OUTPERFORMANCE WEDGE

Potential performance in RIIO-GD2 - report for NGN

September 2020

CONTENTS

EXECUTIVE SUMMARY

Ofgem published its RIIO-2 Draft Determinations (DD) on 9th July. As part of its proposals, Ofgem incorporated a reduction in the allowed return on equity of 25bps, relative to Ofgem's point estimate of the true cost of equity. According to Ofgem, this is to account for anticipated outperformance by licensees with respect to regulatory targets. We refer to this adjustment as the "outperformance wedge".

Frontier has consistently been of the view, as a matter of principle, that the imposition of any outperformance wedge is unjustified, unnecessary, and counter-productive to the underlying objectives of the regulator. In particular, it runs counter to the regulators' objective to protect the interests of customers in the short- and long-run. We continue to be of the firmest view against the imposition of an outperformance wedge on the allowed return on equity, as a matter of principle.

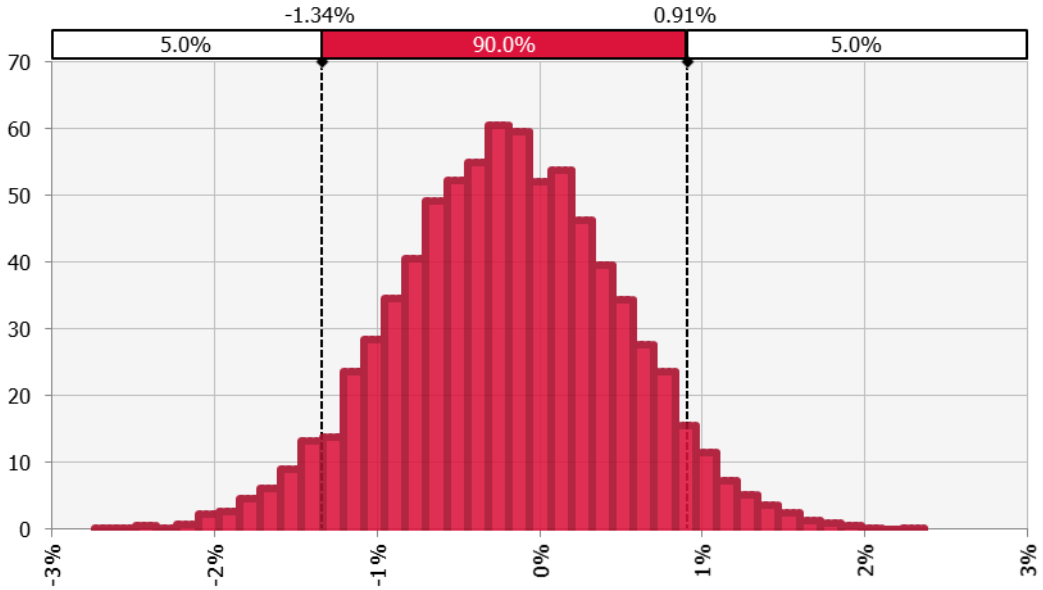
Nevertheless, since Ofgem is minded to introduce an outperformance wedge, it remains important to consider whether there is any evidence to support a view that one might reasonably expect outperformance of 25 bps. To that end, this report has been commissioned by NGN to provide an evaluation of whether Ofgem has reasonable evidential basis to impose the outperformance wedge. The report builds on similar work we previously undertook for NGN (and which was submitted to Ofgem to inform discussions around the wedge).

We have modelled the overall performance of a notional GDN in RIIO-GD2 using a Monte Carlo simulation analysis. Inevitably, any forward-looking analysis of this type will be driven, at least in part, by the assumptions made. Throughout this report, we explain and justify all of our assumptions, and provide a number of sensitivities to check the robustness of the results. We have sought to take into account the specific comments that Ofgem had on our 2019 report, and we believe that our updated work fully reflects the guidance that Ofgem has provided. Our guiding principle has been to adopt, where appropriate, broadly conservative assumptions – meaning our results are likely to over-state the true potential returns that can be expected from the price control package.

Results

Our baseline approach results in an estimated expectation of a -20.2bps underperformance in RoRE terms, for a notional GDN in RIIO-GD2. This is equivalent to an absolute underperformance of -£1.8m per year. Figure 1 below shows the Monte Carlo simulation results of our baseline model.

Figure 1 Baseline model results – total impact (RoRE terms)



Source: *Frontier Economics analysis using @RISK*

Note: *The X-axis measures RoRE out/underperformance and the Y-axis measures the frequency of occurrences.*

The analysis shows that there is only a 25.3% chance that the notional GDN achieves outperformance at or above 25bps. In other words, the notional GDN would see worse than 25bps of outperformance almost three-quarters of the time.

We also calculate that around 6% totex outperformance is necessary to achieve an expected outperformance of 25bps under our base case assumptions. Given the constraints on totex in RIIO-GD2 (outlined in Section 3), we consider it is highly unlikely that a notional GDN would be able to outperform the GD2 DD proposals by 25bps.

Figure 2 provides more detail on the results arising for each incentive. This shows the following key results.

- The main drivers behind the average expected underperformance in our base scenario are the complaints incentive (contributing 8.8bps of underperformance) and the Guaranteed Standards of Performance (GSOP) payments (5.6bps of underperformance).
- The distributional assumptions around totex outperformance are a key driver of the range of plausible outcomes.
- The skew of plausible outcomes is clearly to the downside, suggesting an asymmetrically calibrated price control.

Figure 2 Incentive-level contributions to estimated underperformance

Incentive	Mean RoRE impact (bps)	RoRE impact range (bps)	Mean financial impact (£m/year)	Financial impact range (£m/year)
Totex (excl. NARM and PCDs)	0.0	-108.1 to 108	0.0	-9.67 to 9.67
NARM portion of totex	0.0	-1.4 to 1.4	0.0	-0.12 to 0.12
Tier 1 mains PCD	0.0	-2.2 to 2.2	0.0	-0.19 to 0.19
Tier 1 services PCD	0.0	-0.4 to 0.4	0.0	-0.03 to 0.03
Capital projects PCD	-0.6	0 to 0	-0.1	0 to 0
BPI	0.1	0.1 to 0.1	0.0	0.01 to 0.01
CSS: Planned work	-0.7	-5.9 to 5.2	-0.1	-0.53 to 0.47
CSS: Emergency response and repair	-0.5	-6.2 to 6.1	0.0	-0.56 to 0.55
CSS: Connections work	-0.7	-7.5 to 7.7	-0.1	-0.67 to 0.69
Complaints metric	-8.8	-22 to 0	-0.8	-1.96 to 0
GSOP	-5.6	-11.3 to 0	-0.5	-1.01 to 0
Emergency response time	-2.8	-55.9 to 0	-0.3	-5 to 0
Unplanned interruptions	-0.5	-11 to 0	0.0	-0.98 to 0
Shrinkage and environmental emissions	0.0	-10.7 to 10.7	0.0	-0.96 to 0.96
Total impact	**-20.2**	**-133.9 to 90.7**	**-1.8**	**-11.98 to 8.11**

Source: Frontier Economics analysis using @RISK

Note: RoRE and financial impact ranges report the central 90% of Monte Carlo simulation outcomes i.e. excluding the 5% top most and bottom most extreme outcomes.

Conclusion

Our baseline results suggest that there is no evidence to justify Ofgem's 25 bps outperformance wedge. Given the RIIO-GD2 DD proposals, companies will in all likelihood underperform in RIIO-GD2. Even though there is, of course, a chance that outperformance reaches above 25bps, we do not consider it to be a reasonable exercise of regulatory judgement for Ofgem to base such a key regulatory decision on a scenario with such low (25%) likelihood.

We emphasise that our results arise despite the fact that we have introduced several conservative assumptions that mean our results are likely, in fact, to over-state the actual potential to outperform.

- On totex, we assume a mean expected outperformance of zero. However, we are of the view that the DD is likely to actually result in underperformance for the notional GDN, given the changes that have been introduced in RIIO-2. A full explanation of these changes can be found in our ENA report, but they

include, for example, benchmarking at 85th percentile, setting what appear to be highly stretching productivity targets given the evidence put forward, reduced incentive rates, and more costs exposed to indexing or ex post true up than before. Given this, we anticipate that mean zero is a conservative assumption. In the not-implausible scenario where there is 2% underperformance on totex, this could lead to a further downside of around 15bps.

- While we have modelled the effect of PCDs and NARM on totex incentives separately, we have ignored some material drivers of downside risk – for example the potential for late delivery penalties on some PCDs; and the asymmetric skew of risk associated with the NARM incentive (due to the Delivery Adjustment Factor, and the asymmetric application of tests for "genuine" under/over-spends). We have also ignored the asymmetric incentives around risk-target delivery – i.e. the fact that there is no upside for "justified" departures from the NARM target, but there are downside penalties for any "unjustified" departures.
- We set the totex sharing factor equal to 50%, representing a mildly conservative assumption for the notional GDN's sharing factor (the industry average sharing factor is in fact 49.7%).
- For GSOP, we have conservatively excluded Cadent London's GSOP payments from the analysis. The neutral approach would introduce further downside of around -5bps.
- For emergency response times, we have adopted cautious approach on the penalties networks face if these times were breached. An alternative and more neutral approach may include a further downside of around -3bps.
- Our base case for the BPI assumes a simple average BPI across networks. If we based this on RAV weighted-average BPI outcome this would further worsen the downside by c.1bp in all scenarios.

Unwinding these conservative assumptions might further reduce expected returns by somewhere between 9 and 24 bps (depending on the assumptions made about totex outperformance). Even this range does not factor in the potential for penalties arising on PCDs and NARM.

In short, despite these assumptions which bias our central case results upwards, our analysis still does not support a 25bps wedge. Our findings cast serious doubt over the validity of Ofgem's assumption that 25bps of outperformance can be expected in RIIO-2.

Finally, we note that this report sits alongside two other closely related studies, which have been commissioned as part of the response to Ofgem's DD.

- In our report for the ENA, we have investigated the various analyses Ofgem has put forward in support of its proposals for the outperformance wedge, which Ofgem has provided in the alternative to our Monte Carlo approach.
- We have also undertaken a similar Monte Carlo analysis for National Grid Electricity Transmission (NGET) and National Grid Gas Transmission (NGGT).

We recommend that the three reports be considered in conjunction with each other. Collectively they provide consistent and, in our view, overwhelming evidence that the outperformance wedge cannot be justified.

1 INTRODUCTION

Ofgem published its RIIO-2 Draft Determinations (DD) on 9th July.[1] As part of its proposals, Ofgem incorporated a reduction in the allowed return on equity of 25bps, relative to Ofgem's point estimate of the true cost of equity.[2] According to Ofgem, this is to account for anticipated outperformance by licensees with respect to regulatory targets. We refer to this adjustment as the "outperformance wedge".

Ofgem's 25bps DD proposal is lower than the 50bps outperformance wedge which it had indicated (albeit as a placeholder) in its Sector Specific Methodology Decision (SSMD) in May 2019.[3] In response to the SSMD, one of the GDNs – Northern Gas Networks (NGN) – commissioned a report from Frontier (the original NGN/Frontier report[4], dated 27 September 2019) to evaluate the scope for potential outperformance/underperformance in RIIO-GD2. The purpose was to inform the discussion around the specific level of the wedge Ofgem was proposing.

In response to the DD, NGN has commissioned this report from Frontier to undertake an update of our previous analysis. As we explain further below, we have adopted the same methodological framework that we used in the original NGN/Frontier report – namely a Monte Carlo analysis to simulate plausible outcomes for a notional gas distribution network from the proposed regulatory arrangements. This report seeks to reflect the specific set of proposals which have now been crystallised in the DD (meaning a number of uncertainties we faced when producing the original report have been resolved).

1.1 Purpose of the analysis

There was no clear analytical underpinning which specifically justified Ofgem's original 50bps value for the outperformance wedge at the SSMD, nor has any specific calculation been provided in support of Ofgem's DD value of 25bps. In fact, Ofgem states:

> *using our regulatory judgement, we consider that equity investors should expect at least 0.25% in outperformance returns, in addition to the baseline allowed return on equity*[5]

and that

> *For the avoidance of doubt, Step 3 is not designed to entirely or perfectly capture future outperformance.*[6]

Ofgem's position therefore appears to be that setting a number for the outperformance wedge is not a matter of science, but of judgement. In our view,

1 https://www.ofgem.gov.uk/publications-and-updates/riio-2-draft-determinations-transmission-gas-distribution-and-electricity-system-operator

2 RIIO-2 Draft Determination – Finance Annex, paragraphs 3.108 - 3.148

3 RIIO-2 Sector Specific Methodology Decision, 24 May 2019. Available at https://www.ofgem.gov.uk/system/files/docs/2019/05/riio-2_sector_specific_methodology_decision_-_core_30.5.19.pdf.

4 https://www.northerngasnetworks.co.uk/wp-content/uploads/2019/12/A31-NGN-RIIO-2-Outperformance-Wedge.pdf

5 RIIO-2 DD Finance Annex, paragraph 3.139

6 RIIO-2 DD Finance Annex, paragraph 3.148

however, any fair-minded approach to reaching such a judgement should seek to answer these critical questions:

- what are the potential sources of outperformance in RIIO-2?
- how material are they?
- how plausible is it that 25 bps of outperformance can be expected from the RIIO-2 package, given the specific DD proposals?

Such an analysis is inherently forward-looking. As far as possible it should factor in all the possible ups and downs associated with the proposed price control package.

It is also inherently probabilistic – neither Ofgem nor the sector can know for certain what the outcome will be from any given part of the incentive arrangements. This means that, in exercising its judgement, Ofgem should take into account not only the 'expected' or 'average' level of performance, but also the plausible range of scenarios either side of this baseline expectation.

Our objective, therefore, is to answer the questions above by modelling the RIIO-2 package, and to evaluate whether the resulting range of plausible out- or under-performance could justify an ex ante reduction in allowed equity returns of 25bps.

We note, however, that our analysis also serves a further purpose – namely to provide a comprehensive picture of what the RIIO-2 price control package looks like "in the round". The analysis therefore allows Ofgem, companies, investors and stakeholders to get a picture of the likely net effect of all the decisions on individual parameters, allowances and incentives which make up the RIIO-2 package. This enables us to evaluate, for example, the extent of any skew of risk in the overall package (to the downside or upside); and to stress-test scenarios and sensitivities.

Inevitably, any forward-looking analysis of this type will be driven, at least in part, by the assumptions made. Throughout this report, we explain and justify all of our assumptions, and provide a number of sensitivities to check the robustness of the results. Our guiding principle has been to adopt, where appropriate, broadly conservative assumptions – meaning our results are likely to over-state the true upside potential of the price control package. In our view, if this conservative approach still implies that 25bps overall outperformance is unlikely, this should provide clear evidence that the judgement exercised by Ofgem in reaching its 25bps proposal is unjustified.

We accept, of course, that there is room for debate and interpretation around the assumptions that are used. This is why we have run a number of sensitivities to test the robustness of our conclusions. We hope that Ofgem might find our approach and results informative, and we would be open to further engagement with Ofgem prior to the FD.

1.2 Scope

This report focusses on the DD proposals for the gas distribution sector. We are aware that there will be substantial engagement between the GDNs and Ofgem (as well as input from wider stakeholders) between the DD and the FD, which may result in changes to Ofgem's proposals. We are also aware that there may be a

number of errors and/or data issues in Ofgem's current proposals that need to be resolved.

In general we have not sought to reflect any of these potential changes in our analysis. Rather, we have taken the DD proposals as set out by Ofgem on 9th July as the basis for our analysis. It is clear that this overall package must have been internally consistent from Ofgem's perspective (i.e. that Ofgem considered the 25bps wedge was appropriate, given its DD proposals as set out on 9th July). If Ofgem would find it helpful to see an updated analysis reflecting any changes or error corrections it intends to make for FD, we would be happy to discuss the provision of such an update.

In the original Frontier/NGN paper, we attempted to set out an analysis which conceptually reflected a "notional" GDN – i.e. where possible basing our analysis on average expected performance for the sector (rather than focussing on NGN specifically). The underlying reason for this is that Ofgem's outperformance wedge is applied uniformly across the sector – therefore an evaluation of the price control package for the sector is appropriate. We therefore continue to adopt this 'notional' approach wherever possible. In all cases we explain clearly where our data comes from and how it has been interpreted to reflect notional values.

1.3 Other Frontier work

Alongside this report, two other closely related studies have been commissioned as part of the response to the Ofgem DD.

- In our report for the ENA, we have investigated the various analyses Ofgem has put forward in support of its proposals for the outperformance wedge, which Ofgem has provided in the alternative to our Monte Carlo approach. While we do not repeat the detailed findings of that study here, where relevant we have indicated where the conclusions drawn from that study have been used to inform our thinking on the modelling approach in this paper.
- We have also undertaken a similar analysis for the transmission business, in a report commissioned by National Grid (NG). This analysis will be applied to NG's two transmission businesses – National Grid Electricity Transmission (NGET) and National Grid Gas Transmission (NGGT). We have adopted the same methodological framework that we used in the original NGN/Frontier report – namely a Monte Carlo analysis to simulate plausible outcomes from the proposed regulatory arrangements. However, as we explain in our parallel report for National Grid, it is less feasible to adopt a 'notional' approach in the transmission sectors.

While each of these reports should therefore represent a self-contained assessment, it is also clear that there are degrees of overlap and read-across between them. It is also the case that Ofgem has not distinguished between any of the sectors for the purpose of setting a wedge, but rather has applied a blanket 25bps assumption. We therefore recommend that the three reports be considered in conjunction with each other.

1.4 In principle rejection of outperformance wedge

Frontier has consistently been of the view, as a matter of principle, that the imposition of any outperformance wedge is unjustified, unnecessary, and counter-productive to the underlying objectives of the regulator. In particular, it runs counter to the regulator's objective to protect the interests of customers in the short- and long-run. This is for a wide variety of reasons, including:

- The proposed adjustment would create a link between current performance outturn and future return on capital, thereby undermining incentives to make outperformance in the first place and leading to lower levels of dynamic efficiency.
- It would lead to a headline figure for the cost of equity that would not reflect Ofgem's assessment of the true cost of equity, thereby undermining a key incentive for investment.
- Ofgem's arbitrary adjustment undermines past stability and predictability of the UK regulatory model and would weaken investor confidence to the detriment of customers.
- The proposal of a 25bps reduction is arbitrary, not based on robust analysis and reliant on selective data.
- The proposal also reduces the clarity over how any element of the price control has actually been calibrated. Ofgem intends to set the wedge to correct for perceived errors in the calibration of potentially numerous other parts of the price control, but does not set out any further detail over which elements of the price control have been considered or how materially each element has driven this judgement. This weakens stakeholders ability to scrutinise the detail of the price control, and may frustrate focused appeal rights.

A fuller description of these issues is provided in the separate ENA report. As we explain further in that report, it is also the case that other regulators, including Ofwat, the CAA, and the CMA, have all been faced with the same evidence of past outperformance and the same sorts of challenges currently faced by Ofgem, yet they have adopted alternative approaches, rather than resorting to an outperformance wedge. This demonstrates that more direct remedies for issues in previous price controls are available to regulators. Indeed, Ofgem appears to have adopted many such remedies (indexing RPEs being one such example) and yet has still layered the outperformance wedge on top of this.

We also note that, in many cases, some of the costs associated with achieving outperformance are funded through shareholder investment rather than by customers.[7] This has two implications: first, a review purely of regulatory performance may not fully reflect the actual returns earned by shareholders; and second, the likelihood of such voluntary shareholder investment will be diminished

[7] While this point applies generally, one example of this is a decision made by NGN's shareholders in GD-1 to make additional pension payments to staff over 55 years old, which encouraged them to retire early. This reduced opex spend in subsequent years.

in RIIO-2 as a consequence of the wedge. We explain the potential consequences for customers of reduced incentives in our ENA report.

We continue to be of the firmest view against the imposition of an outperformance wedge on the allowed return on equity, as a matter of principle. We note that, in responding to the original Frontier/NGN report, Ofgem stated:

> *We consider it positive that Frontier have engaged on the topic and acknowledge that the allowed and expected return are not identical. We agree with the approach of making estimates of the AR-ER reflective of allowed and expected returns in RIIO-2.*[8]

For the avoidance of any doubt, our analysis should not be taken to imply our tacit agreement with the idea of separating allowed and expected returns for the purpose of setting the allowed return on equity. We were quite clear in our original report that if the results implied negative outperformance, we would not recommend that the allowed return on equity therefore be increased. Even if our analysis showed expected returns well above 25bps, for the reasons outlined above our view is that it would still represent poor regulatory policy to impose an outperformance wedge.

Our report should therefore be understood as an attempt to provide Ofgem with a tool to evaluate its judgement over the proposed level of the wedge at 25 bps. In other words, our report represents the sort of exercise we assume Ofgem would be interested in undertaking to test the validity of its judgements, given Ofgem's disagreement with our in-principle position.

In our view, Ofgem must undertake a careful review of what its price control package means in reality and in-the-round for company expectations in RIIO-2. Otherwise, a 'judgement' that 25bps can be expected for RIIO-2 is entirely abstract and arbitrary.

1.5 Report structure

The remainder of this report is structured as follows:

- section 2 describes the overarching methodology in this study, including setting out the broad steps we have taken and an overview of Monte Carlo analysis techniques; and
- section 3 focusses on the assumptions we have used to model RIIO-2 totex;
- section 4 sets out a detailed description of how we have modelled a notional GDN's non-totex RIIO-2 incentives;
- section 5 sets out the overall results from our "base case" models;
- section 6 sets out some sensitivities around our base case;
- section 7 pulls together the conclusions and implications we draw from the results in sections 5 and 6.

[8] RIIO-2 DD Finance Annex, Appendix 3, page 193.

2 OVERVIEW OF METHODOLOGY

In this section we:

- first, describe the structure and purpose of Monte Carlo simulation;
- second, set out at a high level the steps we have taken for the analysis; and
- third, provide a high-level response to Ofgem's feedback on our original work for NGN, identifying how it has informed our approach here.

2.1 Monte Carlo simulation

Monte Carlo simulations are used to model the probability of different outcomes in a process that cannot easily be predicted, e.g. due to the existence of random variables or shocks.[9] They involve running a large number of simulations of possible outcomes for a given variable, based on a specific expected mean value for that variable; and a probability distribution of potential variation around the mean. The probability distribution can be specified to reflect the particular characteristics of the variable being assessed (for example, by accounting for skew in the likely distribution of outcomes; by modifying the standard deviation of the probability distribution; and/or by using alternative types of distribution e.g. Normal, Bernoulli; or Triangular). More information on the probability distributions used in this analysis is available in ANNEX B.

In the context of the RIIO price controls, this probabilistic simulation approach is helpful because Ofgem and the companies cannot predict with certainty how companies will perform against their allowances or incentive targets. Performance can therefore be modelled using Monte Carlo simulation, subject to specifying the relevant assumptions for each incentive. The output from each individual simulation is a combination of probabilistically determined out/under-performance for each incentive, which can be aggregated together to derive an overall financial result. With a sufficiently large number of 'draws' from these probabilistic scenarios, an overall distribution of plausible total returns can be estimated by aggregating the output from each individual iteration.

In addition, Monte Carlo analysis enables us to test hypotheses around the extent to which different incentives in a price control package are correlated with one another. So, for example, if Ofgem was of the view that outperformance on costs is typically also associated with outperformance on some ODI targets, that correlation can be built into the Monte Carlo assumptions. This means each individual iteration/simulation is internally consistent, given prior expectations about these correlations between incentives. The effect of different plausible combinations of correlations on the overall results can therefore be tested (including, if relevant, an assumption of no correlation).

2.2 Summary of methodology

Given the above, our methodology follows the following steps.

[9] https://www.investopedia.com/terms/m/montecarlosimulation.asp

- **Step 1**. Identify the relevant incentives from RIIO-GD2 Draft Determinations to be modelled, and establish the target levels and relevant financial incentivisation parameters Ofgem has proposed.
- **Step 2**. Establish key probability parameters for each individual incentive based on evidence e.g. of past performance, or of reasonable expectations of RIIO-2 performance, given the DD approach. Specifically, we identify:
  - the relevant form of probability distribution (normal, Bernoulli, triangular etc)
  - the relevant parameters to populate that distribution (e.g. for normal distribution, the mean expected performance and standard deviation).
- **Step 3.** Where relevant, identify any cross-correlations between incentives.
- **Step 4.** Run Monte Carlo simulations to produce probability distributions for aggregate financial performance.
- **Step 5.** Specify and test sensitivities around the core assumptions used to produce results at Step 4.

Each of these steps is described in detail for totex (section 3); and non-totex incentives (section 4). In each case we explain the relevant evidence that is used to underpin our assumptions.

2.3 Response to Ofgem critique

In its review of the original Frontier/NGN paper, Ofgem acknowledged that:

> *Frontier's work is a helpful contribution, which we recognise as a plausible framework for further work.*

However, Ofgem ultimately placed no weight on the analysis in exercising its judgement around the level of the outperformance wedge. Ofgem's principle concern was that it could not reconcile the input assumptions we had used with "*actual data, including observed returns*." Specifically, Ofgem identified two issues.

- First, our assumption of neutral totex performance as the mean/expected position for totex incentives was, in Ofgem's view, unjustified. This is based on Ofgem's assessment of a database on totex performance in regulated sectors spanning from 2000 to 2020[10], from which Ofgem concludes that average observed totex underspends in the past have been 7%.[11] In Section 3 we therefore explore the relevance of Ofgem's assessment of past underspends for the likely performance in RIIO-2, given the package Ofgem has set out. We also note that while Ofgem disputed the average assumed totex outperformance of zero, the key benefit of Monte Carlo analysis is that it allows us to model the likely *range of possible outcomes* around that average. Ofgem did not appear to engage with this at all in its DD review of our paper.
- Second, Ofgem identifies that some of the results for certain ODIs (specifically GSOP and emergency response times) appeared to give more downside than historical data suggested was plausible. We explore this issue in more detail

[10] Whilst Ofgem refers to totex performance from 2000 to 2020, much of the totex performance included in the analysis occurred in the mid-1990s. These price controls are clearly much less relevant comparators for the present day (for example, DPCR1 started in 1996/97).

[11] RIIO-2 DD Finance Annex, paragraph 3.123

in Section 4.4 and Section 4.5. More generally, however, we agree with Ofgem's view that it is important to sense check the results of the analysis against the available evidence, and to ensure closer alignment to verifiable data and to the emerging incentive framework that is now proposed for RIIO-2. This is a helpful steer from Ofgem and, throughout this report, we have therefore sought to explain fully how our assumptions are derived from the combination of both historical data and the now-crystallised proposals that are set out in the DD. We note, in particular, that there were substantial uncertainties surrounding the specifics of the RIIO-2 incentive framework when our original work was undertaken, the majority of which have now been resolved by the DD. Throughout this work we have therefore sought to tie our assumptions specifically to the DD proposals.

In short, we believe our updated work fully reflects the guidance Ofgem has provided in these comments.

2.4 Reporting financial impact

Our analysis of Ofgem's proposed outperformance wedge attempts to consider out/underperformance from the perspective of a notional company. However, for the purposes of examining bottom-up performance, we have had to refer to financial metrics to calculate payoffs for most incentives. This is because RoRE calculations require a RAV value, and many incentive payoffs are linked to metrics such as allowed totex or revenues. For example, the Customer Satisfaction Survey incentives are linked to a company's allowed revenues and the maximum penalty or reward is capped at ±0.5% of revenues. In order to calculate the financial impact, we therefore have to make use of a consistent set of financial metrics.

We have used forecasts in Ofgem's license model for GD2. We consider NGN's forecasts a reasonable reference point to use for the notional company. Figure 3 compares the GD2 forecast RAV/Totex across the GDNs. It shows that the ratio is relatively consistent across companies. While NGN's RAV/totex ratio is slightly lower than other GDNs, we do not consider this to be an outlier, or unrepresentative of a notional GDN.

Figure 3 Network RAV/totex ratios

Network	GD-2 average RAV (£m, 18/19 prices)	GD-2 average totex (£m, 18/19 prices)	RAV/totex
East	3,182	266	12.0
London	2,302	215	10.7
North West	2,293	201	11.4
West Midlands	2,729	161	10.7
Northern	2,236	224	10.0
Scotland	1,752	174	10.1
Southern	3,876	349	11.1
Wales and West	2,183	206	10.6

Source: Ofgem RIIO-2 Draft Determinations – GD License Model

Given this, our results would not be expected to be any different had we instead used the financial values for any of the other GDNs (or, for example, some proxy for a notional GDN or industry average values). Our approach therefore reflects the results we would expect to see across the industry, and can be interpreted as generally applicable for the whole sector.

For the purposes of our modelling, we use a “notional year” of performance. To model this notional year, we take the average values across GD-2.

3 TOTEX

As outlined above, each of the incentives in our Monte Carlo simulation requires us to specify the form and parameters of a probability distribution, reflecting the expected range and likelihood of plausible outcomes. In this section we set out our approach for totex, which is generally expected to be the most material source of outperformance/underperformance. We consider it is reasonable to assume a normal distribution for totex performance and therefore we need to specify two key parameters: the mean and the standard deviation.

In the previous Frontier/NGN report, we assumed a mean of zero. We explained that this reflected a scenario in which Ofgem was able to set totex allowances that a notional company can meet but not beat, on average. In other words, it reflected a price control that was a "fair bet". We considered this approach was justified because:

- we assumed it is Ofgem's aim to set allowances so as not to systematically provide expected reward (or penalty) for the companies;
- if Ofgem set totex allowances based on an upper quartile benchmarking methodology then assuming zero mean outperformance would be consistent with GDNs improving their efficiency to meet targets that current performance suggests is presently beyond their average capability; and
- there is evidence that Ofgem and other regulators have been able to set such price controls in the past, i.e. that some companies have in the past overspent vs. regulatory totex allowances.

Ofgem has argued that the mean zero assumption "contrasts with available evidence", pointing to its analysis of historical performance from a range of regulated sectors and past price controls. Ofgem concludes from this data that, on average, regulated companies have achieved outperformance of 7%, and that there is a tendency towards underspending.[12] Ofgem also provides an assessment of what, in its view, the outperformance in RIIO-1 would have been if a number of the new policy proposals set out in the RIIO-2 DD had been employed at RIIO-1.[13] Ofgem concludes that both analyses generally support its position that expected outperformance levels are above 0.25% in RoRE terms for RIIO-2.

Both of Ofgem's analyses are scrutinised extensively in our report for the ENA. In short, neither of them stands up to scrutiny. The result from the historical analysis is largely driven by price controls more than a decade old, which no longer hold any relevance to the situation faced by energy networks today. The re-statement of RIIO-1 outperformance contains a material spreadsheet error[14], and fails to reflect a substantial number of policy changes that almost entirely eradicates RIIO-1 totex outperformance (before even reflecting the increasing use of NARMs and PCDs). Similar sorts of adjustments would need to be made for all of the price controls contained in Ofgem's database of historical outperformance in order to

[12] RIIO-2 DD Finance Annex, paragraph 3.123

[13] RIIO-2 DD Finance Annex, paragraphs 3.129 – 3.132

[14] Whilst this spreadsheet error relates to the GT sector, this has an impact on Ofgem's estimate for "average" RIIO-1 restatement at RIIO-2.

undertake a proper analysis. More detail on our assessment can be found in the ENA report.

In the rest of this section we set out how correcting Ofgem's analyses reveals that an assumption of mean zero outperformance would be a conservative approach for evaluating the DD proposals for a notional GDN. We discuss in turn the historical data; and the relevant policy changes for RIIO-2. Finally, we set out what this means for the parameters we have assumed for modelling totex; and the results from the totex incentive for a notional GDN.

3.1 Ofgem's totex outperformance database

In undertaking its historical analysis, Ofgem constructed a dataset of performance from past price controls, covering a range of sectors including:

- Gas distribution;
- Electricity distribution
- Gas transmission;
- Electricity transmission;
- Water;
- Water and sewerage; and
- Aviation.

This comparator set is extremely wide, and covers 27 different price controls spanning almost 25 years. In principle, the risk with building such a wide set of comparators is that the differences between observations will lead to including observations that are not comparable.

Indeed, the issue with this specific comparator set is that the very first price controls in gas and electricity distribution were calibrated in a very different way to the RIIO price controls, and performance against these are unlikely to be comparable with the most recent price controls before RIIO.

Specifically, this is an issue that applies to the first three electricity distribution price controls and the first gas distribution price control because the philosophy and methodologies that underpinned those price controls are far removed from those that have been adopted more recently, in particular those that are being used now to set RIIO-2. Price controls were smaller in scale and ambition with far fewer instruments. Benchmarking was comparatively limited and there was no heavy focus on ensuring that costs and revenues would track one another closely during a price control. The focus was entirely on setting a broadly reasonable "fixed target" alongside very strong incentives (particularly on opex) that would provide strong inducement for the only relatively recently privatised firms to pursue and reveal efficiencies as aggressively as possible.

If we exclude these four price control results from the comparator data, the remaining comparator set shows a new mean historical totex outperformance of 3.7%. Across these price controls, we also calculate the range of totex performance has a standard deviation of around 8.8%.

However, it should be noted that even this totex outperformance also includes data from other sectors including airports, air traffic control and water. While there are some high level similarities in the overall price control frameworks, there are also important differences in the way regulation is done and the underlying costs and cost structures of these different businesses operating in different sectors.[15] Therefore, it is not clear that this data adds much to the debate about what the energy networks may be able to achieve in future. More detail on our assessment can be found in the ENA report.

3.2 Accounting for material shift in RIIO-2

There are a number of additional significant reasons to believe that a notional gas distribution company can actually expect much lower totex outperformance. Below we discuss in turn:

- Indexing RPEs
- Price Control Deliverables (PCDs);
- Network Asset Risk Metric (NARM);
- Cost assessment approach; and
- Ongoing productivity assumptions.

3.2.1 Indexing RPEs

For RIIO-1, Ofgem set fixed ex ante allowances for RPEs over the eight year price controls, based on expectations at the time. For RIIO-2, Ofgem will move to indexing RPEs annually to a set of external indices. This should mean that the input price assumptions underpinning price control allowances more closely track actual movements in input prices year on year.

Ofgem has stated that it believes that the fixed RPE allowances in RIIO-1 were a material source of outperformance in those price controls. In fact, in the course of providing its analysis to re-state RIIO-1 outperformance to be on a RIIO-2 basis, Ofgem has directly estimated what the effect of indexing RPEs in RIIO-1 would have been. Across the sector, RIIO-GD1 allowances would have been reduced by over £700m according to Ofgem's allowances, had RPEs been indexed. This means that over 44% of RIIO-GD1 totex outperformance would have been removed if RPEs were indexed. Put another way, RIIO-GD1 totex outperformance (as a share of allowed totex) would have fallen from just over 11% to just over 6% - a fall of c. 5 percentage points.

Ofgem's analysis therefore suggests that indexing RPEs alone might justify a reduction vs. past totex outperformance of approximately 5%. Clearly this cannot be compared directly with the longer run historical mean totex outperformance of 3.7% (which will have been based on different levels of allowances for RPEs, as well as entirely different price controls). However, it is plausible to believe that

[15] To illustrate, Heathrow has an average revenue form of price control so there is a need to control for volumes. It seems that this has not been done, and hence it is not clear that the data for airports is reliable, even if we were to believe that it is otherwise comparable.

indexing RPEs, on its own, would justify a very substantial reduction in the mean expected outperformance in RIIO-2, potentially even to below mean zero.

3.2.2 Price Control Deliverables (PCDs)

Price control deliverables (PCDs) are characterised by specific deliverables for the funding allocated, and have mechanisms where customers are refunded if the specified output is not delivered. The funding for these projects are not transferrable to a different output.

The nature of individual PCDs is very bespoke, and so the way they are assessed will vary from PCD to PCD. As described by Ofgem, PCDs are subject to project-specific incentives. Some PCDs will have allowances recovered through a formulaic method, while others will be subject to an ex-post review from Ofgem.[16]

However, we understand that Ofgem's broad intention behind introducing PCDs is to restrict any totex outperformance in the event of non-delivery or late-delivery of specific projects, or changes in scope/specification of works vs. what was anticipated when the price control was set. This means another (potentially significant) source of outperformance that would have underpinned historical outperformance has now been removed in RIIO-2.

In gas distribution, the majority of PCDs occur in repex, which relate to specific projects on the replacement of iron mains pipes. These projects are typically assigned into categories of work, each with different unit costs, which have an allocated workload. Ofgem sets the workload for each network, with a common unit cost across categories of work. Ofgem only allows funding for workload higher than in the business plan on a limited basis, whilst all underspend will be clawed back. The maximum additional funding is:

- 2% of planned workload for repex tier 1 mains work; and
- 10% of planned workload for repex tier 1 services work.

While the majority of PCDs relate to repex, there are a small number of capital projects that are subject to PCDs. These are discrete projects with pre-agreed deliverables and specifications. These will be independently audited at the end of the project, to check the project specification has been met.

On both of these types of PCDs, we consider it reasonable to assume the expected outperformance will be zero. However, for the purposes of our modelling of RIIO-2, we have modelled repex and capital projects slightly differently.

- For repex PCDs, given our understanding of the incentive arrangements and Ofgem's intended purpose, we consider it is sensible to assume that expected outperformance is zero on these PCDs. Arguably this may even be conservative, given the potential downside skew outlined above. We also expect that the range of potential performance on PCDs is likely to be significantly narrower than the range of performance observed historically. This is because Ofgem's clear intent with the design of PCDs is to limit the scope for outperformance, meaning the observed range will by definition be narrower than in the past. Furthermore, the restricted upside (which is subject to ex post

[16] RIIO-2 DD core document, paragraph 4.8-4.10

review) clearly represents a weaker incentive structure – with more limited upside we would expect to observe less outturn variation from the mean. We therefore assume the standard deviation on PCDs to be around half of the variation for wider totex.

- For capital projects, our assumptions are slightly stronger. Ofgem consider that *"any late, partial or non-delivery should return 100% of funding to consumers"*.[17] Given this, we model these costs with a Bernoulli distribution, reflecting our prior expectation that the likelihood of non-delivery is low, but the punishment is high if that occurs. We assume a one in a hundred probability of late delivery, with 100% of funding returned in that instance. We believe the one in a hundred probability estimate is conservative, given that the history of large infrastructure projects is littered with examples of specification changes and late delivery.

3.2.3 Network Asset Risk Metric (NARM)

For the RIIO-1 controls, Ofgem introduced a mechanism to monitor the level of risk on the system across key asset classes, known as the Network Outputs Methodology (NOM). Broadly speaking, the NOM framework enabled Ofgem to measure network risk based on data reported by the companies on asset health, loading, and consequence of failure (among other things). This framework allowed Ofgem to introduce a target for the total amount of 'risk removed' from the system, given the expected deterioration in assets and similarly the improvement in asset health measures etc. based on planned interventions that were funded through totex allowances. The details of the NOM methodology, and how it was to be incentivised, evolved through RIIO-1.

3.2.3.1 Description of the RIIO-2 NARM framework

For RIIO-2, Ofgem has proposed to introduce a new incentive framework for what is now termed the Network Asset Risk Metric (NARM). Our understanding is that the NARM methodology is very similar to that for NOM, in the sense that it starts from a target for the monetised value of risk removed over the course of a price control.

However, the RIIO-2 NARM methodology differs from the RIIO-1 approach in a number of key respects:

- First, Ofgem's proposal for RIIO-2 is now to allocate a specific portion of the DD totex allowances to be targeted specifically at the investments and interventions to deliver NARM risk removed output. Our understanding is that this is a far more specific linking of cost allowances to NARM outputs than has been used for NOM in RIIO-1.
- Associated with this, Ofgem has introduced a new framework for financial incentivisation, which is called the 'NARM Funding Adjustment and Penalty Mechanism' (NARM FAPM). Under the NARM FAPM, companies will be set a target for the ratio of baseline allowed NARM-allocated totex over NARM risk removed. This target is referred to as the Unit Cost of Risk Benefit (UCR).

[17] RIIO-2 DD GD annex, para 2.223

- Under the NARM FAPM, any outturn deviations from the UCR target will be closely scrutinised by Ofgem through an ex post review. Ofgem will apply various tests under this ex post review to determine whether/how to modify cost allowances; and whether/how to introduce rewards or penalties.

In our parallel ENA report, we set out in more detail how we understand the NARM FAPM will operate.

3.2.3.2 Effect of NARM framework on outcomes

The clear intention of Ofgem in developing this framework has been to try to remove the possibility of any windfall gains arising from the NARM incentive. Ofgem appears to have concerns that, without some constraints, companies might be able to materially outperform totex allowances while still delivering at (or above) the target NARM benefit - primarily by shifting some expenditure towards interventions which are lower cost but deliver equivalent/higher impact in terms of risk removed. Ofgem evidently would consider that such a shift was not a "genuine" efficiency saving – rather, it would represent companies exploiting the underlying weaknesses of the NARM methodology.[18]

The issue, however, is that in attempting to impose these constraints, Ofgem has proposed a model that relies almost entirely on judgements made by the regulator ex post. Specifically, companies will now be significantly exposed to the decision that Ofgem makes ex post on whether costs savings were "genuine"; and on whether any departures from the risk target were "justified" or "un-justified". Importantly, Ofgem's underlying principle seems to be that companies must bear the burden of proof in these ex-post assessments – in other words, Ofgem's default position will be that deviations are unjustified, and it is up to the companies to convince Ofgem otherwise.

At the same time, the NARM framework imposes a significantly skewed balance of risk towards the downside, conditional on the exercise of Ofgem's ex post discretion.

- First, in relation to **totex over-/under-spends**, if Ofgem deems cost reductions are not genuine, there is virtually no upside (given the application of the so-called Delivery Adjustment Factor (DAF)). Companies will know that even if they pursue and deliver what they consider to be genuine efficiencies, there will still be a chance that Ofgem might not consider those efficiencies to be genuine after the fact. Ofgem has provided no guidance about what tests it will apply to determine whether or not costs are efficient – and by Ofgem's own admission, this exercise will not be straightforward.

  In light of the overall approach that Ofgem appears to be adopting towards incentive regulation and the general clamp-down on outperformance in RIIO-2, our view is that companies would quite reasonably expect that little (if any) cost reductions will be deemed "genuine efficiencies" by Ofgem. This will almost entirely undermine any incentive for the companies to reduce these costs.

[18] In a similar vein, Ofgem has also sought to remove the potential for any equivalent windfall gains/losses to arise due to "non-intervention" changes in the delivered risk output – for example due to NARM methodology changes; consequence of failure changes; or data cleansing.

On the flip side, there is no symmetric protection applied to overspend – for this, the TIM sharing factor is applied. Overall this represent a sharp skew towards downside risk on totex.

- Second, in relation to **NARM output delivery**, Ofgem has imposed (potentially material) downside penalties for any "unjustified" under-delivery or over-delivery, but quite literally no upside for "justified" under-delivery or over-delivery. Again, little if any guidance has been given by Ofgem about what tests it will apply or how in reaching these judgements.

Faced with this set of arrangements and the threat of penalties being applied ex post at the discretion of the regulator, in our view there is only one optimal strategy for the companies – they will stick as closely as possible to the specific allowed costs; and deliver as close as possible the NARM risk target.

3.2.3.3 Consequence for modelling approach

As a result of this, any modelling of expected outperformance in RIIO-2 should start from the expectation that outperformance on totex allocated to NARM should have an expected value of zero and, importantly, a substantially reduced range of potential outcomes either side of this mean.

It is then relevant to consider whether to model the skewed downside risk associated with the imposition of the DAF (which materially reduces the upside potential for non-genuine cost reductions); and the lack of symmetrical tests for whether under/over-spends are "genuine". For our purposes, we have assumed simply that any under/over-spend vs. NARM-allocated totex has the full TIM sharing factor applied. Effectively this assumption implies that all outperformance is deemed to be "genuine" by Ofgem. We consider this to be a conservative approach in the sense that expected returns will be higher, on average, in the absence of modelling the downside skew.

Further, we also have ignored any effect of NARM over- or under-delivery in our modelling. Since Ofgem's approach contains zero upside (even for "justified" over- or under-delivery), we consider this approach to be conservative, since we have simply ignored the downside risk arising from the penalties for "unjustified" outcomes.

3.2.4 Tougher cost assessment

Since RIIO-GD1, Ofgem has taken a tougher approach to the cost assessment and made a number of changes to its benchmarking approach.

- At RIIO-1 Ofgem used the upper quartile as its benchmark in the cost assessment for GDNs, but at RIIO-2 Ofgem has set the tougher benchmark of the 85th percentile. This will set tougher cost allowances and reduce the companies' chance to outperform. The notional GDN will be performing, by definition, at an average level. So increasing the benchmark to the 85th percentile will materially increase expected underperformance for the notional GDN.
- The scope of application of the benchmarking analysis has been expanded in RIIO-GD2. In both RIIO-GD1 and RIIO-GD2 (and in benchmarking more

generally), Ofgem removes certain costs pre-benchmarking on the basis that they should be normalised out. One example of this is regional wage differentials. Companies operating in London and South East have to pay higher wages for certain types of labour - this is normalised out prior to benchmarking, so that it does not distort the assessment of "inefficiency" in a relative benchmarking exercise. In RIIO-GD1, the value of the costs that were normalised pre-benchmarking was allowed back to the relevant companies in full – so for example, if the additional cost of operating in London and the South East was deemed to be £1m, this £1m would be added in to the companies' final allowances. In RIIO-2, Ofgem applies the benchmark efficiency score (now based on the 85th percentile) to these normalised out costs. So, given the benchmark efficiency score is 95% in the RIIO-GD2 DD, the £1m that would have been allowed under the RIIO-1 approach will now be reduced to £950k in allowances in RIIO-GD2. This 5% additional efficiency target is applied to all costs that are normalised out pre-benchmarking, whereas in RIIO-GD1 it was applied to none of these normalised costs.

- The same issue also applies to what are termed "non-regressed costs". The RIIO-GD1 model did not apply the benchmark target upper quartile efficiency score to these cost categories, whereas in RIIO-GD2 they are now given the 85th percentile "catch up" target. However, the direction of travel of this change is less clear, as it depends on how stretching or not Ofgem has been in its separate assessment of each individual non-regressed cost area vs. RIIO-GD1, a topic which we do not explore further here.
- Finally, a further differentiator is the scope of costs to which the headline productivity challenge is applied. In RIIO-GD2, a productivity target is applied to all costs, including pre-regression normalisations (like regional wages); non-regressed costs; and the separate 'technically assessed costs'; as well as to allowances for bespoke outputs and uncertainty mechanisms. In RIIO-GD1, our understanding is that the productivity target was not applied to any such costs. Specifically, Ofgem stated in its RIIO-GD1 FD that "we have not applied productivity assumptions in our assessment of non-regressed costs."[19]

3.2.5 Stretching productivity targets

At RIIO-1, Ofgem set the annual productivity challenge of 1% for opex and 0.7% for capex. For RIIO-2 Ofgem has set the tougher annual challenges of 1.4% for opex and 1.2% for capex and repex.

While we have not undertaken a detailed review of Ofgem's approach to productivity, we note that Ofgem has chosen point estimates at the very top of the range proposed by CEPA, and has introduced what appears to be a novel additional increment of 0.2% to account for past innovation funding. Further, CEPA's range appears to be based on a longer run of historical data going back to prior to the financial crisis, which would appear to play down the relevance of the extended and ongoing productivity slump in the UK since the financial crash. These high-level issues appear to indicate that Ofgem's productivity target is not only tough relative to RIIO-1; but potentially overstates the level of productivity that

[19] Ofgem RIIO-GD1 Final Determinations, Real price effects and ongoing efficiency appendix, para 3.27

might realistically be expected to be achievable in RIIO-2 (thereby 'baking in' some expected underperformance).

Overall it seems likely that the productivity target will result in tougher cost allowances and reduce the companies' chance to outperform still further.

3.2.6 Removing IQI

The IQI has been removed for RIIO-2 and replaced by the BPI. When assessing the IQI compared to the BPI, and the applicability of RIIO-1 outperformance at RIIO-2, Ofgem states that it considers "that the impact of both may be similar".[20] For this reason, Ofgem does not quantify the change of removing the IQI and introducing the BPI in its assessment of re-stating RIIO-1 on a RIIO-2 basis.

We do not consider it is necessary to make such an assumption, since Ofgem's BPI decision is now known. For our purposes of modelling a notional GDN for RIIO-2, we model the BPI as a weighted average BPI effect across all GDNs (see Section 4.1 for a full explanation).

It is important to also be clear that one significant aspect of the IQI in RIIO-1 appears to have been ignored by Ofgem, namely the setting of final allowances as a weighted average of 75% modelled costs and 25% submitted costs (sometimes referred to as 'IQI interpolation'). IQI interpolation had a material impact on final allowances at RIIO-1, and nothing at RIIO-2 could be considered to be equivalent to this or replacing it. This is therefore a further source of reductions in the potential totex outperformance available in RIIO-2 relative to RIIO-1.

3.3 Consequences for our approach

Given the issues set out above, and to provide a richer assessment of the potential for totex outperformance in RIIO-2, we consider it is necessary to separate the cost base into three buckets: costs allocated to PCDs; costs allocated to NARM; and remaining totex. Table 1 below shows the proportion of cost base for NGN which is allocated to each bucket, based on data provided by NGN and reflecting Ofgem's Draft Determination position. Since it is impossible to allocate costs to PCDs, NARMs and remaining totex for a notional GDN, we assume the proportions allocated to NGN to be broadly representative. We understand that, if anything, this is likely to be a conservative approach since NGN has a relatively small proportion of PCDs and NARMs relative to other networks.

For PCDs and NARM, we explained our approach to assuming mean outperformance and standard deviations in the sections above.

For the remaining totex, we consider that there is strong evidence (as set out above) to suggest that the DD proposals set out by Ofgem will in fact result in an expected totex underperformance in RIIO-2. However, taking a cautious approach, we believe it remains plausible to assume an expected 0% outperformance, despite the evidence suggesting the reality is to the downside.

[20] RIIO-2 DD Finance Annex, Table 27

We note that the standard deviation of historic gas distribution totex outperformance is around 6.8%. However, despite this, we again consider it reasonable to adopt a cautious approach and use the standard deviation of 8.8% derived from Ofgem's (corrected) historical database.

The combination of these two conservative assumptions means that, in all likelihood, our central scenario will over-estimate the potential for totex outperformance and the range of plausible outcomes.

Table 1 below summarises our base case assumptions.

Table 1 Summary of approach to totex

Parameters	PCDs	NARM	Other totex
Proportion of cost base	27%	13%	60%
Mean	0%	0%	0%
Standard deviation	0.5%	0.5%	8.8%

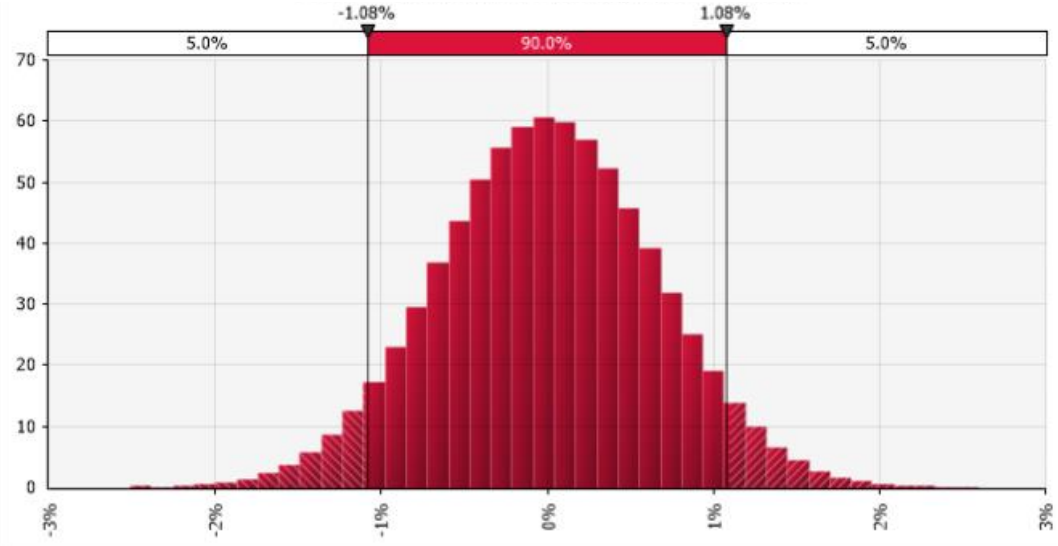
Source: Frontier Economics, based on: NGN cost base, DD technical annex spreadsheet 'AR ER database', and Frontier analysis

3.4 Totex results

In order to estimate the financial impact of totex over or under performance we also define a totex sharing rate so as to convert the modelled outperformance into the value accruing to the notional GDN. We set this rate equal to 50%, representing a conservative assumption for the notional GDN's sharing factor (the industry average sharing factor is in fact 49.7%). This in turn is converted into RoRE values using the financial values set out in the RIIO-2 License Model.

Figure 4 shows the probability distribution of totex outperformance in RoRE terms. 90% of the RoRE performance lies between +/- 108bps.

Figure 4 Totex outperformance – RoRE impact



Source: Frontier analysis using @Risk

4 OTHER INCENTIVES

The list of non-totex incentives that we have modelled for the notional GDN in this report are shown in Figure 5 below.

Figure 5 Relevant incentives in RIIO-GD2 modelled

Incentive	Type	Description
Business Plan Incentive	BPI	Ofgem has proposed BPI outcomes in its DD for all network operators
Customer satisfaction survey	ODI-F	Two-sided (penalty and reward) financial ODI which continues from RIIO-GD1
Complaints metric	ODI-F	One-sided (penalty-only) financial ODI which continues from RIIO-GD1
Guaranteed Standards of Performance	LO	Penalty-only licence obligation which continues from RIIO-GD1. There have been penalties paid in every year of GD1.
Emergency response time	LO	Penalty-only licence obligation which continues from RIIO-GD1. No penalties paid in GD1 but historically there have been.
Unplanned interruptions	ODI-F	One-sided (penalty-only) financial ODI introduced in RIIO-GD2 (previously reputational ODI only)
Shrinkage and environmental emissions	ODI-F	Two-sided (penalty and reward) financial ODI retained in GD2. However, the scope is restricted to changes in shrinkage and leakage due to gas conditioning and pressure management only.

Source: Frontier Economics analysis

Note: For our modelling of NARMs and PCDs, see Totex section.

There are also some additional incentives and mechanisms that we considered but did not model in this report:

- **Uncertainty mechanisms**. These levers allow Ofgem to adjust a network company's allowances in response to changing developments during the price control period. Without these, network companies' allowances could be higher or lower than required. We assume the net impact of UMs is likely to be value-neutral and therefore do not model them here.
- **Return adjustment mechanism**. This limits the total possible outperformance or underperformance. Ofgem has proposed a range of +/- 300bps in its Draft Determinations,[21] which is wider than the range observed in our results. Therefore, the mechanism would have had no effect in our modelling had we included it.
- **Consumer vulnerability minimum standards**. We consider that this incentive is primarily reputational and the chances of financial penalties are very low. NGN told us that no supplier has ever faced action against an equivalent licence condition.

[21] Ofgem RIIO-2 Draft Determinations – Core Document, paragraph 6.13

- **Annual environmental report**. Based on Ofgem's statements we do not expect this to have a financial impact as a notional GDN would produce a compliant report.

The rest of this section sets out the approach and parameters that we adopted for each incentive in turn.

4.1 Business plan incentive

For RIIO-2, the BPI is Ofgem's tool for encouraging the companies to submit high quality and ambitious business plans. It has replaced the IQI + fast-tracking system which performed the same role in RIIO-1 (with the IQI also having been used at prior controls).

When we undertook our previous NGN report, we did not at that time know what the outcome of its application would be. Our approach was therefore based on assumptions and scenarios for what Ofgem might decide, given what Ofgem had set out about how the BPI would work.

We now know the impact of the BPI for each GDN, as proposed in Ofgem's Draft Determinations (Figure 6). Since the outcome is known and fixed, we do not model it stochastically. Rather, we assume this outcome is imposed in every modelled iteration of the Monte Carlo analysis.

Figure 6 Ofgem's BPI outcomes for GDNs

GDN	Total reward/penalty (£m)
Cadent	-£0.1m
NGN	£1.6m
SGN	-£1.1m
WWU	£0m

Source: Ofgem RIIO-2 Draft Determinations – Core Document, Table 15

Note: BPI outcomes for Cadent and SGN were given as an aggregate rather than split by region.

We note that the BPI should be considered as a key part of the overall package of incentives for RIIO-2. In much the same way that Ofgem has reflected IQI/fast-tracking returns in its assessment of RIIO-1 performance, we expect that Ofgem would similarly wish to reflect its BPI decision in any analysis of returns that may be achievable in RIIO-2.

In order to model the BPI impact for the notional GDN, we calculate the GD sector performance in RoRE terms, by taking the sum of the BPI outcomes across all operators in the GD sector, divided by the sum of regulated equity across all GD sector operators.[22] The financial impact for the notional GDN naturally follows from this RoRE impact calculation.

[22] We have also considered using a RAV-weighted average of GDNs' BPI outcomes, which produces a slightly more negative BPI outcome. To be conservative in our modelling, we have opted for the direct GD sector RoRE calculation as our baseline approach. The difference in the two approaches is quite immaterial, producing RoRE impacts which are within 1bps of each other.

4.2 Customer satisfaction survey

The Customer Satisfaction Survey (CSS) was introduced to incentivise GDNs to improve the quality of their customer service. The survey targets three groups of customers: (i) those that have experienced a planned interruption or replacement work; (ii) those that have experienced an unplanned interruption; and (iii) those requiring connections works. In RIIO-GD1, the CSS incentive was set up as a two-sided financial ODI, whereby companies exceeding the target were rewarded and company below the target penalised.

Ofgem's Draft Determination has confirmed that the CSS targets will be static (as in GD1), with rewards and penalties up to 0.5% of base revenue depending on performance against the target score. Ofgem has stated that the CSS targets (Figure 7) are set using the average performance data during the RIIO-GD2 pilot survey period, which "embeds improved performance during RIIO-GD1 into business as usual and takes account of new survey methodologies and content used in the trial".[23] These targets are set higher than those in RIIO-GD1.

One significant update in the Draft Determinations is the introduction of an asymmetric deadband for the CSS incentive. Ofgem has proposed setting a deadband above (but not below) the CSS targets. This means that only CSS scores which are above the upper deadband – set at the upper quartile of the trial survey scores – will earn a reward. In contrast, falling below the target will result in a penalty (with no downside deadband).

Figure 7 CSS target scores

	Planned work	Unplanned work	Connections work
Target	8.51	9.37	8.38
Upper deadband score (minimum score for reward)	8.77	9.44	8.86
Max reward score	9.13	9.58	9.33
Max penalty score	7.87	9.15	7.43

Source: Ofgem RIIO-2 Draft Determinations – GD sector annex, Table 4

4.2.1 Our approach

Relative to our previous report, we have updated our targets (as in Figure 7), and have now modelled the effect of the deadband. For each CSS score category, we have assumed a normal distribution of outcomes.

As Ofgem has explicitly said that the CSS targets were set with reference to the average trial survey scores, we have set the distribution means for each CSS component to be equal to the target of that CSS component. For consistency, we have also calculated the standard deviations using only the trial survey scores. These are summarised in Figure 8.

[23] Ofgem RIIO-2 Draft Determinations – GD sector annex, paragraph 2.27. For RIIO-GD2, Ofgem has decided to make changes to the CSS, and had conducted a six-month trial period for this new survey.

Figure 8 Normal distribution parameters for CSS

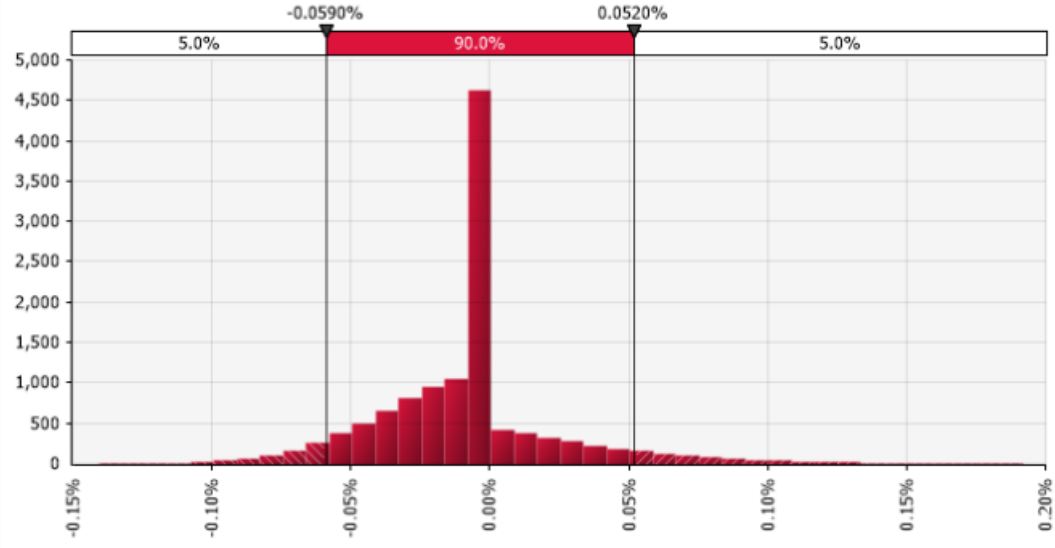
	Planned work	Unplanned work	Connections work
Mean	8.51	9.37	8.38
Standard deviation	0.31	0.11	0.59

Source: Frontier Economics analysis of Ofgem RIIO-2 Draft Determinations for GD sector, and trial survey scores obtained from NGN

4.2.2 Results

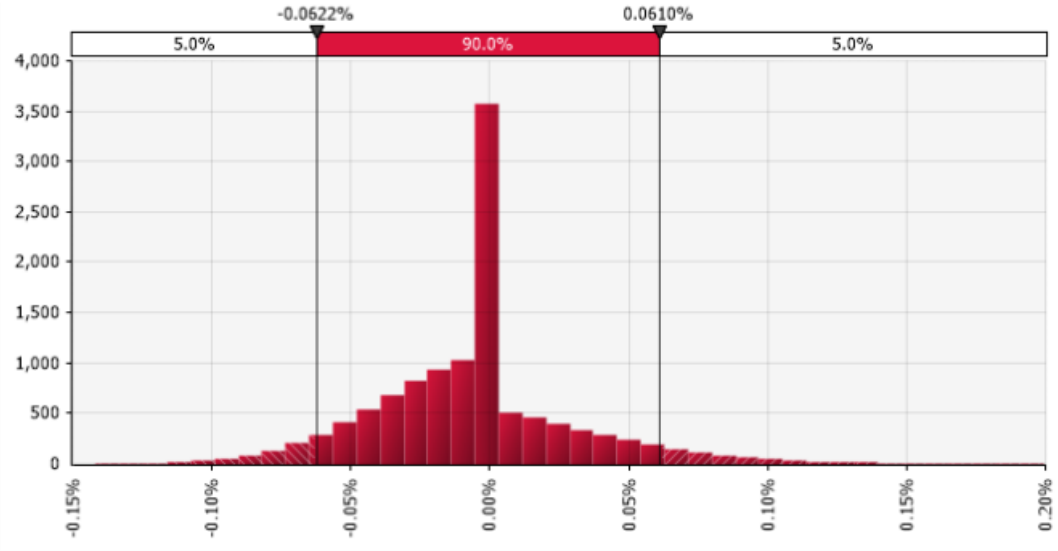
The results from this output suggest that, for the majority of the time, a notional GDN is expected to have zero outperformance. However, the average RoRE impact is underperformance of around 2bps. This combination is because of the asymmetric deadband that limits the scope for outperformance across all three metrics.

Figure 9 CSS, planned work – RoRE impact



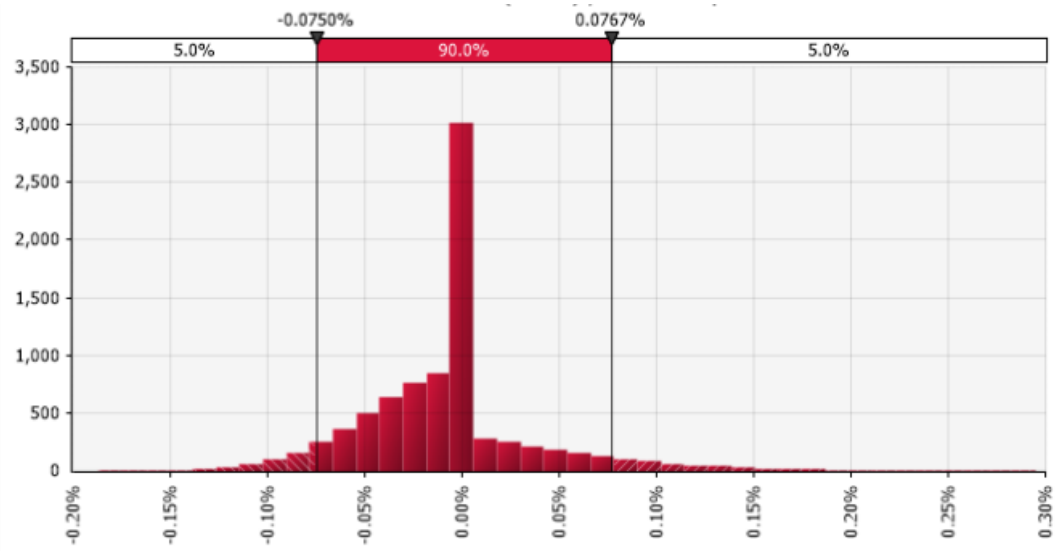
Source: Frontier analysis using @Risk

Figure 10 CSS, unplanned work – RoRE impact



Source: Frontier analysis using @Risk

Figure 11 CSS, connections work – RoRE impact



Source: Frontier analysis using @Risk

4.3 Complaints metric

The complaints metric incentive is intended to drive GDNs to improve their handling of customer complaints. It is a penalty-only financial ODI. In GD1, Ofgem set out that complaints metric should be assessed against four indicators (relative weight in brackets): (i) percentage of complaints unresolved after one working day (10%); (ii) percentage of complaints unresolved after 31 working days (30%); (iii) percentage of repeat complaints (50%); (iv) percentage of Energy Ombudsman

(EO) findings against the GDN (10%). We understand that the calculation of this metric will not change in RIIO-GD2.

Ofgem's Draft Determinations has established that the minimum performance and the maximum penalty levels will be five and ten respectively, and confirmed that the maximum penalty will be 0.5% of base revenue. In the GD sector annex of the Draft Determinations, Ofgem said that it considered a few options for setting a minimum performance level, and eventually settled on a minimum performance level of five. Ofgem stated that this was appropriate as it is "within the range of average scores achieved in RIIO-GD1", and is "simple and provides a clear minimum performance level for stakeholders".[24] Ofgem also said that this target would reflect the improvements made in RIIO-GD1.

Figure 12 Complaints metric targets

	Complaints metric
Target	5
Max penalty	10

Source: Ofgem RIIO-2 Draft Determinations – GD sector annex, paragraph 2.43

4.3.1 Our approach

In our modelling, we have updated our complaints metric target and maximum penalty levels in accordance with Ofgem's Draft Determinations (as in Figure 12).

We have assumed a normal distribution of outcomes for the complaints metric incentive. Our baseline approach is to calculate the distribution mean and standard deviation based on GD1 outturn data for all GDNs, across the regulatory years 2013/14 to 2018/19.

Given that the complaints metric turns out to be a significant driver of our baseline result, we have also modelled two sensitivities to our baseline approach for establishing the distribution mean and standard deviation: (i) using the two most recent years of GD1 data (i.e. 2017/18 and 2018/19), and (ii) using only the most recent year of GD1 data (i.e. 2018/19). These sensitivities are chosen based on Ofgem's options analysis in setting a minimum performance level for the complaints metric. Figure 13 summarises the parameters used in our baseline approach and the two sensitivities.

Figure 13 Normal distribution parameters for complaints metric

	Baseline approach – using data from 203/14 to 2018/19	Sensitivity 1 – using data for 2017/18 and 2018/19	Sensitivity 2 – using data for 2018/19 only
Mean	6.58	4.14	3.12
Standard deviation	3.31	1.97	0.74

Source: Frontier Economics analysis of outturn GD1 data

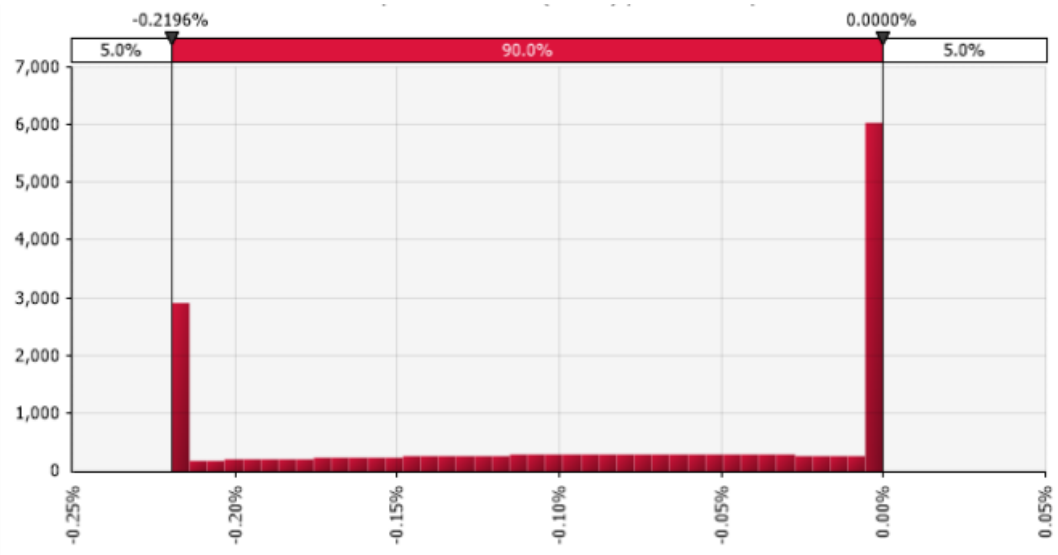
Note: We have made a minor correction from our previous analysis for the baseline approach – previously the mean was listed at 6.5, and the standard deviation as 3.41.

[24] Ofgem RIIO-2 Draft Determinations – GD sector annex, paragraph 2.41

4.3.2 Results

The results from this output suggest an expected underperformance in RoRE terms of almost 9bps. This reflects the assumption that (i) our expected outcome is higher than the RIIO-GD2 target level; and (ii) our standard deviation is wide. Therefore we observe a large number of outcomes either at the maximum penalty level, or at zero outperformance. The results of our two sensitivities are detailed in ANNEX A.

Figure 14 Complaints metric – RoRE impact



Source: Frontier analysis using @Risk

4.4 Guaranteed standards of performance (GSOP)

Guaranteed standards of performance were introduced to provide financial incentives for the GDNs to ensure that they aim to achieve a set of common minimum performance standards with respect to interruptions, connections and customer service.

In our previous report, we modelled the GSOP payments as an aggregate rather than modelling separate payments for each of the 14 GSOPs. We assumed that the distribution of GSOP impact follows that in the GD1 data, and is normally distributed with a standard deviation based on the same data.

4.4.1 Response to Ofgem's critique of our previous GSOP modelling

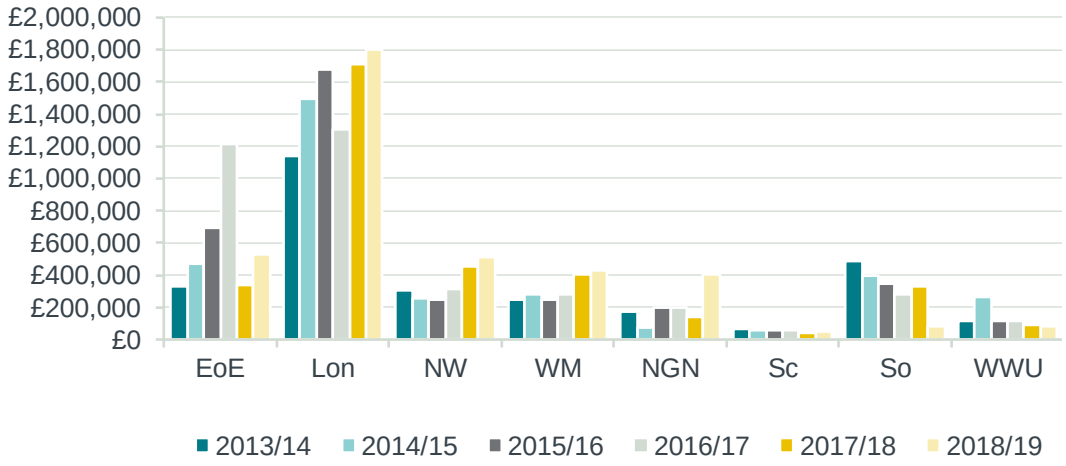
In reviewing our previous report in its Draft Determinations, Ofgem said that underperformance against licence conditions (which includes GSOPs) was an unrealistic assumption, citing unspecified "available evidence". The relevant paragraph of Ofgem's GSOP review is reproduced below.

> *Other input assumptions are difficult to reconcile with a notionally efficient GDN. For example, we note that Frontier's result (27bps underperformance) is in part driven by underperformance against licence conditions, including GSOP (5.4bps underperformance) and Emergency response times (5.4bps underperformance). Available evidence indicates these are not realistic assumptions and GDNs should meet minimum levels of performance as a basic level of service to their consumers.*[25]

Ofgem cites "available evidence" but without pointing to any specific evidence. However, various available evidence would suggest that underperformance can be expected.

- First, the target pass rates attached to connection GSOPs is 90%[26], which means that GDNs could fail to meet these GSOPs in some instances – and have to make some GSOP payments as a result – and still not be in breach of licence conditions.
- Second, the data on GSOP payments in RIIO-GD1 published by Ofgem (see Figure 15) show that GDNs continue to make GSOP payments yearly, and have paid an average of £436k in each year of GD1 so far (2013/14 to 2018/19).[27] No GDN has achieved zero payment in any year of GD1 so far, and the majority of GDNs in fact have experienced an increase in the GSOP payments over the 2013/14 to 2018/19 period.

Figure 15 GSOP payments by GDN, 2013/14 to 2018/19 (£)



Source: Frontier Economics analysis of GD1 outturn GSOP data

The available evidence therefore suggests penalties are quite likely. Moreover, Ofgem's proposed changes to GSOP payments in its Draft Determinations only increase the expected GSOP payments. In the Draft Determinations, Ofgem has said it would double all GSOP payments and payment caps from RIIO-GD1.[28] It

[25] Ofgem RIIO-2 Draft Determinations – Finance annex, 3.117

[26] Ofgem's SSMD GD annex, para 3.138

[27] Ofgem publishes supplementary data files which accompanies the RIIO-GD1 annual reports. These supplementary files contain information on GSOP payments by GDN. For 2013/14 and 2014/15, we obtained the GSOP data from NGN as Ofgem did not publish the supplementary files.

[28] Ofgem RIIO-2 Draft Determinations – GD sector annex, paragraph 2.53

will also tighten GSOP2 and GSOP3 to provide further support for consumers in vulnerable situations, which may increase the expected GSOP payments.[29]

Therefore, we disagree with Ofgem's view that a notional GDN would make zero GSOP payments.

4.4.2 Our approach

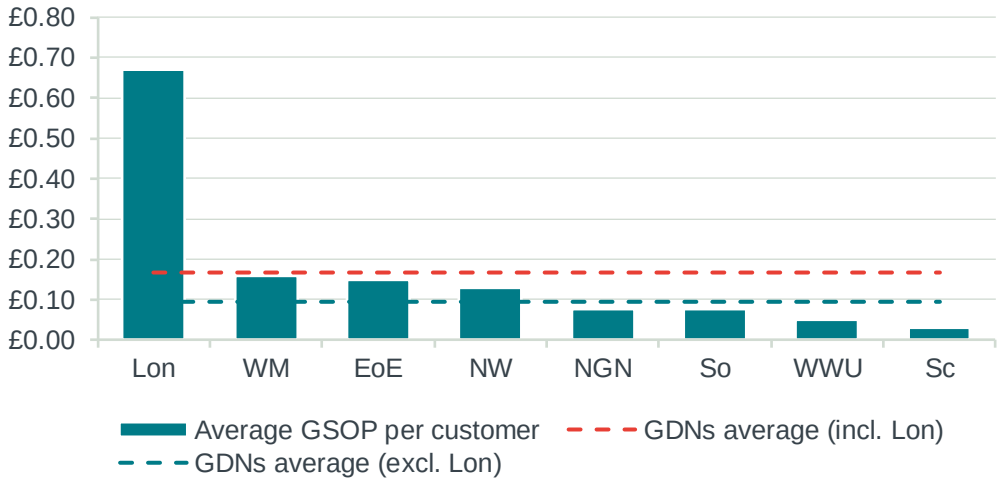
Given the available evidence from RIIO-GD1 above, we think it is still appropriate to model GSOP payments for a notional GDN in RIIO-GD2. However, we make some adjustments to our modelling approach from our previous report so as to make it more conservative.

In our previous report, we normalised the GSOP payments for each GDN by their customer base (to account for differences in size), and assumed that the distribution of GSOP payments per customer in GD2 is similar to that of GD1 (based on GD1 outturn data). We then multiplied the modelled GSOP payments per customer by NGN's customer base, to obtain the estimated financial impact and the associated RoRE impact. We used NGN's customer base in order to be consistent with using NGN's RAV to estimate the financial impact.

Our updated baseline approach is broadly similar but with two key adjustments:

Firstly, our review of GSOP per customer in GD1 shows that London has much higher average GSOP payments than average (Figure 16). Therefore, to keep our approach conservative, we exclude data for London, which brings down the average GSOP per customer in our assumed distribution. We also run a sensitivity to see what happens when we include the data for London.

Figure 16 Average GSOP payments per customer (£) – 2013/14 to 2018/19



Source: Frontier Economics analysis of GD1 outturn data

Secondly, in line with Ofgem's proposal to double the GSOP payments in GD2, we also double the payments per customer in our modelling.

Figure 17 below summarises the distribution parameters in our modelled baseline approach and in the sensitivity.

[29] Ofgem RIIO-2 Draft Determinations – GD sector annex, paragraphs 2.48 and 2.50

Figure 17 Normal distribution parameters for normalised GSOP payments

	Baseline approach – excl. London data	GSOP sensitivity – incl. London data
Mean	0.10	0.17
Standard deviation	0.06	0.20

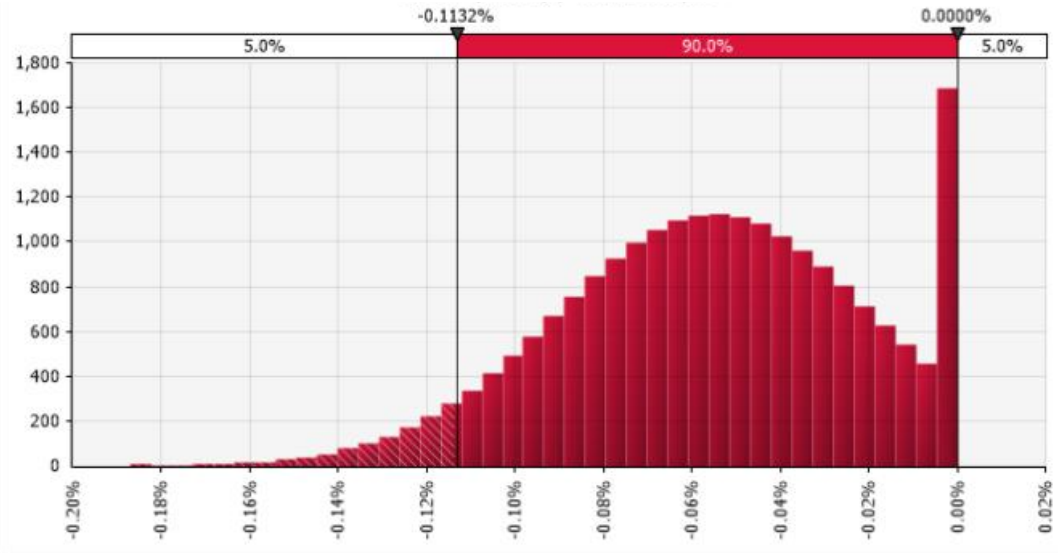
Source: Frontier Economics analysis of GD1 outturn data

Note: The distribution means presented here purely reflect the historical means of GSOP payments, and do not include the doubling of payments yet.

4.4.3 Results

The results from this output suggest an expected underperformance of just over 5bps, or around £500k. On average, historical penalties excluding those for Cadent London have been c. £280k. The increase therefore reflects Ofgem's proposed doubling of payments under GSOP, but does not reflect the higher level of payments observed in London. If London is included, the historical penalties are over £430k. This demonstrates our analysis is in line with the evidence, and reflects Ofgem's proposed changes. These are entirely plausible GSOP values for a notional GDN.

Figure 18 GSOP payments – RoRE impact



Source: Frontier analysis using @Risk

4.5 Emergency response time

This incentive ensures that GDNs respond to 97% of reported gas escapes within one hour for uncontrolled escapes and two hours for controlled escapes.

Similar to GSOP payments, in its Draft Determinations Ofgem also criticised the results for this incentive as being unrealistic. In our previous report, we noted that while no licensee has failed this standard in recent years, there are a number of reasons we chose to explicitly model this:

- In principle, as long as there is a non-zero likelihood of failing to meet the emergency response time standard, it is impossible for the notional GDN to have an expected penalty of zero.
- We understand from NGN that recent good performance may have been helped by benign weather conditions, and that the nature of unpredictable weather in the future makes it potentially possible to fail the standard.
- We also understand that there are historical instances of GDNs being fined for failing this LO. For example NGN was fined in 2011 for failing emergency response times.

We therefore disagree with Ofgem's view that *ex-ante* a notional GDN would have zero likelihood of failing to meet this standard.

4.5.1 Our approach

For our modelling of this incentive for the notional GDN, we have adopted an approach very similar to that in our previous report. That is, we model this incentive on a scenario basis, such that there is a 1-in-20 chance of failing to meet this standard. The 1-in-20 chance is based on the gas network being secured against a 1-in-20 winter standard.

To make our approach more conservative, in line with Ofgem's comments, we have reduced the penalty given to the notional GDN in our model from £10m in our previous report to £5m in the event that the standard is missed.

Figure 19 summarises the scenario modelling parameters.

Figure 19 Scenario modelling parameters for emergency response time

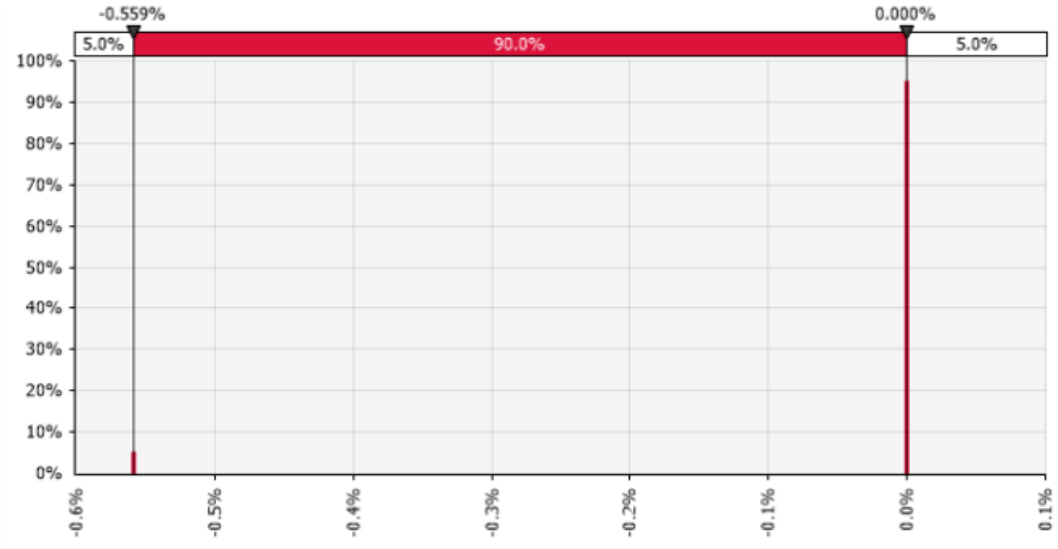
	Breach of emergency response time standard
Probability	5% (equivalent to 1-in-20 chance)
Penalty	£5m

Source: Frontier Economics analysis

4.5.2 Results

The results from this output suggest an expected underperformance of around 3bps. The nature of the Bernoulli distribution means that the majority of outcomes give zero outperformance, but the small likelihood of a large penalty gives (on average) a small average underperformance.

Figure 20 Emergency response time – RoRE impact



Source: Frontier analysis using @Risk

4.6 Unplanned interruptions

In RIIO-GD2, Ofgem will introduce a penalty-only financial ODI on unplanned interruptions, to encourage GDNs to prevent any significant deterioration in the length of unplanned interruptions. This is a new incentive introduced for RIIO-GD2. It will cover all unplanned interruptions with the exception of those on Cadent's North London Network.[30]

Ofgem's Draft Determinations state that the minimum performance levels are set for each GDN based on Ofgem's assessment of historical performance. Specifically, Ofgem have adopted an approach where breaching the minimum performance level equates to a 1-in-20 event in relation to each GDN's historical performance.[31] The targets are therefore GDN-specific. As for the value of the incentive, Ofgem has also said that the maximum penalty will be 0.5% of base revenues.

4.6.1 Our approach

In our previous report, because the targets are GDN-specific, we modelled this incentive by using an NGN-specific target, and assumed a normal distribution for outcomes using RIIO-GD1 outturn data for all GDNs.

Given that Ofgem has now outlined its conceptual approach in setting the minimum performance levels as a 1-in-20 event, we abstract from the individual GDN-specific targets, and model the notional GDN's breach of the minimum performance level as a 1-in-20 event (i.e. 5% probability), in line with Ofgem's

[30] For Cadent's North London network, Ofgem plans to introduce a penalty-only ODI that relates to MOB interruptions and a separate penalty-only ODI that relates to other interruptions. The former is out of the scope of this report.

[31] Ofgem RIIO-2 Draft Determinations – GD sector annex, paragraph 2.86

conceptual approach. We have set the penalty at 0.25% of base revenues in the event of a breach in the minimum performance level. As the penalties increase linearly up to the maximum penalty of 0.5% of base revenue, we have chosen 0.25% as the average penalty in the event that a breach does occur.

Figure 21 summarises the scenario modelling parameters.

Figure 21 Scenario modelling parameters for unplanned interruptions

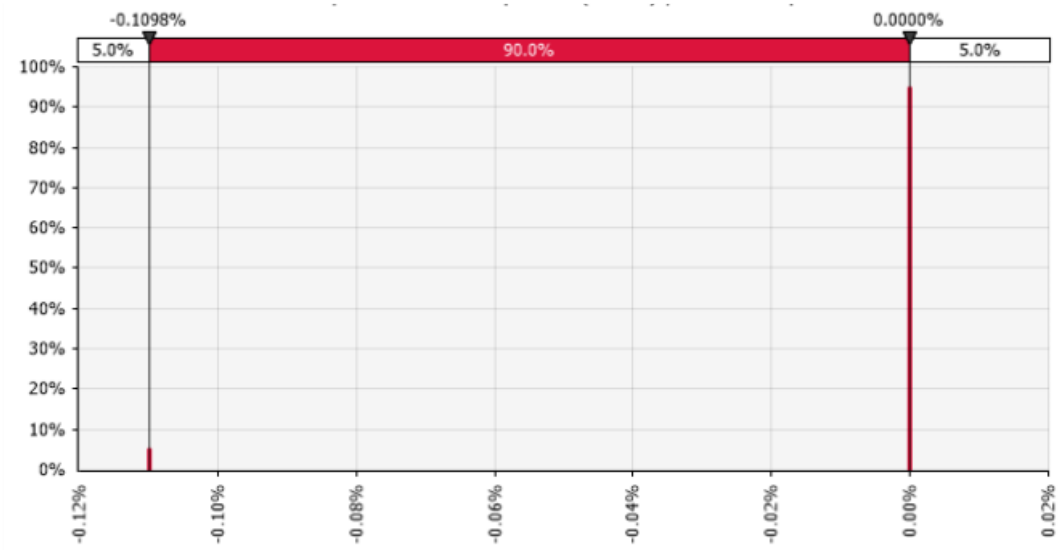
	Breach of min. performance levels
Probability	5% (equivalent to 1-in-20 chance)
Penalty	0.25% of base revenues

Source: Frontier Economics analysis

4.6.2 Results

The results from this output suggest an expected underperformance of around 0.5bps. Similar to the results of the emergency response time output; the nature of the Bernoulli distribution means that the majority of outcomes give zero outperformance, but the small likelihood of a large penalty gives (on average) a small average underperformance.

Figure 22 Unplanned interruptions – RoRE impact



Source: Frontier analysis using @Risk

4.7 Shrinkage and environmental emissions

The incentive exposes GDN's to the market and social cost of the gas escapes from their networks. The mechanism is two sided and provides the incentive for GDNs to take actions to reduce the volume of gas that escapes from their networks.

In our previous report, we noted that Ofgem has said in its Sector Specific Methodology Decision (SSMD) that the impact on shrinkage and environmental

emissions which are driven by the repex programme would be excluded from the calculation volume.[32]

4.7.1 Our approach

Ofgem's position does not appear to have changed substantially in the Draft Determinations. However, we note that Ofgem has now set the value of the maximum reward and penalty at +/- 0.25% of base revenues.[33]

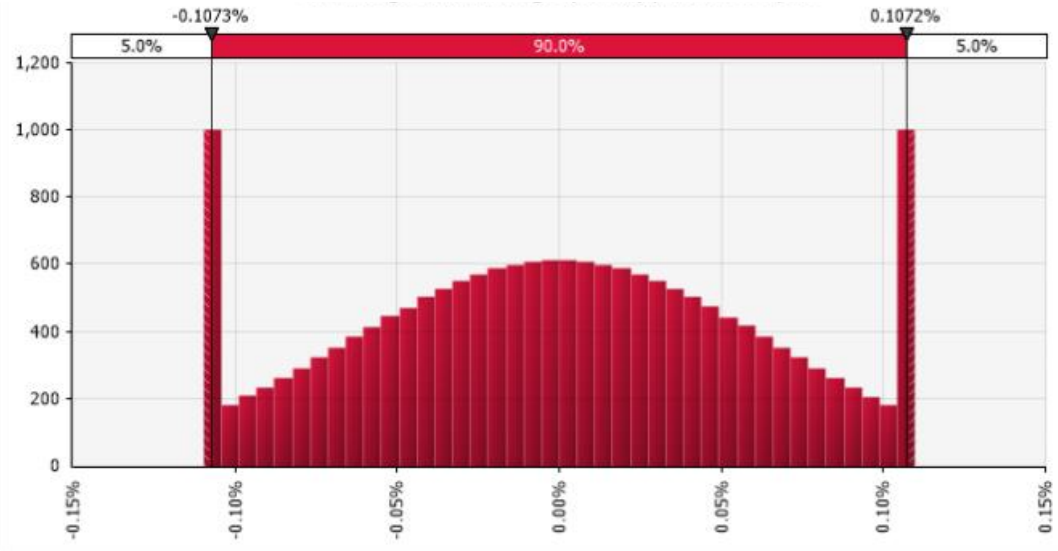
Therefore, we now update our previous modelling approach to include the cap and collar to the shrinkage and environmental emissions incentive in line with Ofgem's Draft Determinations. We assume that potential outcomes are normally distributed, and that the mean performance is a "fair bet" with GDNs as likely to underperform as outperform.

To estimate the standard deviation, we have used data from NGN on the impact that pressure management alone has had on its shrinkage volumes and assumed that leakage is fixed at 95% of shrinkage. We recognise that this evidence is limited as we have only had data on this for NGN and not for all GDNs. This is because whilst there is information on the shrinkage and leakage figures for all GDNs in GD1, this data does not isolate the impact of pressure management so is not informative for the likely spread of outcomes for the revised incentive mechanism in GD2.

4.7.2 Results

The results from this output are shown below. The mean outcome is zero, and the results indicate that the P95/P5 values are captured by the new cap and collar.

Figure 23 Shrinkage and environmental emissions – RoRE impact



Source: Frontier analysis using @Risk

[32] Ofgem RIIO-2 Sector Specific Methodology Decision – GD annex, paragraph 3.17 and Figure 4

[33] Ofgem RIIO-2 Draft Determinations – GD sector annex, paragraph 2.118

4.8 Cross-correlations

In our previous analysis, we assumed some correlation between totex outperformance and non-totex incentives outperformance, as well as some correlation between different non-totex outperformance measures. However, there are two competing arguments for determining cross-correlations between totex and non-totex measures, each with an opposing effect on the RoRE impact:

- The first approach suggests that companies make trade-offs between standards of performance and costs. That is to say if a company spends more on totex, then one would expect an improvement in quality of service. The opposite would therefore be true: a reduction in spending leads to a worsening in the quality of service. We would characterise this as a negative correlation between totex outperformance and non-totex outperformance.
- The second approach suggests that companies do not make such explicit trade-offs between standards of performance and costs. What occurs instead is that some companies make good management decisions on cost and quality of service, and some companies make bad decisions across cost and quality of service. We would characterise this as a positive correlation between totex outperformance and non-totex outperformance.

We understand there is some past evidence of negative correlation between totex and non-totex performance – which was noted in our previous report. Ofgem has stated its view based on reviewing historical data that there is in fact negligible correlation between totex performance and non-totex performance,[34] albeit Ofgem also acknowledges there may be some evidence of positive correlation.[35] Given this competing and inconclusive evidence, we assume zero correlations between totex outperformance and ODI outperformance. But for completeness we include a sensitivity assuming positive correlation between totex and non-totex performance in ANNEX A.

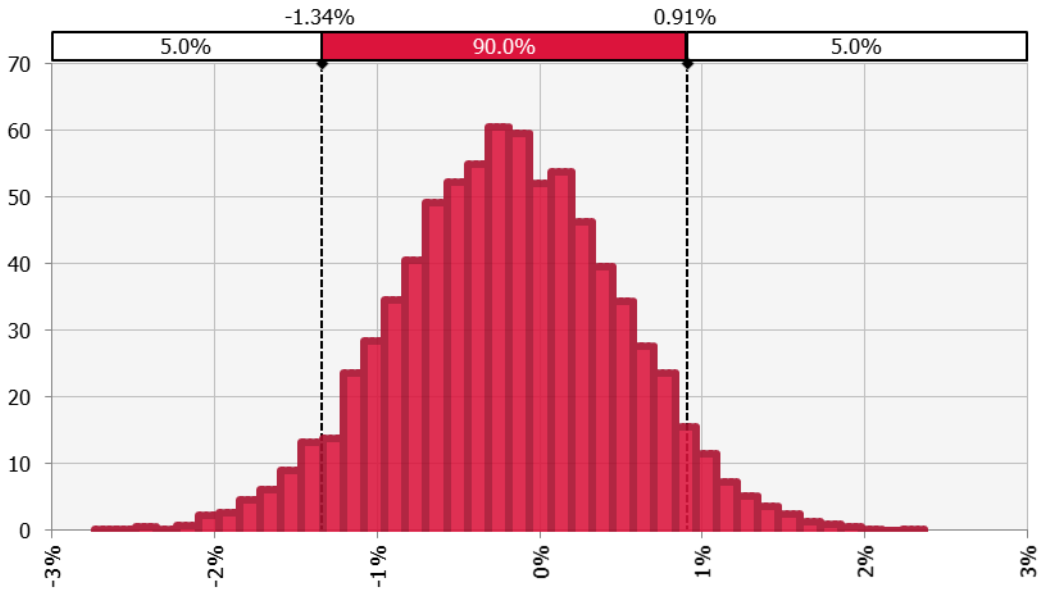
[34] RIIO-2 DD Finance annex, paragraph 3.121

[35] RIIO-2 DD Finance annex, paragraph 3.126

5 RESULTS

Our baseline approach results in an estimated expectation of a -20.2bps underperformance in RoRE terms, for a notional GDN in RIIO-GD2. This is equivalent to an absolute underperformance of -£1.8m per year. Figure 24 below shows the Monte Carlo simulation results of our baseline model.

Figure 24 Baseline model results – total impact (RoRE terms)



Source: *Frontier Economics analysis using @RISK*

Note: *The X-axis measures RoRE out/underperformance and the Y-axis measures the frequency of occurrences.*

The horizontal axis shows financial outperformance in RoRE terms, and the vertical axis shows the frequency of occurrence in our simulation. As set out in our Methodology section above, our model randomly generates an outcome for each of our modelled incentives using the pre-defined probability distributions of each incentives. It then records the resulting RoRE outcome for that realisation. It does so for thousands of iterations, each time recording one RoRE outcome. The diagram above shows the frequency of all iterations from the simulation.

The analysis shows that there is only a 25.3% chance that the notional GDN achieving outperformance at or above 25bps. In other words, the notional GDN would see worse than 25bps of outperformance almost three-quarters of the time.

We also calculate that around 6% totex outperformance is necessary to achieve an expected outperformance of 25bps under our base case assumptions. Given the constraints on totex in RIIO-GD2 (outlined in Section 3), we consider it is highly unlikely that a notional GDN would be able to outperform the GD2 DD proposals by 25bps.

Figure 25 provides more detail on the estimated RoRE and financial contributions to the expected 20.2bps underperformance at the incentive level.

- The key drivers behind the average underperformance are the complaints metric incentive (contributing 8.8bps of underperformance) and the GSOP payments (5.6bps of underperformance).
- The distributional assumptions around totex outperformance are a key driver of the range of plausible outcomes.
- The skew of plausible outcomes is clearly to the downside, suggesting an asymmetrically calibrated price control.

Figure 25 Incentive-level contributions to estimated underperformance

Incentive	Mean RoRE impact (bps)	RoRE impact range (bps)	Mean financial impact (£m/year)	Financial impact range (£m/year)
Totex (excl. NARM and PCDs)	0.0	-108.1 to 108	0.0	-9.67 to 9.67
NARM portion of totex	0.0	-1.4 to 1.4	0.0	-0.12 to 0.12
Tier 1 mains PCD	0.0	-2.2 to 2.2	0.0	-0.19 to 0.19
Tier 1 services PCD	0.0	-0.4 to 0.4	0.0	-0.03 to 0.03
Capital projects PCD	-0.6	0 to 0	-0.1	0 to 0
BPI	0.1	0.1 to 0.1	0.0	0.01 to 0.01
CSS: Planned work	-0.7	-5.9 to 5.2	-0.1	-0.53 to 0.47
CSS: Emergency response and repair	-0.5	-6.2 to 6.1	0.0	-0.56 to 0.55
CSS: Connections work	-0.7	-7.5 to 7.7	-0.1	-0.67 to 0.69
Complaints metric	-8.8	-22 to 0	-0.8	-1.96 to 0
GSOP	-5.6	-11.3 to 0	-0.5	-1.01 to 0
Emergency response time	-2.8	-55.9 to 0	-0.3	-5 to 0
Unplanned interruptions	-0.5	-11 to 0	0.0	-0.98 to 0
Shrinkage and environmental emissions	0.0	-10.7 to 10.7	0.0	-0.96 to 0.96
Total impact	**-20.2**	**-133.9 to 90.7**	**-1.8**	**-11.98 to 8.11**

Source: *Frontier Economics analysis using @RISK*

Note: *RoRE and financial impact ranges report the central 90% of Monte Carlo simulation outcomes i.e. excluding the 5% top most and bottom most extreme outcomes.*

5.1 Sensitivities

In this section, we look at a set of alternative assumptions for some aspects of our modelling that have the potential to change our results materially. We explore

different values for some key assumptions to ascertain the robustness of our baseline model result to these assumptions.

In particular, we consider:

- Changes to the assumed mean totex outperformance;
  - For the purposes of this study, we have utilised the 3.7% value based on the modified historical database as described above to provide an illustrative sense check. However, for the avoidance of doubt we do not consider this to be a relevant benchmark for RIIO-2 expected outperformance. We also model a downside scenario of -2% (these scenario assumptions are explained in more detail in Annex A.1).
- Including historical GSOP data for London;
- Changes to the assumed means and standard deviations for the complaints metric.
  - Using either the most recent year of GD1 data only (2018/19), or the two most recent years only (2017/18 and 2018/19); and
- Introducing a small, positive cross-correlation between totex outperformance and non-totex ODI outperformance

Figure 26 provides a comparison of results of the different sensitivities against the baseline approach. Even the most cautious scenario (mean total outperformance of 3.7%) only gives a small positive outperformance of 7.5 bps - much lower than the 25bps 'expected' by Ofgem. Since we do not consider 3.7% average totex outperformance to be plausible (see discussion in Section 3), the fact that even this materially conservative scenario does not generate average outperformance of 25bps further supports our conclusion. The flip side of this sensitivity is that in a not-implausible downside scenario of 2% totex underspend, the average expected RoRE impact is -35.1bps.

The remaining sensitivities all show negative expected returns and at most a likelihood of achieving above 25bps of less than 30%.

Overall these sensitivity tests show that our conclusions are robust, and that there is no feasible scenario that would lead to expected 25bps outperformance for a notional GDN at RIIO-2.

Figure 26 Comparison of sensitivities against baseline results

Scenario	Mean RoRE impact (bps)	Mean financial impact (£m/year)	Proportion of outcomes above 25bps
Baseline approach	-20.2	-1.80	25.3%
3.7% mean totex outperformance	7.5	0.67	40.2%
-2% mean totex outperformance	-35.1	-3.14	19.2%
Include London data in historical GSOP	-25.5	-2.28	23.3%
Two most recent years of complaints metric data	-13.3	-1.19	28.9%
Only most recent year of complaints metric data	-11.4	-1.02	29.9%
Small, positive cross-correlations	-20.2	-1.80	27.0%

Source: Frontier Economics analysis using @RISK

6 CONCLUSIONS

Our baseline results suggest that there is no evidence to justify Ofgem's 25 bps outperformance wedge. Given the RIIO-GD2 DD proposals, companies will in all likelihood underperform in RIIO-GD2. Even though there is, of course, a chance that outperformance reaches above 25bps, we do not consider it to be a reasonable exercise of regulatory judgement for Ofgem to base such a key regulatory decision on a scenario with such low (25%) likelihood.

We emphasise that our results arise despite the fact that we have introduced several conservative assumptions that mean our results are likely, in fact, to over-state the actual potential to outperform.

- On totex, we assume a mean expected outperformance of zero. However, we are of the view that the DD is likely to actually result in underperformance for the notional GDN, given the changes that have been introduced in RIIO-2. A full explanation of these changes can be found in our ENA report, but they include, for example, benchmarking at 85th percentile, setting what appear to be highly stretching productivity targets given the evidence put forward, reduced incentive rates, and more costs exposed to indexing or ex post true up than before. Given this, we anticipate that mean zero is a conservative assumption. In the not-implausible scenario where there is 2% underperformance on totex, this could lead to a further downside of around 15bps.
- While we have modelled the effect of PCDs and NARM on totex incentives separately, we have ignored some material drivers of downside risk – for example the potential for late delivery penalties on some PCDs; and the asymmetric skew of risk associated with the NARM incentive (due to the Delivery Adjustment Factor, and the asymmetric application of tests for "genuine" under/over-spends). We have also ignored the asymmetric incentives around risk-target delivery – i.e. the fact that there is no upside for "justified" departures from the NARM target, but there are downside penalties for any "unjustified" departures.
- We set the totex sharing factor equal to 50%, representing a mildly conservative assumption for the notional GDN's sharing factor (the industry average sharing factor is in fact 49.7%).
- For GSOP, we have conservatively excluded Cadent London's GSOP payments from the analysis. The neutral approach would introduce further downside of around -5bps.
- For emergency response times, we have adopted cautious approach on the penalties networks face if these times were breached. An alternative and more neutral approach may include a further downside of around -3 bps.
- Our base case for the BPI assumes an average BPI across networks. If we based this on RAV weighted-average BPI outcome this would further worsen the downside by c.1bp in all scenarios.

Unwinding these conservative assumptions might further reduce expected returns by somewhere between 9 and 24 bps (depending on the assumptions made about

totex outperformance). Even this range does not factor in the potential for penalties arising on PCDs and NARM.

Similarly, in order for a notional GDN to outperform by 25bps we would have to assume totex outperformance of around 6%. Given the findings in Section 3 we consider this scenario to be extremely unlikely at RIIO-2 for a notional GDN, and certainly no basis for Ofgem to set a critical component of the price control.

The overall results are robust to changing the modelling assumptions around totex performance and different correlations.

In short, even despite conservative assumptions which bias the results upwards, our central case still does not support a 25bps wedge. Our findings cast serious doubt over the validity of Ofgem's assumption that 25bps of outperformance is a valid central assumption.

Finally, we note that one interpretation of our finding of expected underperformance may be that rather than applying a deduction to the headline cost of equity, Ofgem should apply an uplift. We would encourage the reader not to reach this view. We disagree in principle with Ofgem's proposition that the allowed return on equity should be adjusted to account for expected outperformance (or indeed under-performance).

ANNEX A SENSITIVITIES

It may be helpful to consider the main intuition behind our results, incentive by incentive.

- With totex outperformance set at mean zero, the model naturally predicts no outperformance or underperformance on average. However, the range of potential outcomes is quite wide. This is driven by our conservative approach, using the standard deviation associated with Ofgem's analysis of historical outperformance (8.8%) (See Section 3.3). If we were to instead use the standard deviation associated with RIIO-GD1, the standard deviation would decrease significantly (to about 6.8%), which would result in a much smaller range of outcomes and decrease the proportion of outcomes at or above 25bps outperformance.
- NARMs and Tier 1 PCDs produce no outperformance or underperformance on average, with a very narrow range of outcomes (see Section 3.2.2 and Section 3.2.3). This reflects our conceptual understanding that the incentives, as structured, incentivise the notional GDN to deliver only exactly what they said they would. Any deviation is therefore likely to be small.
- Capital projects PCD produces a small downside on average (0.6bps). This reflects a small likelihood of a high impact downside, with no scope for significant upside – Ofgem's Draft Determinations state that any late, partial or non-delivery would result in 100% of funding being clawed back (see Section 3.2.2).[36]
- BPI delivers a very small upside on average. As the BPI outcomes for most GDNs were fairly close to zero, the notional GDN naturally experiences a near-zero impact from BPI.
- The CSS incentives delivers between 0.5bps to 0.7bps of underperformance for each CSS component on average. This reflects the interaction of (i) Ofgem setting the target at the average trial survey performance, as well (ii) the asymmetric deadband that Ofgem has introduced to limit only the scope of outperformance (but not underperformance). Consequently, even though the notional GDN has an equal chance of outperforming or underperforming on the CSS scores, not every outperformance on scores translates into a financial reward, whereas every underperformance on scores translates into a financial penalty. Therefore, the notional GDN suffers a financial underperformance on average.
- The complaints metric incentive produces 8.8bps of underperformance on average, the largest underperformance contribution among all incentives. This is because the RIIO-GD1 mean of the complaints metric is in fact within the penalty zone – so the notional GDN (assuming historical mean performance) is expected to underperform – and is further compounded by this incentive being penalty-only. Given that this incentive is a key driver of our overall result in the baseline model, we undertake two sensitivities to check the robustness of our result.

[36] Ofgem RIIO-2 Draft Determinations – GD sector annex, paragraph 2.223

- GSOP payments are expected to lead to 5.6bps of underperformance on average. The result reflects the continued existence of GSOP payments in RIIO-GD1, with the size of the impact in our modelling likely driven by Ofgem's decision to double the GSOP payments in RIIO-GD2. See Section 4.4 for an in-depth discussion on the modelling of GSOP payments, including our response to Ofgem's critique.
- Emergency response time is expected to deliver 2.8bps of underperformance on average. This is driven by the notional GDN having *ex-ante* a small likelihood of a high impact downside, with no room for any outperformance (penalty-only incentive).
- Unplanned interruptions incentive results in 0.5bps of underperformance on average. As with the emergency response time, this is also driven by the notional GDN having *ex-ante* a small likelihood of a high impact downside, with no room for any outperformance (penalty-only incentive).
- The shrinkage and environmental emissions incentive produces no underperformance or outperformance on average. This reflects our assumption that the target is a "fair bet".

A.1 Sensitivities for mean totex outperformance

In our explanation of our methodology above, we have explained our rationale for assuming 0% mean totex outperformance, which we use in our baseline model. We consider two sensitivities to the mean totex outperformance assumption here:

- A 'performance upside' model, based on a mean expected totex outperformance of 3.7%. This is based on an amended version of Ofgem's analysis of historic totex outperformance. However, we reiterate that this number does not account for all the ways in which we expect RIIO-GD2 to be more challenging than the past.
- A 'performance downside' model, based on a mean expected totex outperformance of -2%. In the ENA report, we explain that if NGGT's performance at RIIO-1 was to be properly restated using the RIIO-2 framework, NGGT would have underperformed on its totex allowances by around 2%. While this is clearly not a perfect comparator, we consider that this is a reasonable downside assumption for the purposes of a totex underperformance sensitivity.

A.1.1 3.7% mean totex outperformance

This sensitivity considers the upside scenario to totex outperformance, assuming a 3.7% mean totex outperformance for the notional GDN instead of 0% in our baseline approach.

Figure 27 shows the results of this sensitivity at the incentive level. In comparison to our baseline model results, the key change is in totex outperformance. This sensitivity predicts that the expected totex outperformance is 27.7bps, which results in the expected overall impact increasing from -20.2bps in our baseline model to 7.5bps, i.e. going from underperformance to slight outperformance.

Figure 27 Incentive-level results – 3.7% mean totex outperformance sensitivity

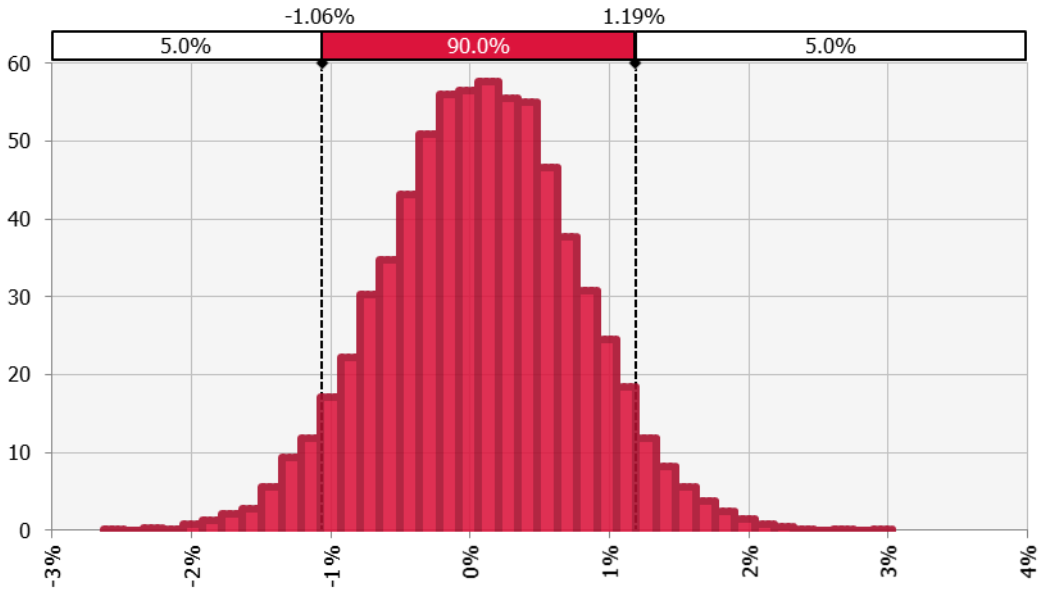
Incentive	Mean RoRE impact (bps)	RoRE impact range (bps)	Mean financial impact (£m/year)	Financial impact range (£m/year)
Totex (excl. NARM and PCDs)	27.7	-80.4 to 135.7	2.5	-7.2 to 12.14
NARM portion of totex	0.0	-1.4 to 1.4	0.0	-0.12 to 0.12
Tier 1 mains PCD	0.0	-2.2 to 2.2	0.0	-0.19 to 0.19
Tier 1 services PCD	0.0	-0.4 to 0.4	0.0	-0.03 to 0.03
Capital projects PCD	-0.6	0 to 0	-0.1	0 to 0
BPI	0.1	0.1 to 0.1	0.0	0.01 to 0.01
CSS: Planned work	-0.7	-5.9 to 5.2	-0.1	-0.53 to 0.47
CSS: Emergency response and repair	-0.5	-6.2 to 6.1	0.0	-0.56 to 0.55
CSS: Connections work	-0.7	-7.5 to 7.7	-0.1	-0.67 to 0.69
Complaints metric	-8.8	-22 to 0	-0.8	-1.96 to 0
GSOP	-5.6	-11.3 to 0	-0.5	-1.01 to 0
Emergency response time	-2.8	-55.9 to 0	-0.3	-5 to 0
Unplanned interruptions	-0.5	-11 to 0	0.0	-0.98 to 0
Shrinkage and environmental emissions	0.0	-10.7 to 10.7	0.0	-0.96 to 0.96
Total impact	**7.5**	**-106.2 to 118.9**	**0.7**	**-9.5 to 10.64**

Source: *Frontier Economic analysis using @RISK*

Note: *RoRE and financial impact ranges report the central 90% of Monte Carlo simulation outcomes i.e. excluding the 5% top most and bottom most extreme outcomes.*

Figure 28 shows the Monte Carlo simulation results of this sensitivity, in the form of a probability distribution of potential RoRE outperformance outcomes, while Figure 29 shows the proportion of outcomes above 25bps in this sensitivity.

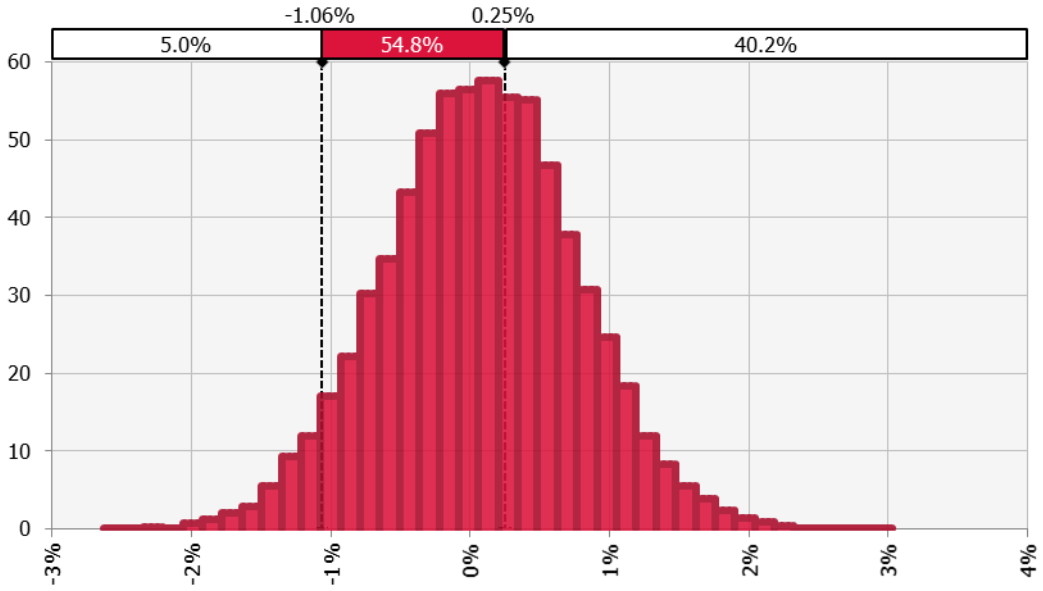
Figure 28 Range of outcomes for total impact (RoRE terms) – 3.7% mean totex outperformance sensitivity



Source: *Frontier Economics analysis using @RISK*

Note: *The histogram above illustrates the probability distribution of a notional company's simulated out/underperformance in RoRE terms. The X-axis measures RoRE out/underperformance and the Y-axis measures the frequency of occurrences.*

Figure 29 Proportion of outcomes above 25bps – 3.7% mean totex outperformance sensitivity



Source: *Frontier Economics analysis using @RISK*

Note: *The histogram above illustrates the probability distribution of a notional company's simulated out/underperformance in RoRE terms. The X-axis measures RoRE out/underperformance and the Y-axis measures the frequency of occurrences.*

Figure 29 shows us that 40.2% of outcomes in our Monte Carlo simulation result in either matching or doing better than 25bps of outperformance.

A.1.2 -2% mean totex outperformance

This sensitivity considers the downside scenario to totex outperformance, assuming a -2% mean totex outperformance for the notional GDN instead of 0% in our baseline approach.

Figure 30 shows the results of this sensitivity at the incentive level. In comparison to our baseline model results, the key change is in totex outperformance. This sensitivity predicts that the expected totex performance is -15bps, which results in the expected overall impact decreasing from -20.2bps to -35.1bps, i.e. going from underperformance to larger underperformance.

Figure 30 Incentive-level results – -2% mean totex outperformance sensitivity

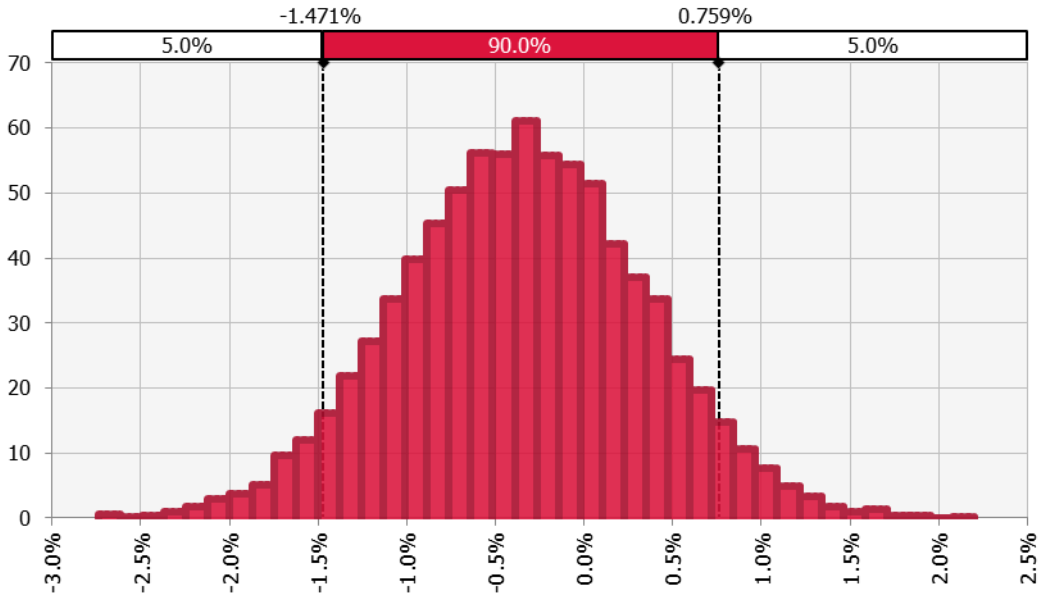
Incentive	Mean RoRE impact (bps)	RoRE impact range (bps)	Mean financial impact (£m/year)	Financial impact range (£m/year)
Totex (excl. NARM and PCDs)	-15.0	-123.1 to 93.1	-1.3	-11.01 to 8.33
NARM portion of totex	0.0	-1.4 to 1.4	0.0	-0.12 to 0.12
Tier 1 mains PCD	0.0	-2.2 to 2.2	0.0	-0.19 to 0.19
Tier 1 services PCD	0.0	-0.4 to 0.4	0.0	-0.03 to 0.03
Capital projects PCD	-0.6	0 to 0	-0.1	0 to 0
BPI	0.1	0.1 to 0.1	0.0	0.01 to 0.01
CSS: Planned work	-0.7	-5.9 to 5.2	-0.1	-0.53 to 0.47
CSS: Emergency response and repair	-0.5	-6.2 to 6.1	0.0	-0.56 to 0.55
CSS: Connections work	-0.7	-7.5 to 7.7	-0.1	-0.67 to 0.69
Complaints metric	-8.8	-22 to 0	-0.8	-1.96 to 0
GSOP	-5.6	-11.3 to 0	-0.5	-1.01 to 0
Emergency response time	-2.8	-55.9 to 0	-0.3	-5 to 0
Unplanned interruptions	-0.5	-11 to 0	0.0	-0.98 to 0
Shrinkage and environmental emissions	0.0	-10.7 to 10.7	0.0	-0.96 to 0.96
Total impact	**-35.1**	**-147.1 to 75.9**	**-3.1**	**-13.16 to 6.79**

Source: *Frontier Economic analysis using @RISK*

Note: *RoRE and financial impact ranges report the central 90% of Monte Carlo simulation outcomes i.e. excluding the 5% top most and bottom most extreme outcomes.*

Figure 31 shows the Monte Carlo simulation results of this sensitivity, in the form of a probability distribution of potential RoRE outperformance outcomes, while Figure 32 shows the proportion of outcomes above 25bps in this sensitivity. In this sensitivity, only 19.2% of outcomes in this sensitivity match or exceed 25bps of outperformance, which implies that the notional GDN would fail to match or exceed 25bps of outperformance over 80% of the time.

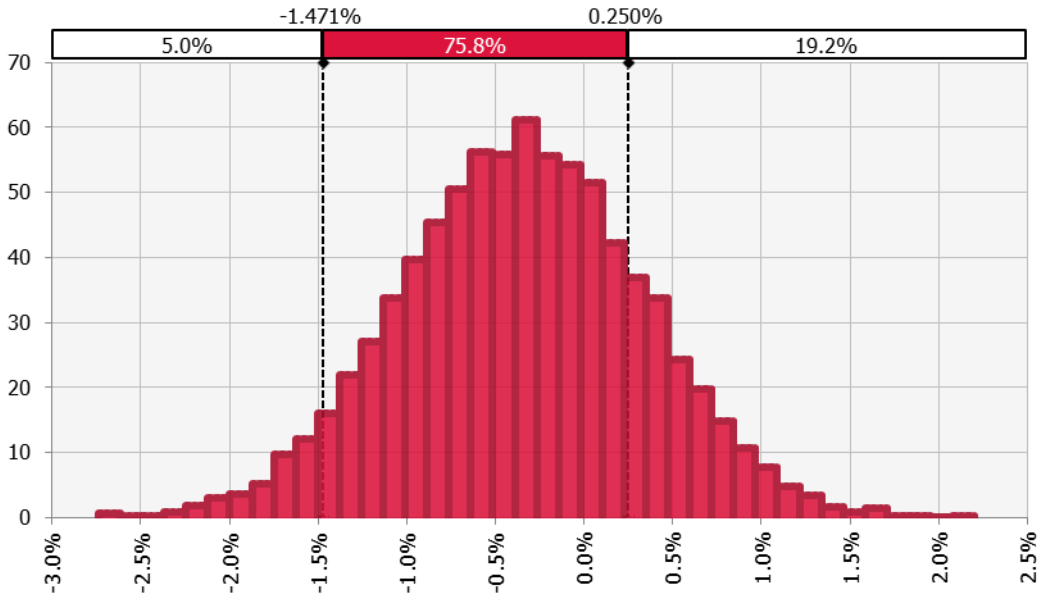
Figure 31 Range of outcomes for total impact (RoRE terms) – -2% mean totex outperformance sensitivity



Source: *Frontier Economics analysis using @RISK*

Note: *The histogram above illustrates the probability distribution of a notional company's simulated out/underperformance in RoRE terms. The X-axis measures RoRE out/underperformance and the Y-axis measures the frequency of occurrences.*

Figure 32 Proportion of outcomes above 25bps – 3.7% mean totex outperformance sensitivity



Source: *Frontier Economics analysis using @RISK*

Note: *The histogram above illustrates the probability distribution of a notional company's simulated out/underperformance in RoRE terms. The X-axis measures RoRE out/underperformance and the Y-axis measures the frequency of occurrences.*

A.2 Sensitivity for GSOP

In our baseline approach, we excluded London data from our calculation of the historical RIIO-GD1 GSOP payments, because it appeared to be an outlier and we wanted to be conservative in our approach. This sensitivity considers what would happen if we included London back into our calculation historical GSOP payments mean and standard deviations. Although London appears to be an outlier, it is nonetheless a GDN and is therefore by definition part of the sample.

Figure 33 shows the results of this sensitivity at the incentive level. In comparison to our baseline model results, this sensitivity predicts that the expected GSOP payments contributes 10.9bps of underperformance (in contrast to 5.6bps of underperformance in our baseline results). This results in the expected overall impact decreasing from -20.2bps to -25.5bps, i.e. going from underperformance to larger underperformance.

Figure 33 Incentive-level results – GSOP sensitivity

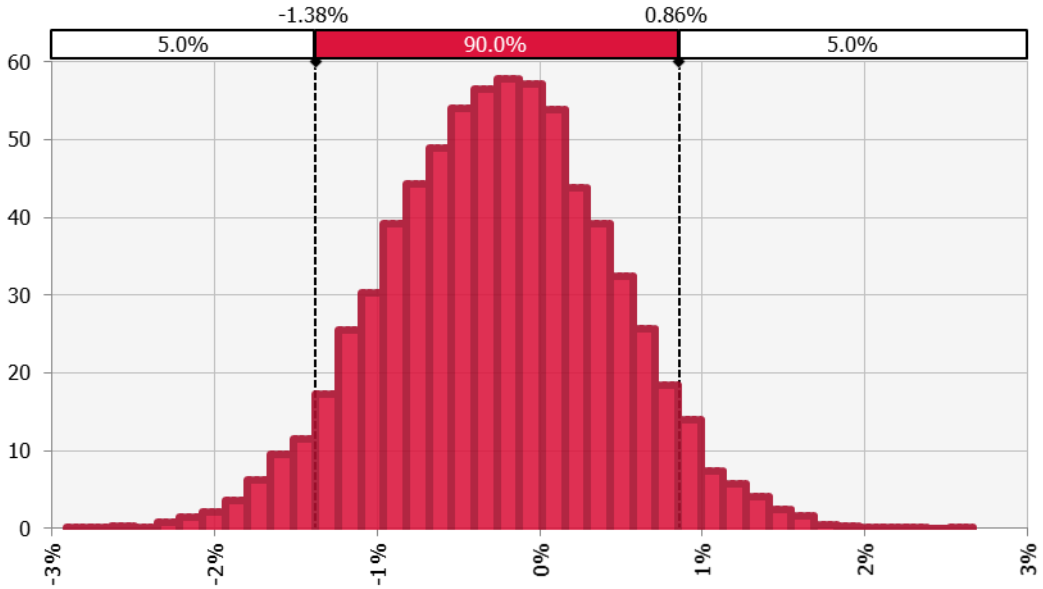
Incentive	Mean RoRE impact (bps)	RoRE impact range (bps)	Mean financial impact (£m/year)	Financial impact range (£m/year)
Totex (excl. NARM and PCDs)	0.0	-108.1 to 108.1	0.0	-9.67 to 9.67
NARM portion of totex	0.0	-1.4 to 1.4	0.0	-0.12 to 0.12
Tier 1 mains PCD	0.0	-2.2 to 2.2	0.0	-0.19 to 0.19
Tier 1 services PCD	0.0	-0.4 to 0.4	0.0	-0.03 to 0.03
Capital projects PCD	-0.6	0 to 0	-0.1	0 to 0
BPI	0.1	0.1 to 0.1	0.0	0.01 to 0.01
CSS: Planned work	-0.7	-5.9 to 5.2	-0.1	-0.53 to 0.47
CSS: Emergency response and repair	-0.5	-6.2 to 6.1	0.0	-0.56 to 0.55
CSS: Connections work	-0.7	-7.5 to 7.7	-0.1	-0.67 to 0.69
Complaints metric	-8.8	-22 to 0	-0.8	-1.96 to 0
GSOP	-10.9	-28.6 to 0	-1.0	-2.56 to 0
Emergency response time	-2.8	-55.9 to 0	-0.3	-5 to 0
Unplanned interruptions	-0.5	-11 to 0	0.0	-0.98 to 0
Shrinkage and environmental emissions	0.0	-10.7 to 10.7	0.0	-0.96 to 0.96
Total impact	**-25.5**	**-138 to 85.7**	**-2.3**	**-12.34 to 7.66**

Source: Frontier Economic analysis using @RISK

Note: RoRE and financial impact ranges report the central 90% of Monte Carlo simulation outcomes i.e. excluding the 5% top most and bottom most extreme outcomes.

Figure 34 shows the Monte Carlo simulation results of this sensitivity, in the form of a probability distribution of potential RoRE outperformance outcomes, while Figure 35 shows the proportion of outcomes above 25bps in this sensitivity. In this sensitivity, only 23.3% of outcomes in this sensitivity match or exceed 25bps of outperformance, which implies that the notional GDN would fail to match or exceed 25bps of outperformance 76.7% of the time. The totex outperformance necessary to reach 25bps outperformance would be around 7%.

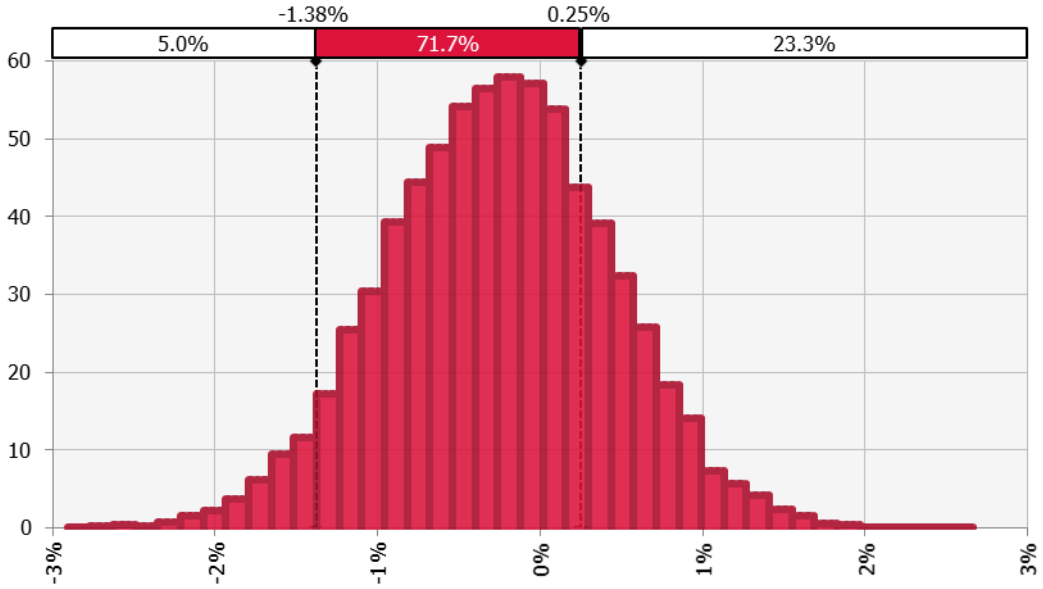
Figure 34 Range of outcomes for total impact (RoRE terms) – GSOP sensitivity



Source: *Frontier Economics analysis using @RISK*

Note: *The histogram above illustrates the probability distribution of a notional company's simulated out/underperformance in RoRE terms. The X-axis measures RoRE out/underperformance and the Y-axis measures the frequency of occurrences.*

Figure 35 Proportion of outcomes above 25bps – GSOP sensitivity



Source: *Frontier Economics analysis using @RISK*

Note: *The histogram above illustrates the probability distribution of a notional company's simulated out/underperformance in RoRE terms. The X-axis measures RoRE out/underperformance and the Y-axis measures the frequency of occurrences.*

A.3 Sensitivity for complaints metric

In our baseline approach, the complaints metric turned out to be a key driver of our overall result, contributing 8.8bps out of the 20.2bps of underperformance. Here, we consider what happens when we change our distribution parameters for the complaints metric.

We used the entirety of the available RIIO-GD1 historical data (2013/14 to 2018/19) to derive our complaints metric distribution mean and standard deviation in our baseline approach. Our two sensitivities take reference from the options that Ofgem considered in setting out its complaints metric target in the Draft Determinations.[37]

In particular, we consider:

- Using only the two most recent years of GD1 data (2017/18 and 2018/19) to calculate our distribution parameters; and
- Using only the most recent year of GD1 data (2018/19).

A.3.1 Using two most recent years of GD1 data

This sensitivity considers using only the two most recent years of GD1 data to calculate our complaints metric distribution mean and standard deviation, instead of using all available years as in our baseline approach. (See Figure 13 for details of changes to distribution parameters.)

Figure 36 shows the results of this sensitivity at the incentive level. In comparison to our baseline model results, this sensitivity predicts that the expected impact of complaints metric is 1.9bps of underperformance (in contrast to 8.8bps of underperformance in our baseline results). This results in the expected overall impact improving from -20.2bps to -13.3bps, but is still an overall underperformance for the notional GDN.

[37] Ofgem RIIO-2 Draft Determinations – GD sector annex, Table 5

Figure 36 Incentive-level results – complaints metric sensitivity (two most recent years)

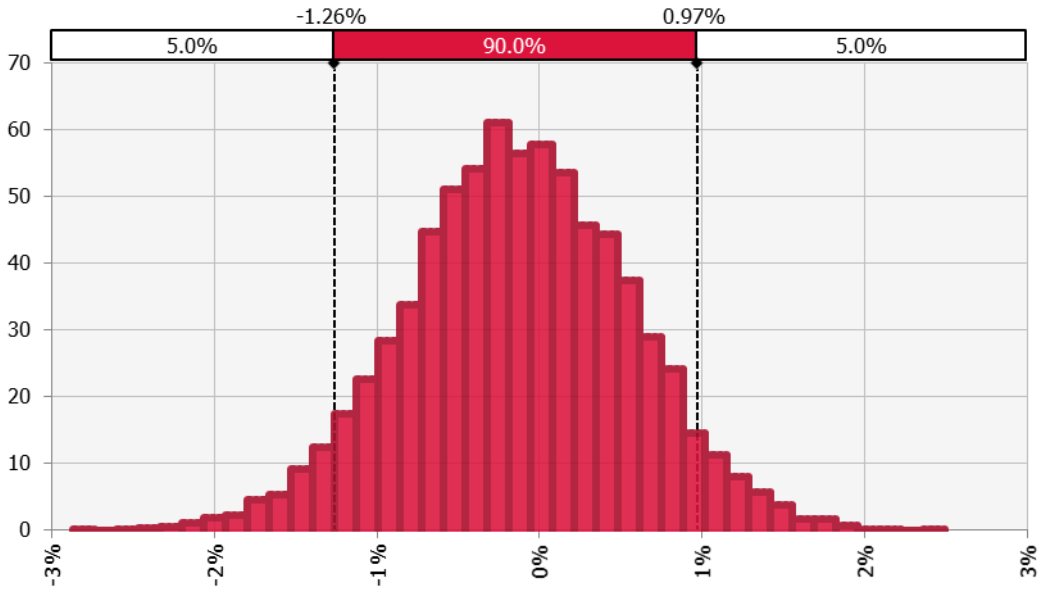
Incentive	Mean RoRE impact (bps)	RoRE impact range (bps)	Mean financial impact (£m/year)	Financial impact range (£m/year)
Totex (excl. NARM and PCDs)	0.0	-108.1 to 108	0.0	-9.67 to 9.67
NARM portion of totex	0.0	-1.4 to 1.4	0.0	-0.12 to 0.12
Tier 1 mains PCD	0.0	-2.2 to 2.2	0.0	-0.19 to 0.19
Tier 1 services PCD	0.0	-0.4 to 0.4	0.0	-0.03 to 0.03
Capital projects PCD	-0.6	0 to 0	-0.1	0 to 0
BPI	0.1	0.1 to 0.1	0.0	0.01 to 0.01
CSS: Planned work	-0.7	-5.9 to 5.2	-0.1	-0.53 to 0.47
CSS: Emergency response and repair	-0.5	-6.2 to 6.1	0.0	-0.56 to 0.55
CSS: Connections work	-0.7	-7.5 to 7.7	-0.1	-0.67 to 0.69
Complaints metric	-1.9	-10.5 to 0	-0.2	-0.94 to 0
GSOP	-5.6	-11.3 to 0	-0.5	-1.01 to 0
Emergency response time	-2.8	-55.9 to 0	-0.3	-5 to 0
Unplanned interruptions	-0.5	-11 to 0	0.0	-0.98 to 0
Shrinkage and environmental emissions	0.0	-10.7 to 10.7	0.0	-0.96 to 0.96
Total impact	**-13.3**	**-126.4 to 96.9**	**-1.2**	**-11.31 to 8.67**

Source: Frontier Economic analysis using @RISK

Note: RoRE and financial impact ranges report the central 90% of Monte Carlo simulation outcomes i.e. excluding the 5% top most and bottom most extreme outcomes.

Figure 37 shows the Monte Carlo simulation results of this sensitivity, in the form of a probability distribution of potential RoRE outperformance outcomes, while Figure 38 shows the proportion of outcomes above 25bps in this sensitivity. In this sensitivity, 28.9% of outcomes in this sensitivity match or exceed 25bps of outperformance, which implies that the notional GDN would fail to match or exceed 25bps of outperformance 71.1% of the time. The totex outperformance necessary to reach 25bps outperformance would be over 5%.

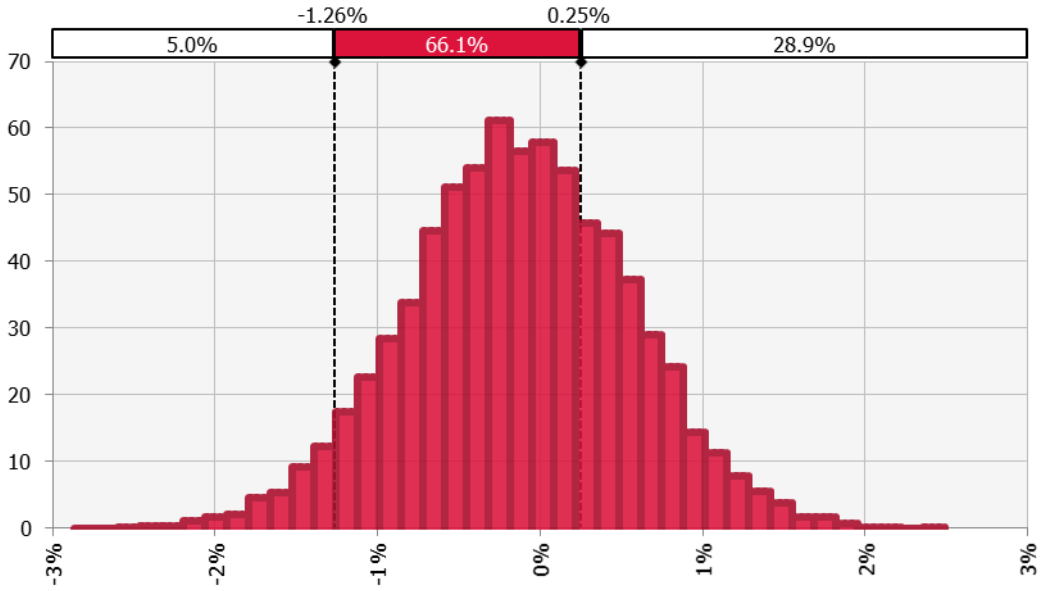
Figure 37 Range of outcomes for total impact (RoRE terms) – complaints metric sensitivity (two most recent years)



Source: *Frontier Economics analysis using @RISK*

Note: *The histogram above illustrates the probability distribution of a notional company's simulated out/underperformance in RoRE terms. The X-axis measures RoRE out/underperformance and the Y-axis measures the frequency of occurrences.*

Figure 38 Proportion of outcomes above 25bps – complaints metric sensitivity (two most recent years)



Source: *Frontier Economics analysis using @RISK*

Note: *The histogram above illustrates the probability distribution of a notional company's simulated out/underperformance in RoRE terms. The X-axis measures RoRE out/underperformance and the Y-axis measures the frequency of occurrences.*

A.3.2 Using most recent year of GD1 data only

This sensitivity considers using only the most recent year of GD1 data to calculate our complaints metric distribution mean and standard deviation, instead of using all available years as in our baseline approach. (See Figure 13 for details of changes to distribution parameters.)

Figure 39 shows the results of this sensitivity at the incentive level. In comparison to our baseline model results, this sensitivity predicts that the expected impact of complaints metric is no outperformance or underperformance (in contrast to 8.8bps of underperformance in our baseline results). This results in the expected overall impact improving from -20.2bps to -11.4bps, but is still an overall underperformance for the notional GDN.

Figure 39 Incentive-level results – complaints metric sensitivity (two most recent years)

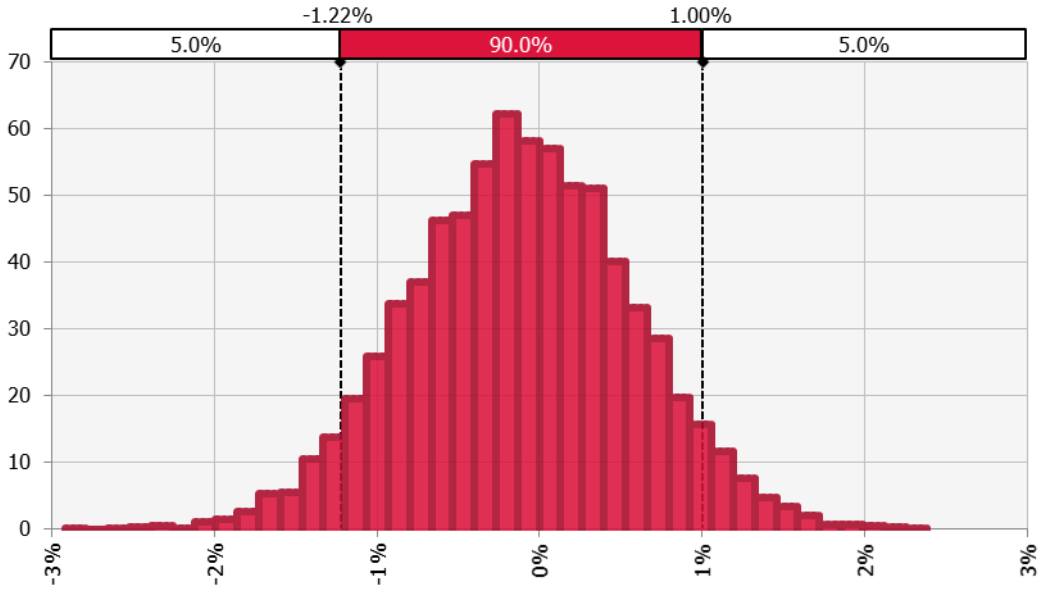
Incentive	Mean RoRE impact (bps)	RoRE impact range (bps)	Mean financial impact (£m/year)	Financial impact range (£m/year)
Totex (excl. NARM and PCDs)	0.0	-108.1 to 108	0.0	-9.67 to 9.66
NARM portion of totex	0.0	-1.4 to 1.4	0.0	-0.12 to 0.12
Tier 1 mains PCD	0.0	-2.2 to 2.2	0.0	-0.19 to 0.19
Tier 1 services PCD	0.0	-0.4 to 0.4	0.0	-0.03 to 0.03
Capital projects PCD	-0.6	0 to 0	-0.1	0 to 0
BPI	0.1	0.1 to 0.1	0.0	0.01 to 0.01
CSS: Planned work	-0.7	-5.9 to 5.2	-0.1	-0.53 to 0.47
CSS: Emergency response and repair	-0.5	-6.2 to 6.1	0.0	-0.56 to 0.55
CSS: Connections work	-0.7	-7.5 to 7.7	-0.1	-0.67 to 0.69
Complaints metric	0.0	0 to 0	0.0	0 to 0
GSOP	-5.6	-11.3 to 0	-0.5	-1.01 to 0
Emergency response time	-2.8	-55.9 to 0	-0.3	-5 to 0
Unplanned interruptions	-0.5	-11 to 0	0.0	-0.98 to 0
Shrinkage and environmental emissions	0.0	-10.7 to 10.7	0.0	-0.96 to 0.96
Total impact	**-11.4**	**-122.4 to 100.4**	**-1.0**	**-10.95 to 8.98**

Source: *Frontier Economic analysis using @RISK*

Note: *RoRE and financial impact ranges report the central 90% of Monte Carlo simulation outcomes i.e. excluding the 5% top most and bottom most extreme outcomes.*

Figure 40 shows the Monte Carlo simulation results of this sensitivity, in the form of a probability distribution of potential RoRE outperformance outcomes, while Figure 41 shows the proportion of outcomes above 25bps in this sensitivity. 29.9% of outcomes in this sensitivity match or exceed 25bps of outperformance, which implies that the notional GDN would fail to match or exceed 25bps of outperformance 70.1% of the time. The totex outperformance necessary to reach 25bps outperformance would be around 5%.

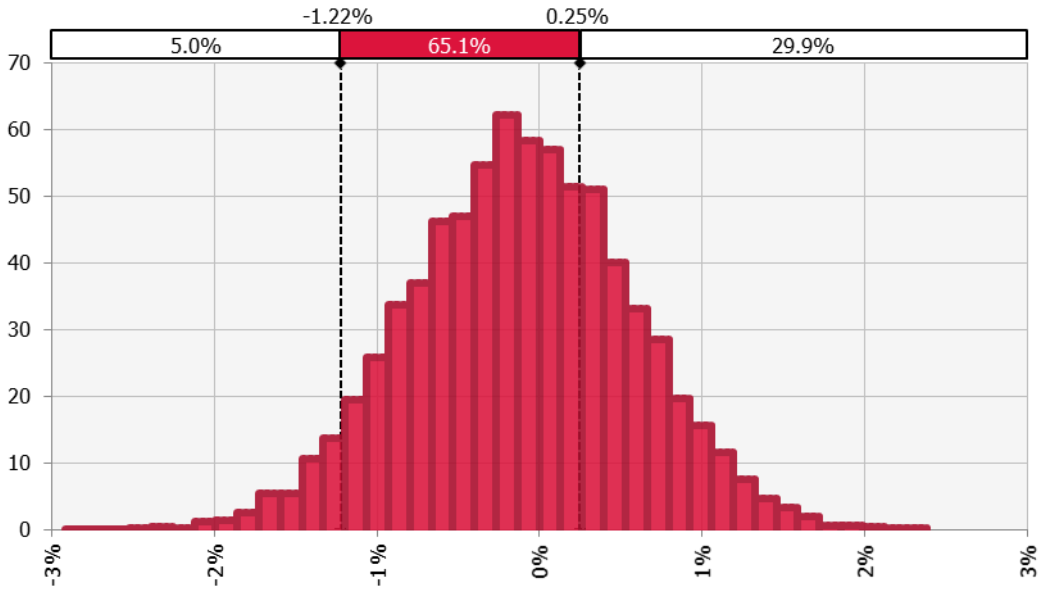
Figure 40 Range of outcomes for total impact (RoRE terms) – complaints metric sensitivity (most recent year only)



Source: *Frontier Economics analysis using @RISK*

Note: *The histogram above illustrates the probability distribution of a notional company's simulated out/underperformance in RoRE terms. The X-axis measures RoRE out/underperformance and the Y-axis measures the frequency of occurrences.*

Figure 41 Proportion of outcomes above 25bps – complaints metric sensitivity (most recent year only)



Source: *Frontier Economics analysis using @RISK*

Note: *The histogram above illustrates the probability distribution of a notional company's simulated out/underperformance in RoRE terms. The X-axis measures RoRE out/underperformance and the Y-axis measures the frequency of occurrences.*

A.4 Sensitivity for cross-correlations

In our baseline approach, we have assumed zero correlations across incentives, in line with Ofgem's assumption used in their analysis of historical outperformance.[38] However, Ofgem also states that their review of historical outperformance actually suggests positive correlation between totex and the ODIs. This section considers a sensitivity in which we introduce positive correlations between totex outperformance and ODI outperformance.

Figure 42 below shows the correlation matrix used in this sensitivity

[38] RIIO-2 DD, Finance annex, paragraph 3.121

Figure 42 Correlations used in this sensitivity

	Totex	NARM & PCDs	CSS components	Complaints	GSOP	Emergency response time	Unplanned interruptions	Shrinkage and environmental emissions
Totex	1							
NARM & PCDs	0	1						
CSS components	0.2	0	1					
Complaints	-0.2	0	0	1				
GSOP	0	0	0	0	1			
Emergency response time	-0.2	0	0	0	0	1		
Unplanned interruptions	-0.2	0	0	0	0	0	1	
Shrinkage and environmental emissions	0	0	0	0	0	0	0	1

Source: *Frontier Economics analysis*

Note: *The correlation matrix has been simplified for brevity. BPI is modelled as a fixed number, and so is uncorrelated with totex or other ODI outperformance. NARMs & PCDs are modelled as uncorrelated with totex or other ODI outperformance, including each other. Each CSS component (total three) is modelled as having 0.2 correlation with totex outperformance, with no correlation to the other two CSS components, or other ODI outperformance. The correlations for the complaints metric, emergency response time, and unplanned interruptions are negative because higher numbers for those ODIs reflects higher probabilities of penalties.*

Figure 43 shows the results of this sensitivity at the incentive level. This sensitivity predicts that the expected overall impact is the same as in our baseline results, i.e. a 20.2bps underperformance. The key change is in the range of results, from -133.9 to 90.7bps in our baseline results to -141.5 to 99bps in this sensitivity. The positive correlations between totex outperformance and ODI outperformance implies that when the notional GDN outperforms in totex, it is more likely (relative to our baseline model) to also outperform in ODIs, and vice versa for underperformance. The result of this interaction is that the overall outcomes become more dispersed, and so the range of potential outcomes increase, even though the mean outcomes do not change.

Figure 43 Incentive-level results – cross-correlations sensitivity

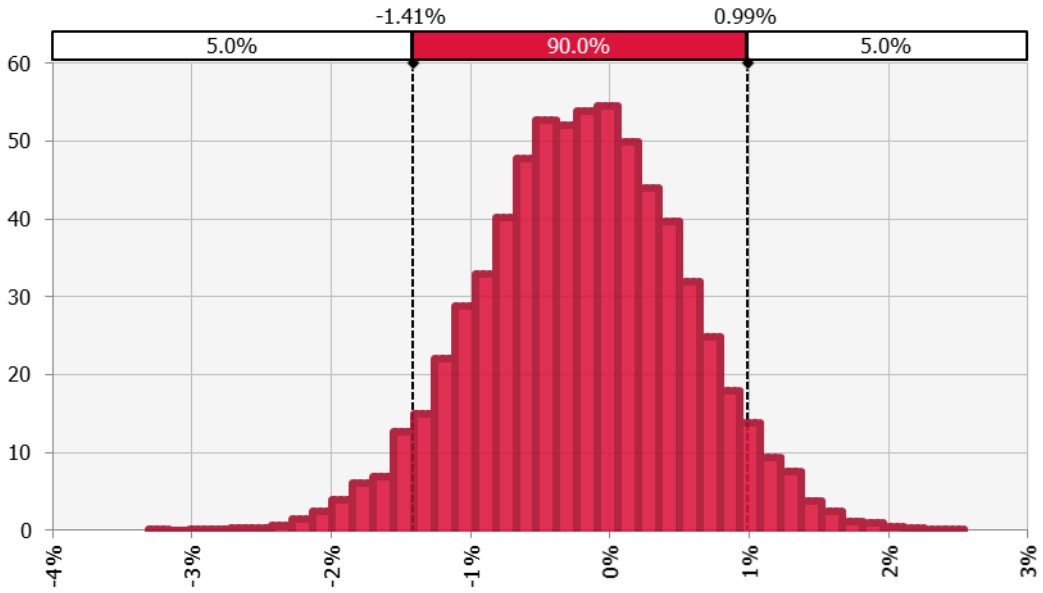
Incentive	Mean RoRE impact (bps)	RoRE impact range (bps)	Mean financial impact (£m/year)	Financial impact range (£m/year)
Totex (excl. NARM and PCDs)	0.0	-108.1 to 108.1	0.0	-9.67 to 9.66
NARM portion of totex	0.0	-1.4 to 1.4	0.0	-0.12 to 0.12
Tier 1 mains PCD	0.0	-2.2 to 2.2	0.0	-0.19 to 0.19
Tier 1 services PCD	0.0	-0.4 to 0.4	0.0	-0.03 to 0.03
Capital projects PCD	-0.6	0 to 0	-0.1	0 to 0
BPI	0.1	0.1 to 0.1	0.0	0.01 to 0.01
CSS: Planned work	-0.7	-5.9 to 5.2	-0.1	-0.53 to 0.47
CSS: Emergency response and repair	-0.5	-6.2 to 6.1	0.0	-0.56 to 0.55
CSS: Connections work	-0.7	-7.5 to 7.7	-0.1	-0.67 to 0.69
Complaints metric	-8.8	-22 to 0	-0.8	0 to 0
GSOP	-5.6	-11.3 to 0	-0.5	-1.01 to 0
Emergency response time	-2.8	-55.9 to 0	-0.3	-5 to 0
Unplanned interruptions	-0.5	-11 to 0	0.0	-0.98 to 0
Shrinkage and environmental emissions	0.0	-10.7 to 10.7	0.0	-0.96 to 0.96
Total impact	**-20.2**	**-141.5 to 99**	**-1.8**	**-10.95 to 8.98**

Source: Frontier Economic analysis using @RISK

Note: RoRE and financial impact ranges report the central 90% of Monte Carlo simulation outcomes i.e. excluding the 5% top most and bottom most extreme outcomes.

Figure 44 shows the Monte Carlo simulation results of this sensitivity, in the form of a probability distribution of potential RoRE outperformance outcomes, while Figure 45 shows the proportion of outcomes above 25bps in this sensitivity. In this sensitivity, 27.0% of outcomes in this sensitivity match or exceed 25bps of outperformance, which implies that the notional GDN would fail to match or exceed 25bps of outperformance 73.0% of the time.

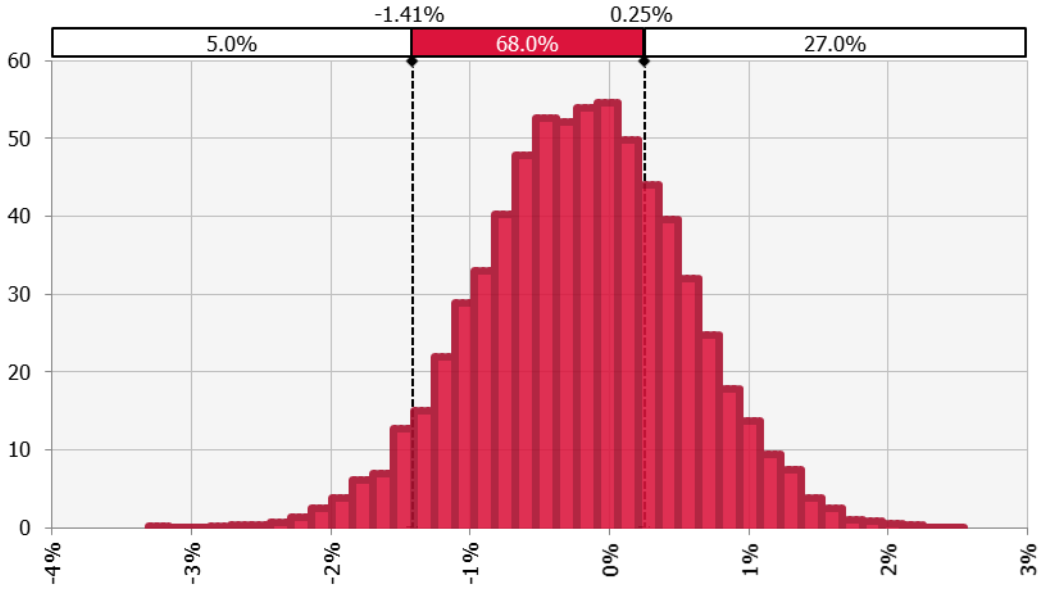
Figure 44 Range of outcomes for total impact (RoRE terms) – cross-correlations sensitivity



Source: *Frontier Economics analysis using @RISK*

Note: *The histogram above illustrates the probability distribution of a notional company's simulated out/underperformance in RoRE terms. The X-axis measures RoRE out/underperformance and the Y-axis measures the frequency of occurrences.*

Figure 45 Proportion of outcomes above 25bps – cross-correlations sensitivity



Source: *Frontier Economics analysis using @RISK*

Note: The histogram above illustrates the probability distribution of a notional company's simulated out/underperformance in RoRE terms. The X-axis measures RoRE out/underperformance and the Y-axis measures the frequency of occurrences.

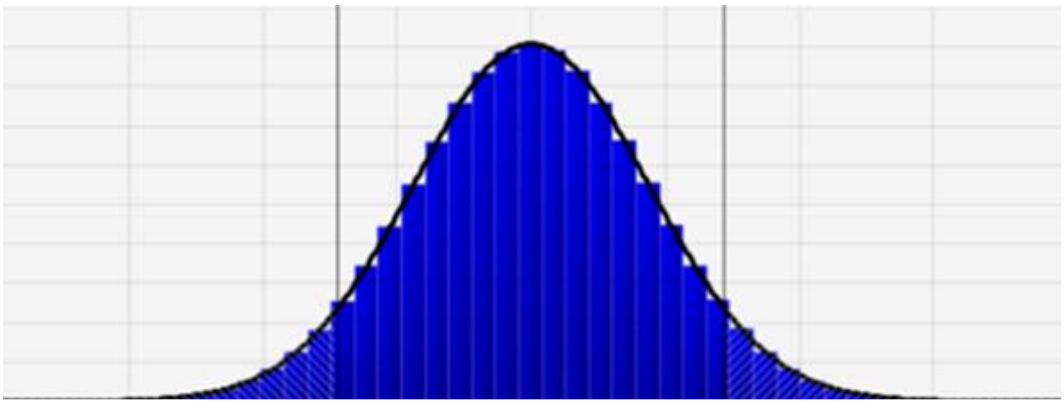
ANNEX B TYPES OF DISTRIBUTIONS MODELLED

A probability distribution is a description of all possible values taken on by a function, and the probabilities of a random variable taking on any of the observations in the range. Exactly how the points in the range take shape when their values are plotted against their probability of occurrence depends on the maximum, minimum, mean, standard deviation, skewness, and kurtosis of the data.[39]

As part of our analysis, we model our variables using 3 types of probability distributions: Normal, Triangular and Bernoulli. A brief description of each is below:

- A distribution in which the data are symmetrically spread across a bell-shaped graph is called a **normal distribution**. The most likely outcome is the mean, while all other data are distributed symmetrically around the mean. 68% of observations lie within one standard deviation on either side of the mean, and 95% of observations lie within two standard deviations on either side of the mean.[40]

Figure 46 A typical Normal distribution



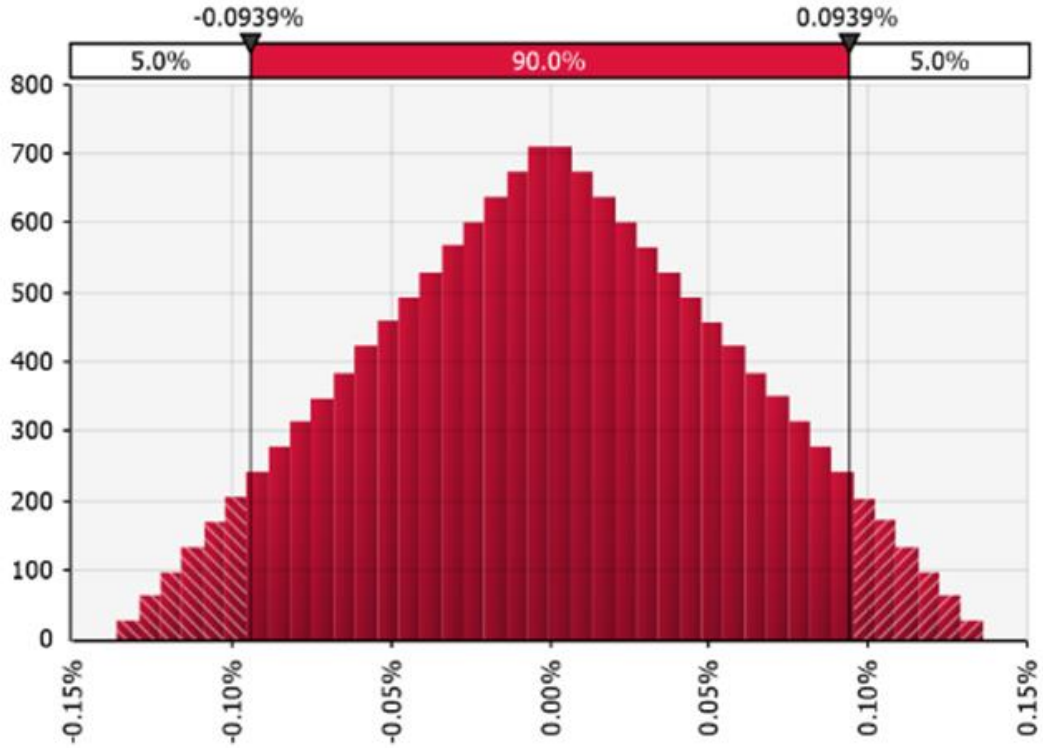
Source: Frontier example of a typical normal distribution

- A **triangular distribution** is a continuous distribution of observations which takes the shape of a triangle when these observations are plotted. This distribution has a lower limit (minimum) and an upper limit (maximum), which are the lowest and highest observations in the distribution and have equally low probabilities of occurrence. The distribution also has a mode, which is the highest point of the triangle and captures the observation with the highest probability of occurrence. Triangular distributions are used when the distribution of observations has a finite range and is bounded by a maximum and a minimum.

[39] https://www.investopedia.com/terms/p/probabilitydistribution.asp

[40] https://www.investopedia.com/terms/n/normaldistribution.asp

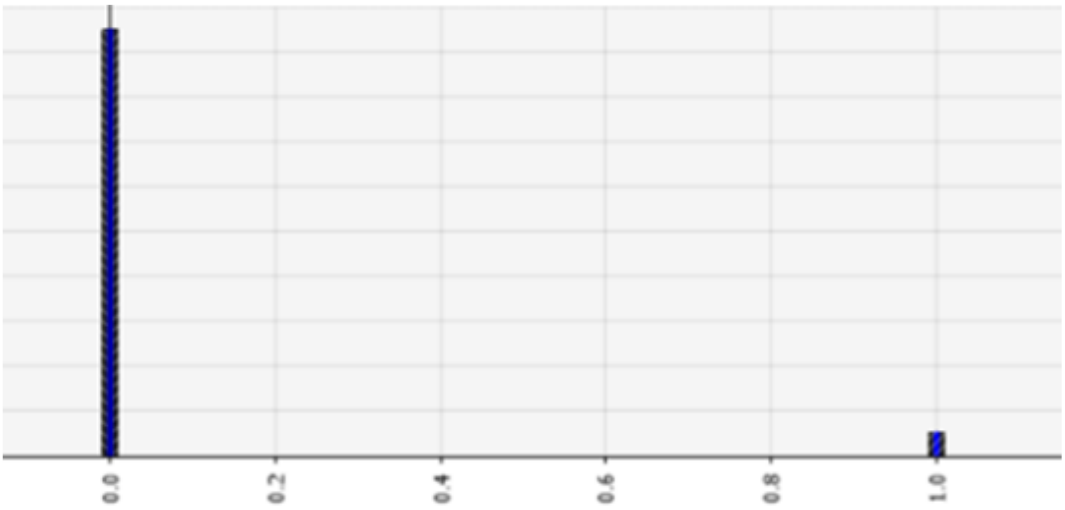
Figure 47 A typical triangular distribution



Source: Frontier example of a typical triangular distribution

- A **Bernoulli distribution** is used when the observations of interest are not in a continuous series but instead take on discrete values.
- So, for example, in our analysis such a distribution is used as opposed to a Normal distribution when assessing outcomes associated with low probability, high impact events.

Figure 48 A typical Bernoulli distribution



Source: Frontier example of a typical Bernoulli distribution

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