and fund the development of innovative

projects, which aim to improve the efficiency of the energy networks, accelerate the development of a low carbon energy sector as well as delivering financial benefits to customers.

The stimulus is time limited and designed to catalyse innovation before it is withdrawn as innovation is embedded within companies. Three specific mechanisms were established that have differing objectives and characteristics as outlined in Table 2 below. A key principle of all of the schemes is that the innovation must be replicable and scalable across the whole industry.

Table 26: Ofgem RIIO innovation

	Network Innovation Competition (NIC)	Network Innovation Allowance (NIA)	Innovation Roll-out Mechanism (IRM)
Objective	To provide funding for selected large flagship innovative projects that would deliver low carbon and environmental benefits to customers	To provide a consistent level of funding to Network Licensees to allow them to carry out smaller innovative projects.	A revenue adjustment mechanism designed to make funding available for the roll-out of proven low carbon or environmental innovations within the price control period.
Scope	Projects must accelerate the move to a low carbon energy sector and/or deliver environmental benefits, and potentially bring net financial benefits to network customers now and in the future.	Smaller scale Research, Development, and Demonstration Projects, and can cover all types of innovation, including commercial, technological and operational.	
Industry coverage	Open to applications from distribution networks, transmission networks, independent companies, offshore transmission owners and national system operator.	RIIO network licensees	RIIO network licensees
Assessment approach	All applications must meet certain criteria. Submissions that do meet criteria are independently assessed by an 'Expert Panel'. The Expert Panel recommends which projects should receive funding. Ofgem uses this information to make the final funding decision (but does not have to follow the recommendations of the Expert Panel).	Assessment of company's innovation strategy submitted with business plans. Plans must exceed minimum requirements to receive more than the default level of funding.	n/a
Assessment criteria	<p>Ofgem and the Expert Panel consider the degree to which the project:</p> <ul style="list-style-type: none"> - Delivers environmental and financial benefits. - Provides value for money to customers. - Generates knowledge that can be shared amongst all Network Licensees. - Is innovative (i.e. not business as usual) and has an unproven business case where the innovation risk warrants a limited Development or Demonstration project to demonstrate its effectiveness. - Demonstrates a robust methodology and readiness of the project. - Involves other partners and external funding. - Is relevant and timely. 	<p>At minimum companies must provide:</p> <ul style="list-style-type: none"> - High level problem(s) which the sector/company expects to face over the period - The process by which the company will decide to focus innovation - Demonstration that stakeholders have been consulted in determining the problem(s) - The consequences of innovation not occurring - Expected deliverables 	<p>Licensee's must demonstrate that the roll-out</p> <ul style="list-style-type: none"> - will deliver carbon benefits, or any wider environmental benefits - will provide long term value for money for customers - will not enable the licensee to receive commercial benefits from the roll-out within the price control period - will not be used to fund any of the Ordinary Business Arrangements of the licensee

Absolute vs relative assessment	Relative where total funding request exceeds total funding value available	Absolute
Incentive value	Electricity: £81m maximum annually Gas: £18m maximum annually	Between 0.5% and 1% of base revenues depending on quality of innovation strategy. Companies must indicate the level of funding requested.
Reward structure	Ex-ante payment of NIC funding. Ex-post Successful Delivery Reward is provided for well managed projects (that meet certain criteria) up to 10% of total NIC funding	Ex-ante payment

Source: Ofgem

The funds for the Network Innovation Stimulus were raised through transmission charges and will be borne by users based on their use of the network (i.e. controlled through allowed revenues of the System Operator).¹⁹⁷ This funding programme intended to encourage innovation, going beyond incentivising companies just to produce high quality plans.

Ofgem considers that its innovation schemes are providing value for money and helping to foster greater innovation. An independent review of the Low Carbon Network Fund (LCNF)¹⁹⁸ – an innovation fund introduced in the electricity DNOs’ previous price control (DPCR5) that included an allowance and competition features similar to the NIA and NIC – estimated net benefits of between £0.8 billion and £1.2 billion when projects were rolled out by the trialling companies.¹⁹⁹ The review also found the following:

- The fund successfully encouraged DNOs to innovate but was less successful in including innovation as a core business area.
- All projects under the schemes made some technical and/or commercial contribution to the development of the low carbon sector.
- Knowledge dissemination was good across large scale projects but weaker across smaller scale projects.

Following this review, Ofgem is currently consulting on a number of proposed changes to the NIA and NIC. This includes: (a) reducing the future level of funding available for the electricity NIC, (b) options to increase third party involvement, (c) requiring a non-returnable contribution towards project costs from network companies; (d) and changes to reduce the administrative burden of participating and running the innovation schemes.

Australian Water (PREMO)

We now consider the water sector in Australia, specifically, in Victoria, which is regulated by the Essential Services Commission (ESC). We focus on this specific area as the new PREMO (Performance, Risk, Engagement, Management, Outcomes) proposals introduced by the ESC include a review of ambitions in business plans. We set out a brief overview of PREMO before reviewing the ESC’s proposals for capturing ambition.

¹⁹⁷ Ofgem (March 2012), p.12, *Decision on the Network Innovation Competition and the timing and next steps on implementing the Innovation Stimulus: Final Decision*.

¹⁹⁸ This review was carried out by Poyry and Ricardo Energy.

¹⁹⁹ Ofgem (2016) *The network innovation review: Our consultation proposals*

Further details on PREMO, including its implementation and differences between the regulatory models in the UK and Australia are provided in Appendix H.

Overview

All Victorian water businesses are state owned and regulated by the ESC under a price cap. Each water business has a clearly defined geographic region and hence there is no direct competition between firms. Businesses are required by the ESC to submit proposed prices and service standards for the next pricing period which are then reviewed to ensure water businesses meet customer service expectations and other regulatory requirements. As part of the next regulatory period which begins from 1 July 2018, the ESC has looked at how to better incentivise firms to produce better quality and more ambitious plans to benefit the customer, resulting in the PREMO framework.

PREMO and ambition

PREMO aims to incentivise businesses to be ambitious in putting forward their best service and price offers in their price submissions. Key features of this mechanism include:

- A requirement that the water companies engage and consult with their customers to identify desired outcomes to include in their submissions;
- A requirement for each company to self-assess their submission in meeting each of the four REMO elements (“P” is treated differently as an ex-post assessment of the implementation of the proposals) using the following four ratings: Leading, Ambitious, Standard, Basic;
- The Commission performs their own assessment of each company’s submission scoring each of the four REMO elements using a flexible framework that outlines some guiding questions and examples of submissions for each of the four ratings;
- The Commission determining the final level of return each firm will be allowed to earn during the regulatory period as a result of these two assessments via a cost of equity menu. An illustration of such a menu is shown in Table 26 below.

Table 27: PREMO cost of equity “menu”

		Water business self-assessment			
		Leading	Ambitious	Standard	Basic
Regulator assessment of submission	Leading	5.3%			
	Ambitious	4.7%	4.9%		
	Standard	4.1%	4.3%	4.5%	
	Basic			3.9%	4.1%

Source: Essential Services Commission

This framework was developed due to a lack of incentives in the Australian regulatory regime, and to provide recognition for high quality and ambitious plans in the previous price review period. Ofwat provided incentives for high quality plans through the RBR mechanism, but did not focus specifically on encouraging ambition or innovation.

Rail

Next we discuss the incentive mechanisms within the rail sector. We will focus on the various cost and performance incentives in place and compare them with the water sector. We will then look at how innovation is incentivised, before finally summarising the lessons that can be learnt from this sector for the water industry.

Overview

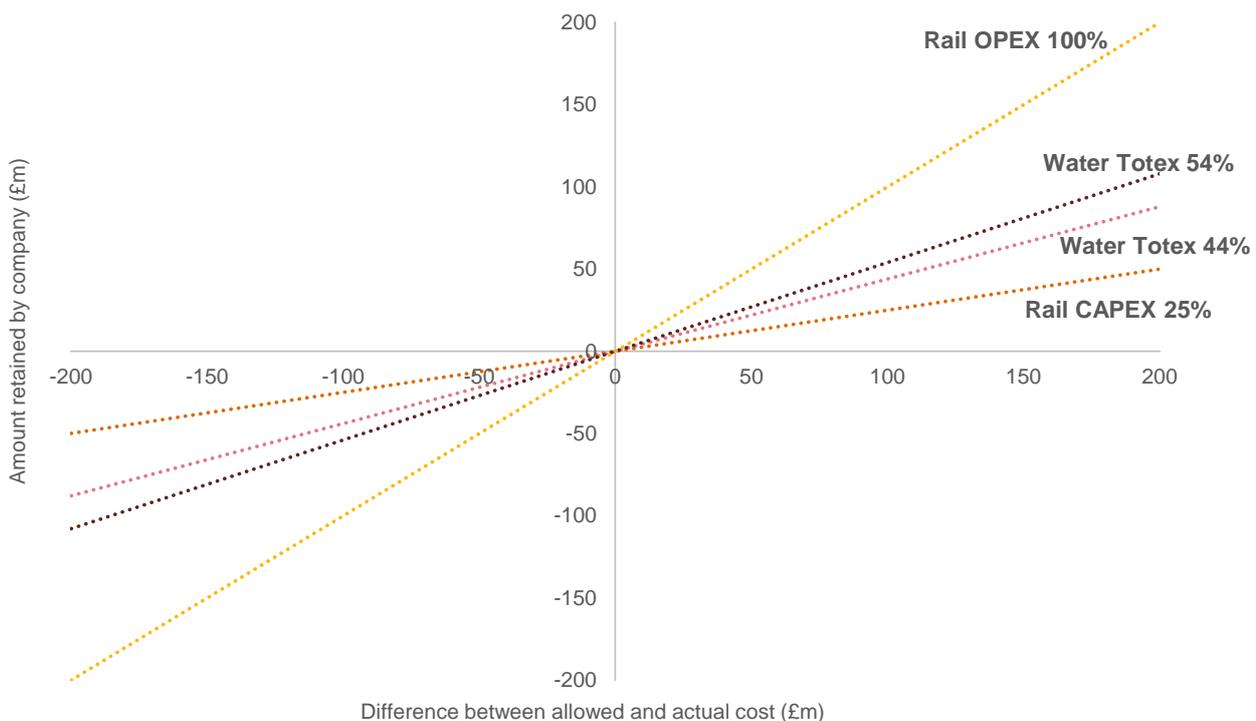
Network Rail is regulated by the Office of Rail and Road (ORR) as it is the monopoly owner and operator of the railway network, including track, signalling, bridges, tunnels and stations. The ORR conduct five-yearly reviews, which set Network Rail's costs and revenue allowances and service quality targets, with the last review having taken place for the control period 2014-19. As part of the price control there are a numbers of incentives in place.

Cost incentives

Similar to the water industry, if there is a difference between the final determination allowances in costs compared to actual costs then the company can retain the benefits in the case of outperformance, or face a penalty in the case of underperformance. The RAB roll forward policy allows Network Rail to retain 25% of capex outperformance and similarly, 25% of underperformance as this the rate at which Network Rail is exposed to risk.²⁰⁰ For opex, Network Rail currently bears 100% of the cost i.e. if Network Rail underspends on maintenance by one pound it keeps one pound, or if there is overspend of one pound then they bear one pound of extra costs.²⁰¹

Figure 39 shows the penalty and reward schedule used in the rail sector for cost performance (25% of under or outperformance) compared to the water sector totex incentive mechanism (range between 44-54% of under and outperformance). We can observe that the magnitude and range used in rail for rewards and penalties is much wider than the water sector at the individual cost category level, but more similar in total expenditure terms.

Figure 39: Penalty and reward schedule for costs



Source: Network Rail, ORR

²⁰⁰ Office of Rail and Road (2015), Annual efficiency and finance assessment of Network Rail 2014-15, p.10

²⁰¹ Office of Rail Regulation (December 2011), Periodic review 2013: consultation on incentives, p.118

Incentive mechanisms in the rail industry also aim to align the interests of train operators and Network Rail by sharing the benefits between the two parts of the value chain. The ORR has financial incentives for three different cost areas. They include incentivising the alignment of interest between Network Rail and train operators, so that operators are also exposed to changes in charges and costs. Incentives also exist for encouraging innovation and responding to excess demand, which are discussed in further detail below.

One such incentive is the *volume incentive*, which was created to encourage Network Rail to be more responsive to unexpected demand for network capacity over and above an agreed growth baseline level. The rationale for this incentive comes from the fact that the structure of charges means that Network Rail faces weak financial incentives to meet additional demand. The charges were designed to reflect efficient costs imposed by the operation of an additional train, so if actual marginal costs are above the efficient marginal costs then this is a disincentive to accommodate for additional demand. With this incentive, Network Rail is encouraged to increase capacity which is also beneficial for operators as they can increase revenues. The incentive also has a downside, with both a ceiling and a floor on payments.²⁰²

Another incentive used to align Network Rail's interest with train operators is the *route-based efficiency benefit sharing (REBS) mechanism*. This works by increasing train operators' interest in reducing infrastructure costs by exposing them to these costs in each year of the control period. The rationale for this comes from the fact that franchise agreements provide franchisees with a high degree of insulation from the financial impact of access charges. The regulator instead wants to create a relationship where operators are exposed to Network Rail's costs. The mechanism addresses this by providing operators with 25% share of the upside and 10% share of the downside by route.²⁰³

Performance incentives

The Schedule 8 ("performance") regime compensates train operators for the financial impact of unplanned service disruption caused by Network Rail and other train operators. This is so that the impact is borne by the organisation who causes the disruption, rather than the operator who faced the disruption.

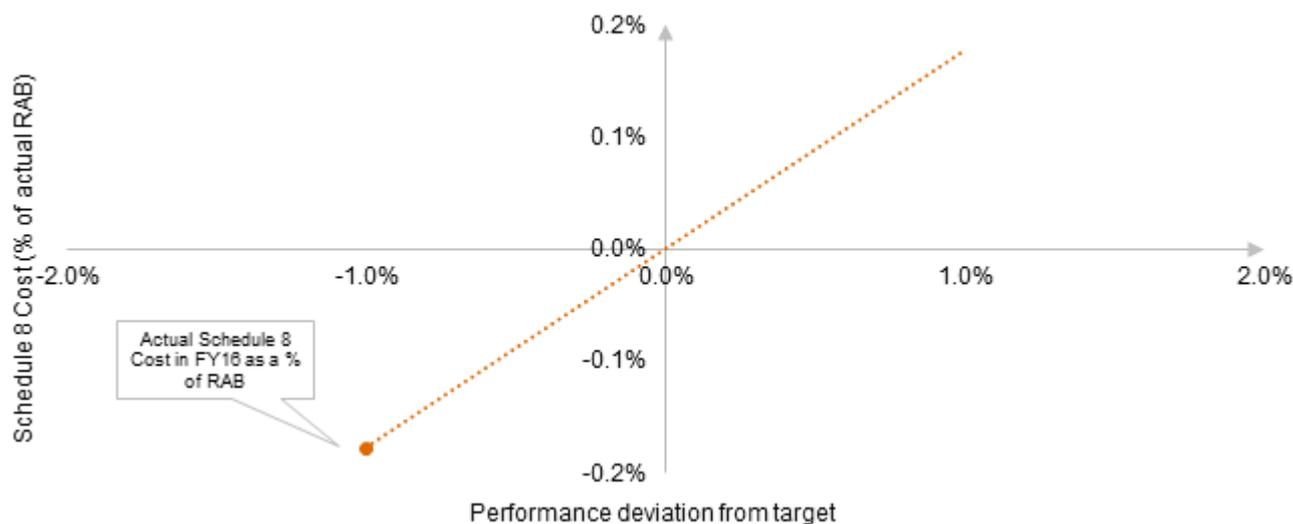
Figure 40 shows the penalty and reward schedule for Schedule 8 plotted against the Public Performance Measure (PPM). Payments from the Schedule 8 regime are determined by a formula that is based on the average number of minutes trains are late. If Network Rail and train operators perform in line with expectations then net Schedule 8 payments will be zero.²⁰⁴ Network Rail pays a bonus to a train operator (payable at the same rate as compensation) if the train operator's performance is better than benchmark.

²⁰² Office of Rail Regulation (October 2013), Final determination of Network Rail's outputs and funding for 2014-19, p.725

²⁰³ Office of Rail Regulation (October 2013), Final determination of Network Rail's outputs and funding for 2014-19, p.705

²⁰⁴ Office of Rail Regulation (October 2013) Final determination of Network Rail's outputs and funding for 2014-19, p.742

Figure 40: Penalty and reward schedule for performance



Source: Network Rail²⁰⁵

Innovation incentives

There is a recognition by the ORR that R&D and innovation is likely to improve Network Rail’s productivity in the long-run. However, they also recognise that it is difficult to incentivise innovation for reasons such as: (i) gains from innovation will be accrued over the long-term while the costs are short-term; (ii) the benefit of innovation may be greater for third parties than it is for Network Rail, and that (iii) monopoly status means there is a lack of competitive tension that incentivises it to reduce costs. After consultations and support from the DfT, the ORR decided to set up a fund for incentivising innovation.

In addition to £50m from High Level Output Specification (HLOS), a publicly funded scheme for rail which aims to support R&D and innovation, the ORR have made provisions for up to £50m to Network Rail of matched funding specifically for R&D and innovation. This will be financed by RAB additions. The fund is intended to incentivise and help kick-start higher levels of innovation but is not designed to provide all innovation funding required in the industry. Other sources of funding are also available through RSSB and the Transport Catapult Fund.²⁰⁶

Potential application

With similarities to the application of the PREMO approach used in the Victorian water industry, where the ownership structure of the firms differed to the water companies regulated by Ofwat, there should also be caution if there is an application of the approaches used in rail. This is because Network Rail is a not-for-dividend company. However, in a similar manner to the other sector examples, rail has also recognised the importance of innovation in helping the sector develop further for improved services and efficiencies.

Healthcare

We now look beyond regulated utilities for potential lessons on the application of incentives from the healthcare sector. Firstly, we will introduce the Vanguard programme established by the NHS, and then explain in more detail how they assess innovation. Finally, we will summarise the lessons that can be learnt from this sector and how it could be applied to the water sector.

Overview

In October 2014 the six (now seven) NHS arm’s length bodies published the Five Year Forward View, which set out a shared vision for the future of the NHS.²⁰⁷ The Five Year Forward View outlines a set of new approaches

²⁰⁵ Network Rail, p.14, Annual Return 2016 Report and p.3, Network Rail Regulatory Financial Statements FY16

²⁰⁶ Office of Rail Regulation (October 2013) Final determination of Network Rail’s outputs and funding for 2014-19, p.722

²⁰⁷ NHS England, Care Quality Commission, Public Health England, Monitor, and Trust Development Authority

for the way in which NHS organisations operate and work together as a system known as ‘new models of care’. To deliver this new vision for the NHS the Vanguard programme was established.

Vanguard programme

The objective of the programme was to provide funding and support for organisations leading the way in developing the five new care models outlined in the NHS Five Year Forward View. The Vanguard programme is designed to enable learnings and best practice to be shared across the whole NHS, enabling a wider rollout of the new care models in the future.

Applicants must apply for funding and support to develop one (or more) of the five specified care models outlined by the regulators and other health arm’s length bodies. The fund is open to all NHS organisations with some of the care models having specific eligibility requirements.

Since March 2015, 50 health systems in England have been selected through a competitive process to participate in the Vanguard programme. The 50 Vanguards are the first to implement five new models of care across England and will act as the blueprints for the NHS moving forward.

Assessment of innovation

The assessment for the Vanguards funding programme tried to involve as many stakeholders and experts as possible to ensure a well informed decision would be made. The process was as follows:

- Applications which met initial eligibility criteria were assessed against key characteristics by a range of stakeholders including the arm’s length bodies, clinicians, patients, community representatives, and local government officials.
- A number of applicants were then shortlisted and invited to present their applications at a selection event attended by fellow applicants, think tanks, specialists, and national bodies.
- Applicants were asked to vote for three preferred sites, excluding themselves, based on level of ambition and innovation and the sites they would most like to work with.
- A board comprised of representatives from the seven arm’s length bodies²⁰⁸ selected the final vanguard organisations based on the initial application, the selection event, and applicant votes as well as considering the portfolio of the different types of care models being developed in different areas of the country.
- The level of funding was agreed after the vanguards had been selected.

As well as considering the overall portfolio of funding, criteria used to assess the applications considered some overall factors such as:

- Scale - Applications were selected to ensure that there were Vanguards adopted at differing scales, e.g. at System Resilience Group level and UEC Network level.
- Geographical coverage – Applications were selected to ensure that there were Vanguards in differing geographical environments, such as, densely populated areas and rural areas.

Further specific characteristics of the application were then assessed depending on the specific issue and solution the application offered. Specific criteria were formed around topics such as the organisation’s history of successful public engagement, whether they had a strong leadership team, and their commitment and ability to measure and evaluate progress.

²⁰⁸ NHS England, Care Quality Commission, Public Health England, NHS Improvement, National Institute for Health Care Excellence, and Health Education England

The reward structure consists of ex-ante funding allocation (although a number of conditions must be met before funds are secured as described above) and it is co-funded with the Vanguards matching national funding. This is to ensure Vanguards are held accountable for the implementation of their proposal.

Potential application

A key feature of the Vanguards' funding scheme was to create substantial competition between organisations for the funding so that each applicant was incentivised to put forward their best proposals given that there was a limited amount of funding to be allocated. A robust assessment process was also in place which involved experts and stakeholders to judge ambition and innovation. This has overlaps with Ofgem's approach to innovation funding.

Financial Services

Another regulated industry of interest is the financial services sector. Specifically, we set out a brief overview of the role of the Financial Conduct Authority (FCA) before looking into how the regulator has facilitated innovation within the sector.

Overview

The FCA is the conduct regulator of many companies including 56,000 financial services firms and financial markets in the UK. In a similar vein to the role of utility regulators, their objectives include protecting consumers, protecting the integrity of the UK financial system and ensuring effective competition for the interests of consumers. Recently, the FCA has dedicated more resources to the management and encouragement of innovation as there has been increasing application of digital technology, as well as growth in the fintech sector.

Innovation support

The FCA have specific schemes targeted at encouraging innovation within financial services named 'Project Innovate'. One such scheme called the Innovation Hub, offers support to businesses with innovative ideas by having a team dedicated to firms which can help them understand the regulatory framework and how it applies to their business. The FCA also benefits from the scheme as it helps them to understand how to adapt the regulatory framework to enable further innovation given their interaction with the firms.

The Regulatory Sandbox is a scheme set up for unauthorised businesses (to conduct regulated activity in the UK a firm must be authorised) with innovative ideas. If successful in the competitive process to be part of the scheme, they are able to receive benefits to get support through the authorisation process. The sandbox also provides authorised firms with clarity around the regulatory rules before implementing an idea that does not fit into the existing framework by giving individual guidance, offering a waiver to breaches of rules and offering 'no enforcement action letters' that protect the firm from unexpected issues that might arise. This type of incentive, which allows the firm to be protected against potential downsides, creates an environment which encourages innovation.

Project Innovate has also introduced events, called TechSprints, which bring together market participants to work together collaboratively over a short space of time (often two days) to share challenges and aim to find solutions. These events support the FCA's goal of further encouraging innovation and technology.

Potential application

The FCA has taken a supportive role for firms by actively engaging with companies over a wide range of initiatives, to understand how developing technology and innovations may affect the market, which in turn helps the regulator develop its policies. Ofwat could consider this approach to supporting innovation if it prefers to have firms themselves driving the innovation but offer the help and advice that firms may require to navigate the regulatory environment. However, the innovation that comes from the firms in the financial sector may be driven by the more competitive nature of the market which is not as prevalent in the water sector.

Telecoms

Telecoms is another regulated sector where we are able to draw some insights. The telecoms industry has arguably been impacted the most in terms on innovation out of all the examples we have described so far, with developments in technology progressing at speed. In this section we will provide an overview of the sector and regulatory environment, and provide commentary on the way the regulator has governed innovation.

Overview

Ofcom is the regulator of the communications industry in the UK, regulating TV, radio, video-on-demand sectors, fixed line telecoms, mobiles and postal services, including the airwaves over which wireless devices operate. They also operate under a set of statutory duties and regulatory principles which include regulating in a way which is least intrusive but being willing to intervene where required to ensure there is sufficient competition and high quality services within the market.

Innovation support

Ofcom have stated that their view of the regulator's role within innovation 'is that industry is best placed to drive the development, standardisation and commercialisation of new technology'.²⁰⁹ They recognise though that for some areas the regulator can have an enabling role, such as the Internet of Things. More generally, Ofcom understands that they have the responsibility to 'encourage investment and innovation within our sector' with the primary purpose of benefiting consumers in relation to communications matters. It is stated within one of their regulatory principles that they 'will research markets constantly and will aim to remain at the forefront of technological understanding.'

Ofcom regularly conducts research into the telecoms market to understand the market they regulate. Their annual Communications Market Report is a statistical survey of developments in the sector which helps keep them and others informed about new technological developments and the impact that these might have on the sector. For example in the 2016 report, Ofcom's Director of Technology Strategy set out his view on innovation for Ofcom to 'liaise closely with the industry and international standard bodies to keep abreast of the scope and impact of the latest technical developments'. Overall, Ofcom engages in more of a supportive role and in order to understand the best way to regulate, they keep a strong understanding of current and emerging technologies.²¹⁰

Companies, for instance BT, also agree the regulator should enable the market to develop most effectively with particular focus in providing support in legislative and policy issues, such as security and privacy in an world of increasing big data access and cyber threats.²¹¹ Another company, SSE, also commented on Ofcom's role as the regulator, stating that they welcome inclusive and independently managed governance arrangements which allows a forum to discuss relevant policy matters as markets develop.²¹²

Potential application

The role of the regulator in the telecoms sector has been directed into a supportive and informative position. This seems appropriate for this sector given the rapid and continuous developments in technology. Whilst technological development is not as rapid in the water sector, Ofwat can draw lessons from the way in which Ofcom supports innovation by actively understanding the technological environment and developments and aiming to work with companies to construct a role for the regulator which best suits the market – whether it is for policy development or legislative support. However, similar to the financial services sector, the more competitive nature of the telecoms sector may in itself encourage innovation, whereas the water sector may require more encouragement to reach greater levels of innovation.

²⁰⁹ Ofcom (2014), *Promoting investment and innovation in the Internet of Things Consultation*

²¹⁰ Ofcom (2016), *Communications Market Report 2016*

²¹¹ BT (2014), *Ofcom Internet of Things Consultation (October 2014) – BT Response*

²¹² SSE (2014), *Ofcom Internet of Things Consultation (October 2014) – SSE Response*

Appendix G – Menu based incentives

Menus provide regulated companies with choices and/or trade-offs in relation to efficiency requirements and potential rewards. The use of menus in incentive regulation is primarily seen as a response to an asymmetric information problem faced by regulators.²¹³ That is, the inability of the regulator to distinguish a stretching business plan expenditure forecast from an inefficient forecast. Provided a set of outcomes a company must achieve, menu regulation aims to incentivise companies to submit to the regulator an expenditure forecast that is a fair reflection of expected values.

In this appendix, we set out Ofwat’s current use of menus and consider options for the future use of menus within its regulatory regime.

The operation of menus

Historically, the goal of menu regulation has been to encourage companies to submit accurate and efficient expenditure forecasts – hence Ofgem’s naming of their menu as the ‘Information Quality Incentive’.

If designed successfully, menus have the ability to reveal a company’s true ‘type’. This is done by allowing the company to submit an expenditure forecast of their choosing but to make a cost performance incentive conditional on the forecast submitted. For example, the lower the forecast submitted, the higher the proportion of any outperformance the company is allowed to retain. Faced with a menu such as this, a higher ability company may opt to submit a lower expenditure forecast²¹⁴, in turn resulting in a lower allowance, but gain the ability to retain a higher proportion of any cost outperformance they subsequently achieve.²¹⁵ By selecting a given expenditure to incentive-power trade-off, the regulator gains information on the companies’ view of its expected cost performance.

The operation of Ofwat’s totex menu

Ofwat currently uses a totex menu in setting total expenditure allowances and incentive rates. As it is a complex element of the regulatory incentives package, we focus on the key inputs and parameters used - rather than provide a step-by-step guide to its operation and calibration.

The operation of the totex menu requires two main inputs:

1. A company forecast of required expenditure; and
2. An Ofwat forecast of required expenditure.

Given these two inputs, Ofwat’s menu produces a series of parameters. These parameters are then used to estimate the output from the totex menu which then sets potential rewards to companies. The parameters are:

- The implied menu choice;
- The allowed expenditure;
- The cost sharing rate; and
- The additional income element.

We discuss each parameter below.

²¹³ See Stern (2014), ‘The British Utility Regulation Model: Its Recent History and Future Prospects’, *CCRP Working Paper Series*, No.23

²¹⁴ Where the regulator does not know for certain, which companies are of which ability.

²¹⁵ A company’s ability may change over time; for example, outcome expectations may evolve, management quality could vary or other exogenous factors may influence performance.

Implied menu choice

The 'implied menu choice' is the ratio of the company forecast to Ofwat's forecast, it can be expressed as:

$$\text{Implied menu choice} = \left(\frac{\text{Company forecast}}{\text{Ofwat forecast}} \right) \times 100\%$$

Allowed expenditure

The menu choice is used as an input for determining the allowed expenditure. The allowed expenditure is comprised of Ofwat's baseline forecast of required expenditure and the menu choice as follows:

$$\text{Allowed expenditure} = (75\% + 25\%(\text{implied menu choice})) \times \text{Ofwat forecast}$$

In other words, the allowed expenditure is a 75% weighting of Ofwat's forecast, and a 25% weight of the company's forecast.

Cost sharing rate

The cost sharing rate is the percentage of totex outperformance which is retained by the company. Where a company's actual expenditure is less than their allowed expenditure, the company will retain the amount of outperformance set out below:

$$\text{outperformance retained} = (\text{cost sharing rate } \%) \times (\text{allowed exp.} - \text{actual exp.})$$

The outperformance which is not retained is shared with customers through end of period reconciliations (carried out at the end of the price control period and setting the inputs into the next price control period). The cost sharing rate is bounded between 44% and 54% by Ofwat for non-enhanced companies²¹⁶, and is negatively related with menu choices i.e. the lower the menu choice, the higher the cost sharing rate.

Additional income

Lastly, the additional income element is a parameter in the menu incentive. It is a direct addition (which can be positive or negative) to the company's revenue allowance and is negatively related to the menu choice i.e. the lower the menu choice, the higher the additional income. This aspect of the menu is key in encouraging companies to provide efficient expenditure forecasts. It is specifically targeted at management due to the direct reward/penalty received in the short term, whereas the menu benefits derived from cost sharing are longer term. This further incentivises lower menu choices.

Each of these parameters is ultimately linked to the forecast expenditure submitted by the company, and they combine to form the total potential reward for the company. Where total reward is given by:

$$\text{Total reward} = ((\text{Allowed exp.} - \text{Actual exp.}) \times (\text{cost sharing rate } \%)) + \text{additional income}$$

In Table 27 below we show an extract from Ofwat's totex menu to demonstrate the relationship between reward and forecast expenditure.

Table 28: Totex menu extract

Menu choice	90	100	110
Cost sharing rate	52%	50%	48%
Allowed expenditure (% of Ofwat baseline)	97.5	100	102.5
Additional income (% of Ofwat baseline)	1.2	0.0	(1.3)
Actual expenditure (% of Ofwat baseline)	Shareholder reward (% of Ofwat baseline)		
90	5.1	5.0	4.7
100	(0.1)	0.0	(0.1)
110	(5.3)	(5.0)	(4.9)

Source: Ofwat menu model

Note: Extract shown is for a non-enhanced company

²¹⁶ This boundary is formed from the interaction of the slope of the efficiency incentive and the minimum/maximum menu choice range of 80/130. The lower and upper bound cost sharing rates for enhanced companies is 52% to 59%.

Final menu choices

A key aspect of Ofwat's current totex menu is that the implied menu choices used in setting allowances for final determinations are not necessarily the company's ultimate choice. Ofwat allowed companies to choose a different menu option following the finalisation of their baseline cost assessments.²¹⁷

As shown in Table 28 below, six companies (three companies for wholesale water, two companies for wholesale wastewater and one company for both) did selected final menu choices which were different from their FD implied menu choice; and in all instances they selected lower values.

Table 29: Final menu choices

Company	Wholesale Water			Wholesale Wastewater		
	Final menu choice	FD implied menu choice	Downward revision?	Final menu choice	FD implied menu choice	Downward revision?
ANH	102.9	102.9		98.4	98.4	
WSH	100.4	100.4		97.0	97.0	
NES	94.0	98.3	YES	94	98.4	YES
SVT	103.3	103.3		95.1	95.1	
SWT	91.5	91.5		99.5	100.2	YES
SRN	106.3	106.3		100	102	YES
TMS	95.3	95.3		98	98	
UU	100.5	100.5		106.2	106.2	
WSX	103.8	103.8		102.9	102.9	
YKY	94.3	94.3		99.5	99.5	
AFW	94.7	94.7				
BRL	125.0	130.0	YES			
DVW	100.0	103.8	YES			
PRT	96.5	96.5				
SBW	101.2	101.2				
SEW	100.0	103.1	YES			
SSC	103.2	103.2				
SES	102.5	102.5				

Source: Ofwat

The balance of Ofwat's menu

Although one key aim of the introduction of menus to British regulation was on encouraging accurate business plan forecasting, the balance of Ofwat's totex menu has shifted away from this objective. This can be seen in two ways.

²¹⁷ As the 'final' menu choice is a figure selected by companies post final determinations, it is not possible to reflect this choice in allowances for the 2015-2020 period. Therefore, adjustments are required to the starting values for the next price review to mimic the circumstances where the final menu choices had been used.

Firstly, the elapsed time between the initial business plan expenditure submissions and the final menu choice following the publication of Ofwat's final determinations is considerable. In PR14 initial business plans were submitted in December 2013, but final menu choices were made in January 2015, following final determinations. This long elapsed time period and the movements in cost estimates during the price control setting period mean that initial business plan expenditure submissions have minimal impact on setting final allowances. This mutes some of incentive for submitting cost reflective initial business plans.

Secondly, the long-term impact on shareholders from submitting an expenditure forecast that is different to the true expectation of expenditure is minimal. This can be demonstrated by contrasting the total rewards available under different menu choice scenarios. As set out in Figure 26 below, once any out/under-performance has been shared with customers, the effect of alternative menu choices on revenue, and ultimately rewards to shareholders, is minimal (for details of these calculations see Box 4 below).

Box 3: Menu calculations

Given a value for expected expenditure (which is assumed equal to actual expenditure), we first calculate the 'expected future adjustments to implement cost sharing' with customers for a non-enhanced company.* This is given by the expression:

$$\text{Expected future adjustments} = (1 - \text{cost sharing rate \%}) \times (\text{actual expenditure} - \text{allowed expenditure})$$

These expected future adjustments are then combined with the additional income and allowed expenditure elements of the menu to calculate the long-term expected revenue of a company. This is given by the expression:

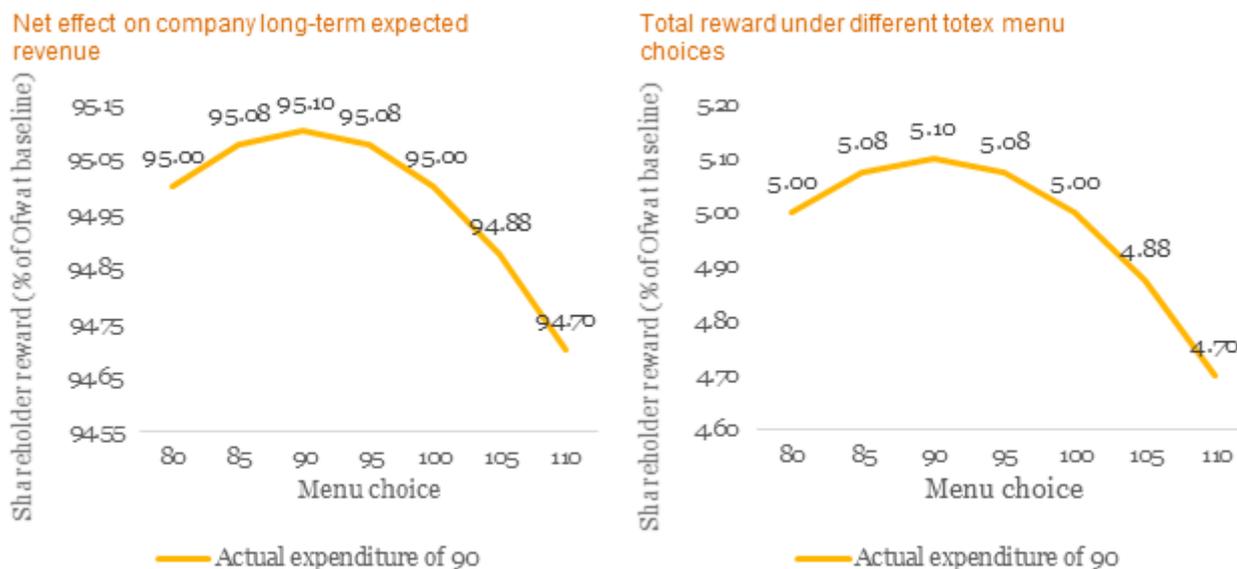
$$\text{Long term expected revenue} = \text{additional income} + \text{allowed expenditure} + \text{expected future adjustments}$$

The other item plotted is total long-term rewards, and these are simply given by (These values are already generated in the menu model, and so can be read-off directly):

$$\text{total rewards} = \text{long term expected revenue} - \text{expected costs}$$

* As delivered through adjustments to future revenues and RCV at the end of the control period.

Figure 41: Reward and menu choice



Source: Ofwat PR14 water menu model, PwC analysis

The stylised example in Figure 26 demonstrates that for a company which expects actual expenditure to be 90²¹⁸, long-term expected revenues are highest where a menu choice of 90 is submitted to the regulator; however, it also shows that a menu choice of 100 would lead to a reward of very similar magnitude. This shows that there is only minimal incentive power within the current totex menu to submit accurate expenditure forecasts.

Instead, the balance of Ofwat's totex menu has shifted towards allowing company additional flexibility in setting totex baselines and efficiency sharing factors. A justification for this approach is that relying upon business plan expenditure forecasts from earlier in the determination process would restrict company choice; this is because a company cannot observe Ofwat's cost assessment prior to their business plan submission. As this lack of choice impacts upon the ability of companies to efficiently manage risk. Ofwat therefore opted for a balance away from information revelation and towards increased flexibility for companies.

There remain some future information benefits which can be obtained from the current menu approach though. The change in menu choices made by companies' post-FD may reveal useful information which can feed into future price reviews. As shown in Table 17 above, there were several instances where companies' final menu choices were lowered from the implied choice in the FD – in three of these cases, the company moved to Ofwat's cost baseline, i.e. a menu choice of 100.

In their 2015 determination for Bristol Water, the CMA raised some criticisms of this shift in balance. They found that, "It is unclear whether the scheme in practice provides companies with flexibility to make choices." Adding that, "While it is true that the company forecasts that are taken as inputs to the scheme affect the cost sharing incentive and the wholesale expenditure baseline, these are not free choices for the company to make. Attempting to use the scheme to achieve a specific cost sharing incentive or wholesale expenditure allowance comes at a price."²¹⁹

Rebalancing the menu

As discussed above, the current menu is balanced towards company flexibility rather than information quality incentives. We now go onto discuss three potential options for altering that balance in future price reviews – setting out the arguments for and against each option.

1. **Removal of the totex menu** – As efficiency incentives such as a cost sharing rate can be implemented without a menu, a simplification to the regulatory regime may be to remove the menu aspect in selecting a cost sharing rate, and instead adopting an alternative approach. We set out two possible approaches below:
 - a. **A single rate** – a single cost sharing rate for all companies is the simplest approach. For example, as the CMA did in the 2015 redetermination for Bristol Water, this could be set at 50%. Importantly, a single rate still ensures that the interests of customers, management and investors are aligned. The key challenge with the implementation of a single rate is that it does not directly address the problem of asymmetric information as it lacks the trade-off between incentive power and the level of the expenditure forecast submission.
 - b. **A rate conditional on business plan assessment** – this approach would establish more than one cost sharing rate, for example, one high rate and one low rate.²²⁰ The ability to obtain a higher rate could then form part of the business plan assessment, and would be linked to the level of ambition shown in the plan. For instance, a key element of the business plan assessment is stretching cost performance that delivers stretching outcomes. The pairing of the cost sharing rate with business plan assessments may be advantageous relative to a menu, for example, a recent CCRP paper noted that other 'information revelation devices' such as fast-tracking, "have similar – and

²¹⁸ The example also assumes that outturn expenditure is also 90.

²¹⁹ CMA, "Bristol Water plc - A reference under section 12(3)(a) of the Water Industry Act 1991 Report". 6 October 2015

²²⁰ An alternative could be to introduce asymmetric cost sharing.

arguably more powerful – incentive effects than menu regulation on its own.”²²¹ Furthermore, a recent survey of companies conducted by Anglian Water found that the relative importance of achieving ‘enhanced’ status at PR14 was significantly greater than menu choices.²²² Coupling the cost sharing incentive to the business plan process may therefore sharpen company focus on submitting accurate expenditure forecasts.

2. **Rebalance the menu towards information quality** – although the menu is perceived as a complex regulatory incentive, it can assist in solving the key problem of asymmetric information a regulator faces. Furthermore, it can be adapted over time – building on lessons learned at previous determinations. For those reasons, its removal is possibly undesirable. In order to fulfil this role of solving the asymmetry problem, the menu could be rebalanced towards incentivising information quality - sacrificing some of the flexibility in the current approach. This could be done through two means:²²³
 - a. **Using information from business plans to set final menu choices** – this approach would use expenditure forecast submissions from earlier in the determination process to calculate a company’s position on the menu. Critically, there would be no choice once Ofwat had finalised its own costs assessment. This would provide incentives at an earlier stage (e.g. initial business plan phase) to present accurate forecasts. However, it would restrict subsequent company choice. It would also need to be compatible with the business plan procedures in place. A challenge with this approach is that for this incentive to work effectively, Ofwat needs to form a view of costs independently from the company, but in practice detailed engagement on special cost factors is required in order to adjust top-down modelling outputs appropriately.
 - b. **Recalibrating the menu parameters** – as set out earlier in the appendix, the current incentives to submit menu choices consistent with expected expenditure are minimal. In order to re-balance the menu towards information quality, these incentives could be strengthened by recalibrating the various parameters available to Ofwat. For example, there could be greater difference in the cost sharing rates, or increased additional income amounts available for companies choosing stretching targets on the menu.

Building on point 2b above, we set out below how menu parameters could be recalibrated in order to create more powerful information quality incentives. Specifically, we consider the effect of changing the slope of the efficiency incentive.²²⁴ This parameter controls how quickly the cost sharing rate rises (falls) as the business plan forecasts falls (rises) relative to Ofwat’s cost baseline.

The slope in the current menu is -0.2%, so an expenditure forecast 10% below Ofwat’s baseline attracts an increase in cost sharing rate of 2% and an expenditure forecast 20% below Ofwat’s baseline attracts an increase in cost sharing rate of 4%. Selecting a slope figure of -0.5% would result in the long-term rewards under different menu ‘choices’ shown in the Figure below (once again for a company that expects expenditure of 90).

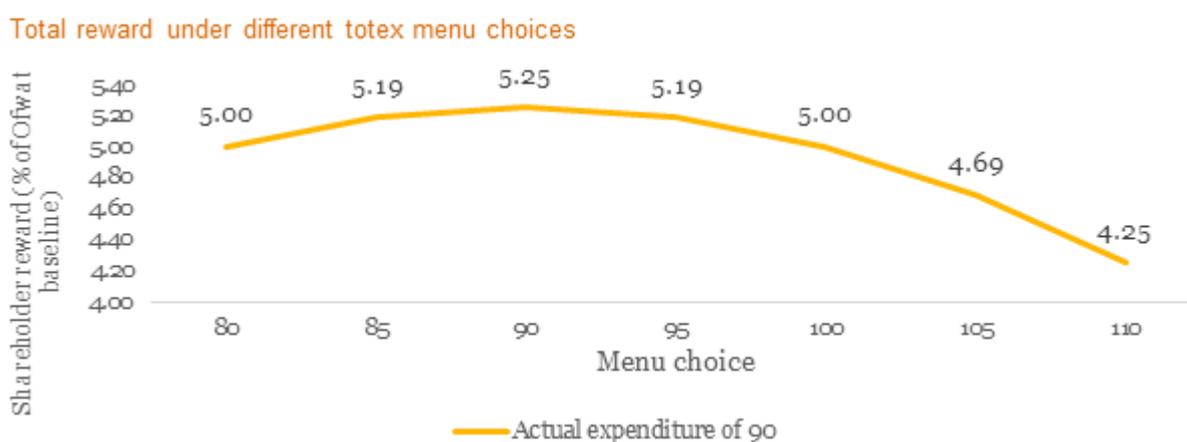
²²¹ Stern (2014), ‘The British Utility Regulation Model: Its Recent History and Future Prospects’, *CCRP Working Paper Series*, No.23

²²² Anglian Water (2015), ‘Future use of menus as part of price setting methodology’.

²²³ These two means are not mutually exclusive, and may create stronger incentives when combined.

²²⁴ If the focus was on shorter-term incentivisation of management (rather than longer-term rewards to the company) an alternative lever to focus on would be the additional income parameter.

Figure 42: Reward and menu choice – steeper slope factor



Comparing this with Figure 42 above, we can see that the reduction in shareholder reward for submitting an expenditure forecast of 100 rather than 90 is 0.25% under the steeper slope factor, but was only 0.10% for the original slope factor. There are therefore stronger incentives for submitting expected expenditure.

Beyond the recalibration of specific menu parameters, menu incentives must form part of a coherent set of business plan incentives that work in for the benefit of customers. In other words, the overall package of incentives should avoid unintended consequences such as firms having incentives to submit higher than expected cost estimates.

Conclusion

On the one hand, the removal of menus may enhance the simplicity of incentives. In their absence, other information revelation devices such as achieving ‘fast-tracked’ status could still provide sufficient incentives for companies to provide efficient expenditure forecasts in the absence of menus. On the other hand, despite its complexity, a reformed menu regime could still be a useful tool in helping Ofwat to mitigate the asymmetric information problem. In order for this tool to be effective, stronger incentives against inefficient expenditure forecasts are required. For example, this strengthening could be achieved through a steeper slope factor in the menu model, but whatever the approach adopted, ensuring consistency with wider business plan incentives is key.

However, even if the stronger incentives against inefficient expenditure plans are implemented, it may still be the case that there is not sufficient power in the menu to change company behaviour at the margin. For example, as shown in Figure 42 above, while the application of the menu with a steeper slope factor strengthens incentives, for small differences in menu choice, this strength is still limited. Therefore, a stronger calibration may still not be effective in preventing smaller amounts of cost inflation in submissions, only deterring larger amounts.

In summary, where Ofwat believes that other information revelation devices such as ‘fast-tracked’ status will already prevent large amounts of cost inflation in submissions, then the application of menus will add to complexity yet provide little incremental incentive power.

Appendix H – PREMO

In this appendix we provide an overview of the PREMO regime developed by the Essential Services Commission in Victoria, provide an overview of its implementation in practice, describe the key differences between the Australian and Ofwat’s regulatory regimes and set out lessons from this approach for the water sector in England and Wales.

Overview of PREMO

PREMO (Performance, Risk, Engagement, Management, Outcomes) is an incentive mechanism under development by the Essential Services Commission (“The Commission”, the water regulator in Victoria, Australia). The aim of the framework is to incentivise businesses to be ambitious in putting forward their best service and price offers in their price submissions. It incentivises ambition through return on equity that impacts calculated allowed revenue. Key features of this mechanism include:

- A requirement that the water companies engage and consult with their customers to identify desired outcomes to include in their submissions;
- A requirement for each company to self-assess their submission in meeting each of the four REMO elements (“P” is treated differently as an ex-post assessment of the implementation of the proposals) using the following four ratings: Leading, Ambitious, Standard, Basic;
- The Commission performs their own assessment of each company’s submission scoring each of the four REMO elements using the same ratings;
- The Commission determining the final level of return each firm will be allowed to earn during the regulatory period as a result of these two assessments.

All submissions are expected to achieve a “Standard” rating. In cases of sub-standard proposals, the Commission can require a resubmission or set a shorter regulatory period for that business. Guidelines illustrating the Commission’s expectations for “Standard” (and better) submissions are published to provide a steer to water businesses. These are based on high level principles to avoid disincentivising novel approaches and gaming the process.

Implementation of PREMO

In a company’s price submission they are required to self-assess an overall PREMO rating for their company, informed by the self-assessment of each of the four elements. The ESC will then use an assessment tool to help guide their assessment of each element to form their view of the overall PREMO rating. The four elements are weighted evenly to establish an overall PREMO price submission rating. Once these are determined, the company is allocated a return on equity value used to calculate allowed revenue (see Table 29 below).

Table 30: PREMO cost of equity “menu”

		Water business self-assessment			
		Leading	Ambitious	Standard	Basic
Regulator assessment of submission	Leading	5.3%			
	Ambitious	4.7%	4.9%		
	Standard	4.1%	4.3%	4.5%	
	Basic			3.9%	4.1%

Source: Essential Services Commission

The best outcome for the water business will be achieved when the ESC and water business’ self-assessment is aligned. The more ambitious the submission according to both, the greater will be the allowed return on equity. The grey shaded area represents where the ESC will not assess a proposal more favourable than the water business’s self-assessment, to incentives businesses to put forward their best offer. The red shaded zone indicates where a business may need to resubmit its price submission. These features aim to incentivise accurate and honest proposals.

For the ESC to make their judgement, a set of guiding questions and examples of what might constitute a ‘Leading’, ‘Ambitious’, ‘Standard’, or ‘Basic’ is proposed in the PREMO assessment tool. Some guiding questions are outlined in Table 19 below.²²⁵

Table 31: Guiding questions for PREMO assessment

PREMO Element	Guiding questions
Risk	To what extent has the business demonstrated a robust process for identifying risk, and how it has decided who should bear these risks? To what extent does the proposed guaranteed service level (GSL) scheme provide incentives for the business to be accountable for the quality of services delivered, and provide incentives to deliver valued services efficiently?
Engagement	To what extent has the business justified how the form of engagement suits the content of consultation, the circumstances facing the water business and its customers? To what extent has the business demonstrated that it provided appropriate instruction and information to customers about the purpose, form and content of the customer engagement?
Management	To what extent has the business demonstrated how its proposed prices reflect only prudent and efficient expenditure? To what extent has the business justified its commitment to cost efficiency or productivity improvements?
Outcomes	Has the business provided evidence that the outcomes proposed have taken into account the views, concerns and priorities of customers? Has the business proposed outputs to support each of its outcomes, which are measurable, robust and deliverable?

Source: Essential Services Commission

²²⁵ Essential Services Commission (November 2016), ‘2018 Water Price Review Guidance Paper’.

Below is an extract of the PREMO assessment tool which helps rate the company on the Outcomes element for each of the ratings.²²⁶

Table 32: Extract from PREMO assessment tool

Examples for a Basic submission	Examples for a Standard submission	Examples for an Advanced Submission	Examples for a Leading submission
The business has proposed degradation in customer outcomes, not justified or supported by customer feedback.	The outcomes proposed are broadly consistent with existing levels of service provided to customers.	The outcomes proposed reflect a significant improvement in customer value delivered. This might be demonstrated by significant improvements in output targets (or performance measures) for outcomes that matter most to most customers. The business proposes outcomes that are well ahead of the industry average or past performance (measured by reference to output targets).	The outcomes proposed reflect a very significant improvement in customer value delivered. The business proposes outcomes that lead the industry.
Most outcomes are defined as outputs (that is, at a granular level consistent with practice in the 2013 water price review).	The outcomes proposed have mostly been defined in ways that reflect the customer service experience (e.g. safe, clean water supply).	All outcomes proposed have been defined in ways that reflect the customer service experience.	

Source: Essential Services Commission

The framework notes that this assessment tool does not provide an exhaustive list of what may be taken into account by either the water business or the ESC in assessing a rating. The business being considered also does not need to meet all of the examples in the tool for a given rating to reach that rating overall. The advantage of this is that it allows for flexibility in novel ideas, it does not constrain ambitious ideas and allows for its recognition. Having a framework which is less rigid, reduces the risk that PREMO becomes a check list exercise and accommodates for diversity of water businesses and their customers.²²⁷

However, a high degree of judgement will be involved in assessing the water companies given the flexibility of the framework. This leads to concerns over how the framework can be implemented fairly and transparently given that the water industry is diverse in terms of the size and challenges faced by companies, if plans are compared against each other for ambition.

Comparing the UK and Australian regulatory environment

There are a few key differences, as well as some similarities, between the Australian and English and Welsh water sector which influences the assessment of how successful a PREMO framework approach could be if implemented by Ofwat.

- 1. Ownership structure** – Water companies in England and Wales are primarily privately owned whereas Victorian water businesses are primarily state-owned. This difference suggests how incentives are considered should also differ. With privately owned companies there is incentive for the Board to achieve

²²⁶ Essential Services Commission (November 2016), '2018 Water Price Review Guidance Paper'.

²²⁷ KPMG (September 2016), 'Essential Services Commission - PREMO Assessment Tool'.

higher profits to maximise shareholder value, whereas for public Victorian water companies this incentive does not exist. High performing private companies can also reward management with increases in salary and bonuses, whereas public Victorian water companies are restrained by the State Government Executive Remuneration Panel. This limits the effectiveness of financial incentives of Victorian water companies.

- 2. Incentive mechanisms** – The number and variety of incentive mechanisms in place between the two water sectors also vary.
- **Service quality** – At PR14, ODIs, AIM and SIM were used to financially incentivise water companies to submit plans which made them strongly consider their service quality performance. This differs to the Victorian framework which had weaker incentive mechanisms in place for delivering outcomes. Only one financial incentive existed for businesses to meet service standards for customers - the guaranteed service level (GSL) scheme, which rebates customers who receive a poor level of service. The other non-financial incentive was to have businesses' performance reported and audited against a set of indicators.
 - **Cost efficiency** – Victorian water companies are allowed to retain savings for a full five years before being required to share a proportion of those savings with customers. At PR14, Ofwat similarly provided a totex incentive mechanism for water companies which rewards companies for outperforming on their costs and awards penalties for underperformance against set targets. However, the totex mechanism also includes a menu that determines the cost sharing between the business and the customers.
 - **Revenue forecasting accuracy** – WRFIM is a penalty only incentive mechanism being used for AMP6 to incentivise accurate revenue forecasting. As with water companies in England and Wales, Victorian water companies can also retain any benefits that arise from exceeding the forecasts and also any losses.
 - **Business plan quality** - At PR14, the Risk Based Review (RBR) of business plans tested for well written business plans outlining outcomes, costs, risk and reward, and affordability and financeability. Reputational, financial and procedural benefits were associated with the status (Enhanced, Standard, and Resubmission) of the company that Ofwat awarded. No similar incentive mechanism was drafted by the ESC in their last price review. By introducing PREMO in Victoria, this will address incentivising better quality business plans. Further to this, **ambition** will also be encouraged by PREMO.

The differences fundamentally affect the comparability of the PREMO framework and its possible application in the English and Welsh water sector environment. The types of incentives which are effective may be influenced by the ownership structure. The regulatory incentive base from which the two water sectors operate in also differ in advancement. Noting these factors, the direct application of elements of PREMO should be done with caution (further views from water companies in England and Wales are explained in Box 5). However, it should also be noted that PREMO aims to address ambition which neither Ofwat nor the ESC targeted specifically in their previous frameworks.

Box 4: Cost of debt consultation responses on PREMO

In the September 2016 consultation ‘*Water 2020: consultation on the approach to the cost of debt for PR19*’, one of the questions focused on the potential advantages and disadvantages of a menu based approach to the cost of equity, with reference to the PREMO framework. Water companies’ views generally recognised more disadvantages in this approach, if implemented in England and Wales, than advantages for several reasons which are summarised below.

- **PR14 mechanisms are sufficient** – Water companies view current mechanisms driven by reputational, procedural and financial benefits as already working well for incentivising companies to be ambitious in finding solutions to customers’ concerns. They also suggest it may be more effective to improve the existing incentive structure first.
- **Different regulatory environments** - Water companies regulated by ESC and Ofwat operate in different environments (see **above** for key differences) and so the framework may not be applicable to the Ofwat environment. PREMO has not been tested yet either since the framework will only be used to establish prices from July 2018.
- **Judgement may be too subjective** – Some companies have identified that judgement for which category a company falls under (Leading/Ambitious/Standard/Basic) could be highly subjective since the criteria under each of the categories are fairly open.
- **Act as a disincentive for ambitious plans/ inflate all plans** – Another concern was that companies may in fact be disincentivised from submitting ambitious plans. The reason for this is that if the regulator decides that a plan is not ambitious as the company’s self-assessment, then a penalty is awarded which may cause all companies to tend toward the ‘safe’ option. On the other hand, the Boards of companies are unlikely to want to be seen as submitting a plan which is ‘standard’ or ‘basic’, hence plans may be inflated with greater ambition that may not balance with actual delivery and customer preferences.

Overall companies, were not in favour of implementing a menu based approach to the cost of equity according to the reasons stated above. Nevertheless, it was expressed that Ofwat should continue to develop the regulatory framework to encourage strong, innovative and balanced business plans, with rewards to successful delivery.

Conclusion

Overall, PREMO may be appropriate in the Australian water sector context given that the previous regulatory framework did not develop incentive mechanisms for certain factors which are currently being addressed by Ofwat. However, given the differences in the two environments and hence the impact that the PREMO incentive mechanism could have in England and Wales, its application may not be completely appropriate.

It should be recognised though, that the PREMO framework advances the subject of trying to encourage companies to create ambitious plans and implement innovative solutions. Ofwat currently awards well evidenced and high quality plans through the risk-based review requirements but ambition is not directly considered. Whilst it is important to produce high quality plans, these may not be ambitious in leading innovation to achieve greater benefits for the customer.

Appendix I – ODI structure

This appendix sets out the current structure of financial Outcome Delivery Incentives (ODIs), distinguishing between ‘penalty only’ ODIs and ‘reward and penalty’ ODIs.

Current structure of ODIs

Currently companies are asked in their business plans to propose a set of outcomes they will deliver. Each outcome has an accompanying measure of performance e.g. for the outcome of leakage a measure is mega-litres per day (Ml/d). The companies then commit to achieving certain level of performance, known as the ‘performance commitment’ (or PC) e.g. for leakage this could be 10 Ml/d.

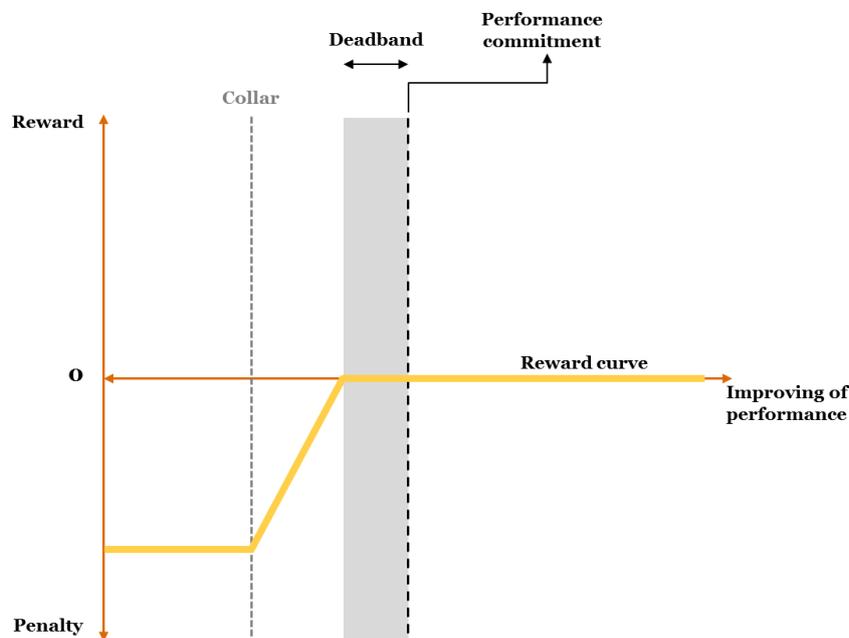
For financial ODIs – those that will attract monetary rewards and/or penalties depending on performance – the pay-out to companies from ODIs is determined by the following structural features:

- *Deadband* – this is a buffer around the PC level for which there are no penalties or rewards.
- *Collars* – below a certain performance level penalties are maximised.
- *Caps* – above a certain performance level rewards are maximised
- *Incentive rate* – for performance that is between the deadband and any caps and collars, the incentive rate is the reward or penalty earned per unit of performance i.e. it determines how quickly rewards/penalties accumulate as performance improves/declines.

Penalty only ODIs

The structure of a penalty only ODIs is shown in Figure 28 below. As the name suggests, there are no rewards for above PC level performance. For below PC level performance outside of the deadband, penalties are accumulated up to the level of the collar. Any deterioration in performance below the collar attracts no further penalty.

Figure 43: Penalty only ODIs

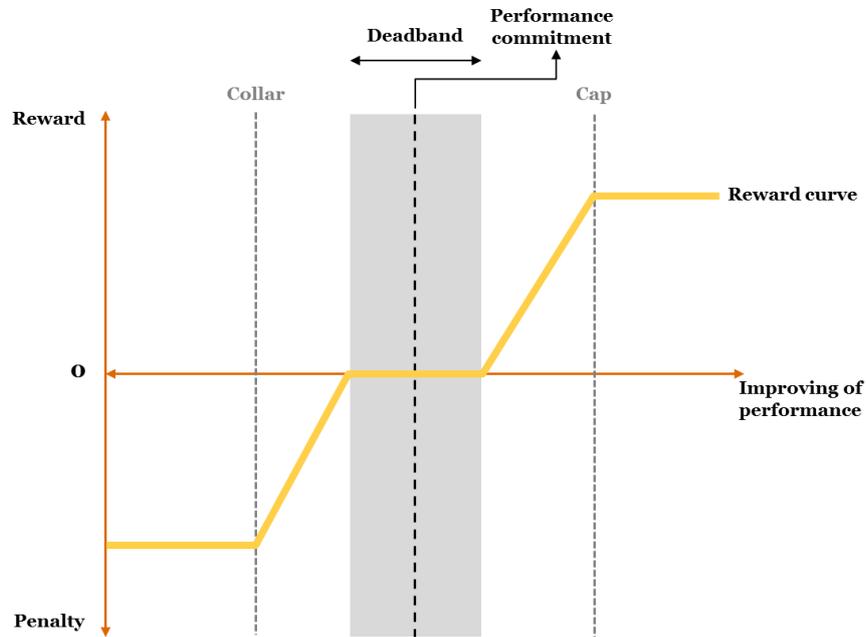


Source: PwC analysis

Reward and penalty ODIs

The structure of a reward and penalty ODIs is shown in Figure 44 below. These ODIs have a positive pay-out associated with above PC level performance, but, as with penalties, a cap to rewards is applied beyond a given level of outperformance.

Figure 44: Reward and penalty ODIs



Source: PwC analysis

Appendix J – Innovation, uncertainty and real options

This appendix sets out the regulatory challenge that innovative projects create, establishes a framework for thinking about company innovation under uncertainty and highlights potential regulatory options for encouraging innovation.

Cost and value uncertainty

To frame the regulatory challenge created by innovation, Table 32 below sets out the information problem faced by regulators and companies. The matrix shown distinguishes between situations where the regulator and company have differing degrees of uncertainty regarding the costs and value a project can generate. The quadrants of the matrix show the following:

- In the upper left-hand quadrant we have a situation where both the regulator and the company have certainty over the costs and value of a given project; in this situation it can be observed which projects are value-enhancing.
- In the upper right-hand quadrant we have a typically regulatory problem, where a company has an information advantage over the regulator regarding the level of costs required to deliver value (for instance the costs required to achieve a given performance level on a specific outcome). This type of regulatory challenge can be solved through mechanisms such as menus and business plan incentives (see Appendix E).
- In the lower right-hand quadrant both the regulator and company have uncertainty over the value a project will generate for a given cost.

It is in the lower right-hand space that many innovative projects are likely to lie. Innovating inherently involves some process of trial and error. Companies and regulators alike will be uncertain ex-ante over which projects will lead to successes and innovation and which will not.

Table 33: Uncertainty and innovation

		Regulator info on costs to value trade-off from a project	
		Certain	Uncertain
Company info on costs to value trade-off from a project	Certain	Regulator and company aligned on which projects are value-enhancing.	Regulator cannot observe company effort/ability. Menus, business plan incentives and other info revelation devices are used to address this issue.
	Uncertain		It is in this space that many innovative projects will lie.

Source: PwC analysis

Company innovation under uncertainty

Given the challenge set out above, under what circumstances will companies choose to proceed with potentially innovative projects? To explore the answer to that question we consider a simple illustration of a company choice as set out in Table 33 below.

Table 34: Real option example

Option	Probability	Costs	Performance	Revenue
Investment (INV)	a	C^*	P^*	R'
	1-a	C^*	P'	R'
No Investment (NINV)	1	C'	P'	R'

Source: PwC analysis

Where:

'a' is a probability such as that [$0 < a < 1$];

$C^* > C'$; and

$P^* > P'$.

Given these circumstances, the company will choose the no investment option when the profit from not investing (π_{NINV}) is greater than the expected profit from investing ($E(\pi_{INV})$). This can be checked by seeing whether the following expression holds:

$$\begin{aligned} \pi_{NINV} &> E(\pi_{INV}) \\ (R' - C') &> (a(R' - C^*) + (1 - a)(R' - C^*)) \\ (R' - C') &> (R' - C^*) \\ C^* &> C' \end{aligned}$$

As the expression holds, we find under these conditions that the profit from not investing is greater than the expected profit from investing. From this simple illustration, three implications can be drawn:

- Where the investment leads to a reduction in costs i.e. where $C' > C^*$, there is a cost saving, the investment will be favoured. But where there is a positive cost from the project, the expected return from the investment will need to change for the project to be viable.
- One mechanism by which the investment could be made viable is through ex-ante funding of projects. The funding required would be equal to the amount $C^* - C'$. The aggregate of funding available could be capped and access to funding made competitive (this would be similar to the Ofgem Network Innovation Competition).
- A second mechanism by which the investment could be made viable is by linking rewards (delivered through higher revenue) to performance.²²⁸ For example, this could be done through ODI rewards. This case is shown in Table 34 below:

Table 35: Real option example with revenue as a function of performance

Option	Probability	Costs	Performance	Revenue
Investment (INV)	a	C^*	P^*	R^*
	1-a	C^*	P'	R'
No Investment (NINV)	1	C'	P'	R'

Source: PwC analysis

Where:

$$R = f(p); \text{ and}$$

²²⁸ A reward could also be achieved through an upward adjustments to the RCV rather than directly to revenues.

$$R^* > R'$$

Given these circumstances, we find that the investment will go ahead where the following holds:

$$\begin{aligned}\pi_{NINV} &< E(\pi_{INV}) \\ (R' - C') &< (a(R^* - C^*) + (1 - a)(R' - C^*)) \\ (C^* - C') &< a(R^* - R')\end{aligned}$$

The expression above shows that for an investment to go ahead, given the uncertainty inherent in the project (as captured by 'a'), the rewards for successfully improving performance must outweigh the investment cost. Furthermore, it shows that as the probability of an investment leading to improved performance decreases (a lower value of 'a'), the rewards required per successful project grow.

The key challenge with this approach is that it involves estimating a value that customers derive from a given level of performance improvement. For a given company, for their customers to be better off as a result of the project, the rewards, recovered through higher bills, would have to be outweighed by the monetary value of the improved performance.

Viewing innovation through the lens of a single company may overlook potential externalities that innovation can generate. If innovation is shared and performance across the industry improves as a result, then there is a social benefit from innovation that is greater than the private benefit to specific group of customers. For this reason, a company earning a private reward in excess of the benefits to its own customers may be preferable so long as the reward is less than the social benefit of the innovation.

Implications

The implications of the analysis in this appendix are fourfold. Firstly, without a regulatory mechanism to support innovation, investment into potentially outcome improving projects may not occur – this is particularly relevant where ODIs are mostly 'penalty-only'. Secondly, ex-ante funding of projects can support innovation, but a mechanism for funding and selecting which projects qualify is required. Thirdly, innovation can be encouraged through rewards for performance improvements, however, careful consideration regarding the quantification of rewards required. Lastly, where the probability of success is small, regulators may have to be prepared to accept large rewards on a small proportion of projects for the incentive to operate efficiently.

Appendix K – Measuring AMP5 and AMP6 performance

For the analysis on the current balance of incentives, given that only FY16 data is available, we have also used data from AMP5. This provides us with a larger set of data to gain more informed insights about the trends in companies’ performance over time. However, given that there are differences in the incentives used between the two price review periods, this required us to carefully consider how to make the data comparable. In this section, we will outline the key differences, and then the assumptions and sources used in order to reconcile the dissimilarities.

Looking at the incentives used in AMP6, we recognised that it would be possible to compare the following areas with AMP5 performance:

- Totex;
- Financing;
- Revenue; and
- Service Incentive Mechanism (SIM).

In this appendix, we will take each in turn to discuss the process used to generate our analysis.

Totex

Cost incentives used in AMP5 involved an opex incentive allowance (OIA) and a capital expenditure incentive scheme (CIS). During AMP6, these were replaced with the totex menu reconciliation so that companies had more incentive to reveal information and for some extra flexibility in setting totex baselines and cost sharing factors. To make the two incentives comparable across the price control periods, we have summed the AMP5 opex and capex allowance (and similarly with actual spend) and made an assumption that the cost sharing rate in AMP5 is the same as in FY16.

The table below lists the key data used, sources, and adjustments made to calculate cost performance.

Table 36 AMP5 and AMP6 totex data and assumptions

Data	Source	Adjustments and assumptions
Allowed totex in AMP5	Allowed opex: Ofwat > PR14 final determination > legacy populated feeder models at final determination > opex outperformance Downloaded on a company by company basis and aggregated.	Values provided in 2012/13 prices. Financial year-average RPI used to convert values into nominal prices.
	Allowed capex: Ofwat > PR14 final determination > legacy populated feeder models at final determination > Capital incentive scheme Downloaded on a company by company basis and aggregated.	Values provided in 2007/8 prices. Financial year-average RPI used to convert values into nominal prices. COPI index component not taken into account.
Actual totex in AMP5	For FY11 to FY14 data source the same as allowed opex. For FY15 data sourced from individual company regulatory accounts.	Values provided in 2012/13 prices. Financial year-average RPI used to convert values into nominal prices. FY15 retail opex does not distinguish between water and wastewater. Hence, historic average of split between water

		and wastewater in retail component used for FY15.
	For FY11 to FY14 data source the same as allowed capex. For FY15 data sourced from individual company regulatory accounts.	No adjustments, as values are in nominal prices.
Allowed totex in FY16	PR14 final determination > company specific appendices > Table A2.4 and table A3.4	Values provided in 2012/13 prices. Financial year-average RPI used to convert values into nominal prices.
Actual totex in FY16	From individual company regulatory accounts.	No adjustments, as values are in nominal prices.

Financing

Another area that we can compare for the water companies between the two price control periods is how they have performed in their financing costs. This is done by looking at their real cost of debt versus the allowed cost of debt in their allowances. Companies have an incentive to efficiently finance their debt as this will impact their allowed costs and hence whether they will out or underperform on costs.

The table below lists the key data used, sources, and adjustments made to calculate financing performance.

Table 37 AMP5 and AMP6 financing data and assumptions

Data	Source	Adjustments and assumptions
Allowed cost of debt AMP5	Ofwat PR09 final determination.	No adjustment, as values are real figures.
Actual cost of debt AMP5	From individual company regulatory accounts.	Weighted real average of the nominal, index-linked and floating rate cost of debt. Where values are not presented, for each type of rate, the interest rate is calculated using cash interest payments divided by the total borrowings.
Allowed cost of debt FY16	Ofwat PR14 final determination > Policy chapter A7 ²²⁹	No adjustment, as values are real figures.
Actual cost of debt FY16	From individual company annual performance reports, table 1E	Weighted real average of the nominal, index-linked and floating rate cost of debt. Nominal and floating deflated using actual prevailing RPI.

Revenue

To incentivise companies to outperform their revenue allowances, the revenue correction mechanism (RCM) was used in AMP5, whilst the wholesale revenue forecasting incentive (WRIFM) was used in AMP6. The decision to separate out retail and wholesale performance was taken so that competition within retail could be introduced. For this analysis, we compare the outperformance in each of the respective mechanisms, regardless of the fact that WRIFM only controls for wholesale revenue, because companies would have been incentivised to perform in accordance with the incentive guidelines set at the beginning of each of the price control periods.

The table below lists the key data used, sources, and adjustments made to calculate revenue performance.

²²⁹ Ofwat (December 2014), *Final price control determination notice: policy chapter A7 – risk and reward*

Table 38 AMP5 and AMP6 revenue data and assumptions

Data	Source	Adjustments and assumptions
Allowed Revenues AMP5	Allowed revenues: Ofwat > PR14 final determination > legacy populated feeder models at final determination > revenue correction mechanism Downloaded on a company by company basis and aggregated.	Values provided in 2007/08 prices. Financial year-average RPI used to convert values into nominal prices.
Actual Revenues AMP5	For FY11 to FY14 data source the same as allowed revenues. For FY15 data sourced from individual company regulatory current profit and loss accounts.	No adjustments, as values are in nominal prices.
Allowed Revenues FY16	Ofwat PR14 final determination > companies' populated PR14 financial models	Values provided in 2012/13 prices. Financial year-average RPI used to convert values into nominal prices.
Actual Revenues FY16	From individual company regulatory accounts.	No adjustments, as values are in nominal prices.

SIM

The service incentive mechanism (SIM) was introduced for the first time in PR09, and continued in PR14, to financially reward high quality customer service performance and penalise poorer performance. The amount the company was rewarded or penalised depended on their ranking against other companies. This then determined the percentage revenue that would be awarded. This incentive mechanism will largely remained the same between the two price controls so we have processed FY16 SIM scores using the same method.

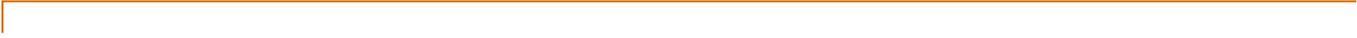
Table 39 AMP5 and AMP6 SIM data and assumptions

Data	Source	Adjustments and assumptions
Reward/penalty AMP5	Ofwat PR14 final determination > policy chapter A4 ²³⁰	Since the financial reward or penalty is calculated cumulatively across the whole period, we have assumed that this amount is evenly split between the five years in AMP5.
Reward/penalty FY16	Ofwat FY16 SIM score Ofwat consultation for percentage of revenue reward/penalty ²³¹	Given that FY17-FY20 SIM scores are unavailable, we are only using FY16 scores to rank companies. Assume companies within 0.5 standard deviations from the mean do not receive a reward/penalty. Assume percentage of revenue to reward/penalise companies is linear to the SIM score.

²³⁰ Ofwat (December 2014), *Final price control determination notice: policy chapter A4 – reconciling 2010-15 performance*,

²³¹ Ofwat guidance on calculation of SIM reward / penalty:

“Most respondents favoured retaining the current level of incentive as this has proven to be effective in improving the level of customer service across the sector. So, we will retain the financial magnitude of the current SIM (that is, the range of -1.0% to +0.5% on total integrated revenues), but will express this in terms of household retail revenues (+6% reward to -12% penalty).”



This document has been prepared only for Water Services Regulation Authority (Ofwat) and solely for the purpose and on the terms agreed with Water Services Regulation Authority (Ofwat) in our agreement dated 23 November 2016.

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