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ADDITIONAL CONSIDERATIONS FOR THE PR24 ALLOWED RETURN ON EQUITY

A REPORT PREPARED FOR YORKSHIRE

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Executive Summary

1 Ofwat is currently undertaking the 2024 price review (PR24) with the Final Determination (FD) due in December 2024. The determinations will consider the information provided by companies in their respective business plans.

2 What is clear from the plans submitted is that major new investments are required across the water and wastewater value chain. This is in response to multiple challenges faced by the sector, including resilience to climate change and meeting environmental standards.[1]

3 What is also clear is that investments made in the next five-year period[2] are an essential part of long-term (25-year) delivery strategies to meet the challenges the sector faces. Ofwat recognises this saying that, "*Funding will support efficient enhancement investment, both in the short and long term.*"[3] This means that the next five years are far from 'business as usual' for the sector, as companies strive to transform the value chain and improve outcomes, facilitated by a step-change in investment.

4 Investors therefore have a key role to play in the next five-year period. Significant sums of capital are required to make the investments set out in long-term plans a reality. However, capital cannot be transformed into assets if the sector cannot attract that capital in the first place. It is the challenge of attracting and retaining capital in the sector that this report provides a fresh perspective on.[4]

5 In this report we focus on the topic of attracting and retaining *equity capital* – but note that attracting all types of capital is essential for the sector to deliver on investment plans.

6 The work presented in this report was initially developed in response to Ofgem's Sector Specific Methodology Consultation (SSMC) for the RIIO-3 process. The analysis was therefore developed through late 2023 and early 2024. However, there are common challenges across sectors which mean the outputs are relevant for water networks as well as energy networks. We have therefore set out the implications from that work for Ofwat at the earliest opportunity following its completion.

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1 Water UK estimates that PR24 business plans set out £96bn of investment between 2025 and 2030. This represents a 63% increase, in real terms, on the expenditure allowed by Ofwat in the current five year period.

2 The next five-year period running from April 2025 to March 2030 is often referred to as "AMP8" (Asset Management Period 8).

3 Ofwat (2022), "Our final methodology for PR24: foreword and executive summary", pg.7.

4 Further detail on sector-specific and market context is provided in Section 2.

What is the challenge?

7 In the past two years capital market conditions have changed substantially. In response to a variety of global shocks, the period of accommodative macroeconomic policy has ended. There has been an abrupt rise in interest rates and the cost of borrowing – gilt yields have increased by c.3.5% over a short space of time. It is arguable that this was not fully factored into the PR24 Final Methodology, particularly where the allowed rate of return was discussed.[5]

8 The PR24 DD and FD will be taken in a very different environment to the equivalent at PR19. Allowances which reflected the era of low interest rates and required returns in the past will now have to be adapted to reflect the new conditions in financial markets. The challenge is to how adapt allowances proportionally to current market conditions.

9 In addition, it is not just water networks which have growing capital requirements. This challenge is arriving at a time when infrastructure investors have many competing opportunities (projects, companies and geographies) for deploying capital. This is driven by countries all over the world seeking rapid progress towards a decarbonised future – enabled, in many instances, by infrastructure investments. The financing costs faced by the water sector will reflect the competition for capital from other investment opportunities in these market conditions.

10 As the cost of equity cannot be directly observed, a range of tools are needed to assess what the new capital market environment means for the cost of equity. We consider it is important to review evidence produced by a range of tools – and note that this is consistent with UKRN guidance on the cost of capital.[6] Drawing upon a range of sources is a key way to ensure the allowed rate of return is set in a way that encourages long-term equity investment.

11 We present two tools for understanding the relationship between capital market conditions and the cost of equity. Both draw upon capital market data to support developing an appropriate allowed return on equity for PR24.

(a) **A cross-check derived from hybrid bonds** – as the name suggests, these are securities that combine debt and equity characteristics. But, as traded bonds, there is market information on the yields of these securities. This means those yields can be analysed to infer required equity returns. This

5 At the time the final methodology was being prepared, there was greater uncertainty around how persistent rate rises could be – the data cut-off used was September 2022.

6 The UKRN guidance says, "*The CAPM is a model of required returns; there is inherently some degree of parameter uncertainty. It is therefore important to sense check the resulting point estimate where there is evidence to do so."* UKRN guidance for regulators on the methodology for setting the cost of capital, page 26.

cross-check provides a clear link from capital market conditions through to the equity returns that utilities investors are likely to require. It also helps to test whether the difference between the cost of equity and cost of new debt is consistent within reasonable bounds of the CAPM logic. As far as we are aware this evidence source and cross-check has not been discussed in the context of PR24.

(b) **The relationship between total market returns (TMR) and gilt yields** – we have explored what the academic literature tells us about the relationship between forward looking estimates of TMR and the yields on index-linked gilts (ILGs). We then follow this literature to develop our own model of the relationship, finding that this can be used to calibrate a "TMR Glider" i.e. an assessment of what market evidence tells us about the appropriate level of TMR implied by market movements in gilts (used to proxy the risk-free rate (RFR)).

12 In both cases we have developed these new sources of evidence in response to the persistence of capital market conditions at a level significantly different to PR19. Arguably even at PR24 Final Methodology, markets already started to show material changes (relative to the conditions during PR19, which had persisted for around a decade at that point), although it was then unclear how significant the changes would ultimately become and quite how enduring this would prove to be. The persistence of this change has now become more evident in the past two years – meaning the need to carefully consider this issue has grown. We set out our key findings from each evidence source below.

A hybrid bond cross-check on the cost of equity

13 We have developed a new cross-check on the cost of equity. This cross-check is based on ensuring that the cost of equity lies sufficiently far above the long-term return on senior investment-grade debt. This condition derives from the relative risk profile of debt and equity.

14 Senior debt implies lower risk and better recovery prospects: senior debt is paid first and it is paid a contractually stipulated sum, with contractual protections available as a backup. In contrast, holders of equity are paid last, and act as residual claimants on the business with no guarantee they receive anything, in particular in times of financial distress. Because of this marked difference in risk, it would be irrational for investors to opt for equity if equity returns are not sufficiently above the rates that could be earned from providing senior debt instead.

15 Given the large gap in relative risk between senior conventional debt and equity, comparing unadjusted yields on senior debt to equity returns would only provide a limited cross-check on equity returns, i.e. a test that we would typically expect to

be easily passed.. A meaningful cross-check must reflect the incremental return that equity requires over debt.

16 We find that hybrid bonds, which are closer to equity in nature, provide a more meaningful point of comparison.[7] Since the yield on these hybrid bonds is directly observable, with an appropriate assumption on the proportion of equity like feature of the hybrid bond, an expected return on equity can be implied from a relatively simple formula. If the allowed equity return is set below the level implied by of the yields of hybrid bonds, then risks to attracting sufficient equity capital are greater.

17 Specifically, we use hybrid bonds issued by regulated UK utility networks companies as the basis of the cross-check.[8] This provides an output which is relevant for PR24 given the similarities in regulation between water networks and the other utility networks. To provide further confidence that results from the hybrid bond cross-check are applicable to the water sector we have undertaken a range of sector-specific analysis. Most notably, we have used a recent direct market quote on a potential hybrid bond issuance for Severn Trent, and found very similar results to our original analysis. Concluding that the outputs from the cross-check are relevant and appropriate to apply to water company cost of equity.

18 Drawing on recent capital market data, evidence from hybrid bonds indicates that the cost of equity should fall in the range 5.8% to 8.4% (CPIH deflated), with a central estimate of 6.6%.[9] This compares with an 'early central view' allowed return on equity from the PR24 methodology of 4.14%.

19 Our view is that a cost of equity set below this range would heighten equity financing risks at PR24 and is therefore a cross-check we would encourage Ofwat to carefully consider.

The relationship between total market returns and gilt yields

20 UK regulatory practice over the past decade or more has been to move TMR down to reflect prevailing market conditions. As interest rates and yields on government bonds fell over much of the last decade, UK regulators responded by lowering their estimates of TMR used to determine the allowed cost of equity. This movement was not one-for-one, i.e. regulators moved TMR by a proportion of the fall in yields

7 Hybrid bonds can be of very long tenor – covering multiple decades, making it more similar to the perpetual nature of equity. These securities can also have debt like qualities, including periodic coupon payments, however, in certain circumstances there can be a higher degree of flexibility over when these are paid. Hybrid bonds also sit between senior debt and ordinary shares in a company structure, being eligible for payments prior to equity-holders, but after senior debt-holders.

8 NGG Finance (a part of the wider National Grid group of companies) issues hybrid securities. Therefore, they provide a specific figure that reflects risk for regulated network businesses.

9 Expressed in CPIH-deflated terms; using data to the end of February 2024.

on government bonds. This "stable but not fixed" policy has been endorsed by the UK Regulators Network (UKRN).[10]

21 The low interest rate environment has now reversed. The deeply negative real interest rates that caused regulators to lower their estimates of TMR over the last decade are no longer observed. On the contrary, real interest rates are now materially positive. Available evidence points to materially positive real rates persisting.

22 By the same logic that caused estimates of TMR to fall at PR19, it is now time for regulators to increase TMR for PR24 (instead of further decreasing as set out in Ofwat's PR24 FM). As for the size of the appropriate increase, we have explored what the academic literature tells us about the relationship between short run, forward-looking estimates of TMR and yields on index-linked gilts (ILGs). Mirroring the UKRN guidance, we find that the literature finds such a relationship, and confirms that this is not one-for-one, i.e. TMR is stable but not fixed.

23 We then follow the academic literature to develop our own model. In line with the approach taken in the academic literature, we begin by using a Dividend Discount Model (DDM) to estimate a 'market-based' measure of nominal required TMR.[11] In accordance with what we have found in the literature, we analyse the relationship between these estimates of TMR and yields on government bonds (in particular 20-year nominal gilt yields, which are often used as a proxy for the RFR.

24 We posit that this relationship can be used to calibrate a TMR Glider, i.e. an assessment of what market evidence tells us about the appropriate level of TMR implied by market movements given the observable level of yields on 20 year gilts used to proxy RFR.

25 Our assessment is that the Glider we estimate is able to explain past regulatory TMR decisions, given each regulator's assessment of RFR, reasonably well. The implication of this is that past regulatory decisions have indeed responded to interest rate developments. On this basis, we think that the Glider provides useful guidance and insight on how the TMR can be set for future price controls.

26 We have considered what the Glider would imply for current and future regulatory decisions. On the basis of prevailing gilt yields, all Glider specifications predict a

10 UKRN (2023) UKRN guidance for regulators on the methodology for setting the cost of capital, p19.

11 In fact, we note that Ofwat had considered DDM evidence in the past, when setting the allowed TMR. See for example: Ofwat (2019) PR19 Final Determinations, Allowed return on capital technical appendix. In this case, however, we are not suggesting to use the DDM outputs directly. Rather, we note that the academic literature suggests that the DDM can capture short-term investor expectations, and we posit that this information can be used to calibrate a TMR Glider to facilitate regulatory decision making, as we explain in our approach (and also in more detail in the chapter outlining our Glider approach and results).

current TMR above 7.5%, in the range of 7.55%-7.86%.[12] Given that interest rates at prevailing levels have not been observed for more than ten years, and the 'stable but not fixed' regulatory construct that has emerged, it is perhaps not surprising that the predicted TMR is considerably higher than observed in the most recent decisions.

27 Overall, we consider that this TMR Glider provides a way to adapt TMR estimates in the cost of equity to market conditions while maintaining consistency with regulatory best practice – we therefore encourage Ofwat to consider this evidence the making cost of equity allowances for PR24.

What next?

28 This report provides two specific tools which can be used by Ofwat to help calibrate the appropriate cost of equity for PR24. These tools have been developed so that the regulatory framework is able to adapt to the challenges posed by the new capital market environment which has emerged.

29 Both tools are able to capture the impact of this new environment as their inputs are directly sourced from capital markets. This means they are transparent, simple to apply, and they are also tailored to the UK regulatory landscape.

(a) The outputs from the hybrid bond cross-check on the current cost of equity show a need to revise upwards the CAPM inputs used at PR19 to calculate the cost of equity. Without revision there are heightened risks to the sector in terms of the equity capital is able to raise.

(b) The TMR Glider provides a guide for how the TMR CAPM input can be revised in a proportional manner that is consistent with regulatory guidance and the wider capital market environment.

30 We note that there are other CAPM inputs which may also require revision in order to reach an appropriate cost of equity PR24 – such as beta. But those other inputs are beyond the scope of this report.

31 We invite further engagement with Ofwat on the tools set out in this report and the fresh perspectives they provide for the PR24 cost of equity.

[12] CPIH-deflated terms. We have considered three different specifications which are discussed in this report.

1 Introduction

32 Frontier Economics has been commissioned by a group of water companies to explore the relationship between capital market conditions and allowed equity return at the PR24. This report supports Yorkshire Water for its submission to Ofwat on additional considerations for the cost of equity in PR24. The work presented in this report was initially developed in response to Ofgem's Sector Specific Methodology Consultation (SSMC) for the RIIO-3 process. The analysis was therefore developed through late 2023 and early 2024. However, there are common challenges across sectors which mean the outputs are relevant for water networks as well as energy networks. We have therefore set out the implications from that work for Ofwat at the earliest opportunity following its completion.

33 At a time when the water sector is going to require substantial investment, it is critical that equity capital can be attracted, at competitive costs, to the level required. Capital raised and invested during the next five year period is key for ensuring companies can deliver their long term strategies.

34 The specific challenge this report considers is how the allowed equity return should adapt to capital market conditions which have changed substantially since PR19. As the price control process has progressed it has become clear that conditions markedly different to PR19 are likely to persist into the next price control period. The need to carefully consider this issue has therefore grown.

35 In this report we provide two new perspectives on the relationship between capital markets and the cost of equity. In other words, these are perspectives, which, to our knowledge, have not been explored in the price review to date. These are:

- A new cross-check on the cost of equity based on hybrid bonds; and
- A TMR Glider – which provides an assessment of what market evidence tells us about the appropriate level of TMR.

36 The tools developed in this report demonstrate the need for CAPM inputs applied during the era of low interest rates and required returns to be revised significantly. We are not arguing that CAPM should be disregarded or that an entirely new methodology should be used to set the allowance. Rather we recommend Ofwat to take into account these relevant factors while exercising its regulatory judgement. We invite Ofwat to engage with the findings of this report and consider them when setting the allowed equity return for PR24.

37 The remainder of this report provides a full exposition of the points made in the Executive Summary, and is structured as follows:

- In Section 2 we set out the capital market and sector-specific context and the need for additional considerations when setting the PR24 cost of equity.

- In Section 3 we set out the hybrid bond cross-check on the cost of equity we have developed.
- In Section 4 we set out the history of TMR allowances and market conditions.
- In Section 5 we set out the TMR Glider we have developed.
- Section 6 concludes with the overall implications for the PR24 cost of equity.
- The annexes provide the further detail, to aid review of our work.

2 Context and the need for additional considerations when setting the PR24 cost of equity

38 In this section we:

- Outline the changes in market conditions that have occurred. We show that these have been significant, and that the deeply negative interest rate environment has come to an abrupt end.
- Outline sector-specific PR24 context on the scale of investment and financing.
- Conclude the section by setting out the implications for the PR24 cost of equity if market conditions are not adequately reflected.

2.1 Macroeconomic context

2.1.1 Interest rate expectations at PR19

39 The final determination for PR19 was published in December 2019. At the time, there had been a prolonged period of extremely accommodative monetary policy since the Global Financial Crisis (GFC). This low interest rate period was projected to continue. This is illustrated in Table 1 below, which sets out the market projected path for the Bank of England base rate at the time.

40 As shown in the table, the market anticipated the base rate remaining at 0.5% for the foreseeable future. There was no indication that upward interest rates pressure would be a feature of the next regulatory cycle.

Table 1 Base rate market expectations from November 2019

Month	Dec 2019	Dec 2020	Dec 2021	Dec 2022
Base rate	0.7%	0.5%	0.5%	0.5%

Source: Bank of England, November 2019 Monetary Policy Report
Note: Base rate projection rounded to 1dp

41 This view of the macroeconomy was consistent with the earlier view of Ofwat at the time the PR19 methodology was being developed. Ofwat stated that:

> 42 *"The latest medium-term forecasts for the UK economy support the view that prospects for future growth will remain weak, decreasing the*

> *probability that interest rates and returns will normalise to the higher rates seen in the last few decades."*[13]

43 Ofwat's decisions on the cost of equity were taken with the macroeconomic backdrop in mind. And it is clear that this supported their thinking when making allowances. Ofwat stated that:

> 44 *"low interest rates will be accompanied by low equity returns in coming years."*[14]

45 As such, at the time of the PR19 decision, there was no expectation of any imminent departure from the era of very low interest rates. Even at the time of the CMA's PR19 final determination, for those companies that appealed, the was a continued expectation that low interest rates would persist years ahead.[15]

2.1.2 The abrupt end of the era of low interest rates

46 The interest rate environment at PR24 is now fundamentally different. It is clear that the monetary policy environment has abruptly changed, in response to major global shocks that have affected both real and financial markets. The base rate rose sharply from 0.25% at the start of 2022 to 5.25% today (see Figure 1). There is no indication of a near-term return to the period of extremely accommodative monetary policy.[16]

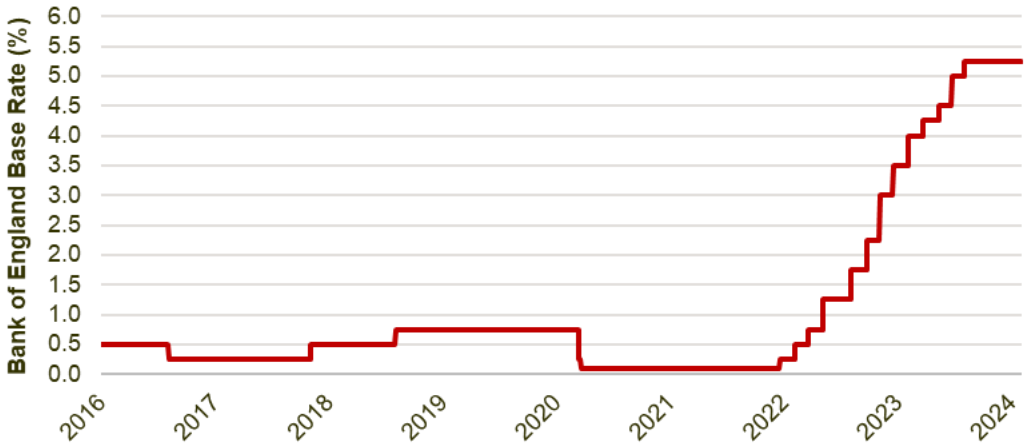
13 Ofwat (2017), "Delivering Water 2020: Our methodology for the 2019 price review; Appendix 12: Aligning risk and return; section 5.4.

14 Ofwat (2017), "Delivering Water 2020: Our methodology for the 2019 price review; Appendix 12: Aligning risk and return; section 5.4.

15 See, for example, Table 1.A and Chart 2.6 in the BoE Monetary Policy Report February 2021.

16 See, for example, Table 1.A and Chart 2.6 in the BoE Monetary Policy Report February 2024.

Figure 1 Bank of England base rate



Source: Bank of England

47 Since PR19, long-term gilt yields have also moved upwards by around 3.5 percentage points – a substantial increase over a relatively short period of time.

48 Together, this shows that PR24 decisions cannot be made with the same mindset as PR19, as the market outlook has fundamentally changed. However, we note that Ofwat's early view resulted in a lower allowed equity return for PR24 than for PR19. It is clear to us that there is a need to re-assess what Ofwat considered to be appropriate at its PR24 FM.

2.2 Investment and financing challenges going into PR24

49 Alongside the macro-economic situation described above, the water sector is heading into the PR24 price control facing a substantial increase in its investment programme. The water company business plans for the period 2025 to 2030, submitted in October 2023, implied spending requirements of £96 billion on delivering water and wastewater services. This represents a 63% increase, in real terms, on the expenditure allowed by Ofwat in the current five year period.

50 More specifically, that expenditure total includes £41 billion on enhancement schemes, compared to £11 billion allowed by Ofwat for 2020 to 2025. This represents a 271% increase. It includes £11 billion to upgrade the wastewater system to reduce sewage spills and the construction of up to ten new reservoirs to improve water supply resilience in the face of climate change.[17]

51 The scale of the investment programme implies the need for significant new financing over the period 2025 to 2030. This will consist of both new equity and

[17] Source: Water UK; https://www.water.org.uk/investing-future/pr24

new debt finance. Most of the companies in the sector propose some level of equity injection during the PR24 period. In addition, all companies propose a level of dividend yield that is materially below the long-term level implied by the cost of equity, providing a further source of equity injection into the companies.

52 Ofwat is in the process of assessing these business plan proposals and will publish its determinations later this year. Nevertheless, given the underlying drivers for investment in the sector it is inevitable that the final determination will include a significant increase in investment, with the associated implications for new financing.

2.3 Implications for setting an appropriate allowed equity return at PR24

53 The water sector needs to undergo a period of significant transformation to meet environmental and resilience goals.

54 The success of meeting these challenges will depend crucially on maintaining efficient ongoing access to capital markets, to raise and retain funding at efficient cost from both debt and equity investors. Without the ability to raise and retain capital in this way, it will not be possible to deliver the large scale investment needed.

55 What is also clear is that investments made in the next five-year period[18] are an essential part of long-term (25-year) delivery strategies to meet the challenges the sector faces. Ofwat recognises this saying that, "*Funding will support efficient enhancement investment, both in the short and long term.*"[19] This means that the next five years are far from "business as usual" for the sector, as companies strive to transform the value chain and improve outcomes, facilitated by a step-change in investment.

56 Investors therefore have a key role to play – both in the next five-years and beyond. Significant sums of capital are required to make the investments set out in long-term plans a reality. However, capital cannot be transformed into assets if the sector cannot attract that capital in the first place. An open approach to engagement has the potential to buttress investor confidence, by making it clear what investors can expect.

57 In the PR24 methodology Ofwat has signalled that they expected the balance of financing to change relative to past regulatory cycles. Its view is that a 55% level of gearing is appropriate for a notional company, a reduction from 60% at PR19.

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18 The next five-year period running from April 2025 to March 2030 is often referred to as "AMP8" (Asset Management Period 8).

19 Ofwat (2022), "Our final methodology for PR24: foreword and executive summary", pg.7.

This demonstrates greater scope Ofwat sees for equity in the sector going forward, and therefore emphasises the importance of setting an appropriate allowed return on equity to ensure that the required financing is forthcoming.

58 It is the allowed return on equity – and the impact of changing capital market conditions on that allowance – that we focus on in this report. Given the role of equity in financing the sector's investments, we believe that the hybrid bond cross-check to the cost of equity set out in Section 3 requires careful consideration. By considering all available evidence, including this cross-check, there is a greater likelihood of striking an appropriate balance between customers and investors.

3 Hybrid bond cross-check

59 This part of the report outlines the details of our hybrid bond cross-check methodology. It covers:

- The context – explaining the rationale for hybrid debt as a cross-check;
- The methodology we have used to estimate the cost of equity cross-check;
- Results of the cost of equity cross-check; and
- How we have ensured the findings are applicable to the water sector.

60 In Annex A we provide further details on sensitivity tests on the key assumptions, and additional robustness tests supporting the methodology.

3.1 Context

61 The risk and return principles in corporate finance requires that the expected return on equity lies sufficiently far above the long-term return on senior investment-grade debt of the same entity. This condition derives from their relative risk profile. Senior debt implies lower risk and better recovery prospects. It is paid first and it is paid a contractually stipulated sum. In contrast, holders of equity are paid last, and act as residual claimants on the business with no guarantee they receive anything, particularly in times of financial distress. Because of this difference in risk, it would be irrational for investors to opt for equity if expected returns were similar to or below the expected returns on senior debt.

62 Therefore, the relevant question is how much higher should equity returns be, relative to debt. Given the large gap in relative risk between senior conventional debt and equity, the unadjusted yield on senior debt would only provide a limited cross-check on equity returns, i.e. a test that we would typically expect to be easily passed (although Ofwat's early view can be considered to not even pass this test in places).[20]

63 To provide stronger, more suitable cross-check we have considered securities that are somewhat debt like, but more similar to equity, for which yield information is available. Specifically, we focus on hybrid bonds to infer required equity returns.

64 Hybrid bonds, as the name suggests, are securities that combine debt and equity characteristics. For example, hybrid bonds can be of very long tenor – covering multiple decades, making them more similar to the perpetual nature of equity.

[20] Ofwat's early view of the allowed return on equity is 3.67% - 4.60%, with a central estimate of 4.14%, all figures in CPIH-real. Using a CPIH assumption of 2%, this translates approximately to 5.74% - 6.69% nominal, with a central estimate of 6.22%. At the end of February 2024, the iBoxx £ Non-Financial BBB 10Y+ recorded a nominal yield of 5.86%. If this was the relevant benchmark, the low end of Ofwat's early view on the allowed return of equity fails this check of relative risk and return between debt and equity.

These securities can also have debt-like qualities, including periodic coupon payments. But, importantly, in certain circumstances there can be a higher degree of flexibility over when these are paid.[21] Hybrid bonds also sit between senior debt and ordinary shares in a company structure, being eligible for payments prior to equity-holders, but after senior debt-holders.

65 Since the yield on these hybrid bonds is directly observable, with an appropriate assumption on the proportion of equity-like feature of the hybrid bond, an expected return on equity can be implied from a relatively simple formula. If the allowed equity return is set below the level implied by of the yields of hybrid bonds, then a rational investor would not invest in equity capital.

3.2 Hybrid debt

66 Our work is focused on hybrid bonds issued by GB utilities. The table below provides an overview of the available securities. They are issued by NGG Finance Plc, a financing subsidiary of National Grid Plc, and by SSE Plc. We have not identified any hybrid bonds issued by water companies which are currently outstanding. However, we review in detail the applicability of analysis based on hybrid bonds issued by these other GB Utilities in Section 3.5.

Table 2 Hybrid bonds for GB utilities

Issuer	Issue date	Maturity date	Amount
NGG Finance Plc	Mar 2013	Jun 2073	£1,000m
NGG Finance Plc	Sep 2019	Dec 2079	€500m
NGG Finance Plc	Sep 2019	Sep 2082	€750m
SSE Plc	July 2020	Perpetual	£600m
SSE Plc	July 2020	Perpetual	€500m
SSE Plc	April 2022	Perpetual	€1,000m

Source: Fitch, Bloomberg
Note: Our analysis excludes SSE bonds that have been superseded by more recent hybrid bonds

67 These hybrid bonds present the following characteristics:

- Subordination: Hybrid debt-holders receive payment after senior debt-holders but before ordinary shareholders;
- Extended tenors: All bonds have a maturity of more than 60 years at issuance;

[21] Coupons payments can sometimes be deferred. This flexibility over payments is closer to the nature of dividend payments on equity.

- Deferrable coupons: The coupons attached to these bonds are deferrable;
- Call dates: Periodic call dates are incorporated into the structure of all bonds, with the specifics varying by security;
- 50% equity attributes: Rating agencies designate these hybrid bonds as 50% equity-like and 50% debt-like from an analytical standpoint;[22] and
- All the bonds listed above were issued during the period when the RIIO framework (which has similarities to the model adopt by Ofwat since PR14) was operational and are currently traded.

3.3 Inferring the right level of equity returns from hybrid debt

68 We use the hybrid bond data to estimate the implied cost of equity. Assuming the allocation of securities between debt and equity stands at 50%, the spread between the expected return on hybrid bonds and conventional senior debt would fall at the midpoint between equity and senior debt costs. This approach enables us to sense check the allowed cost of equity.

3.4 Methodology and results based on available traded hybrid debt

69 This section summarises the methodology that estimates the hybrid bond cross-check, including the selection of bonds, and the approach to computing the cost of equity in nominal and real terms.

70 Our method for deducing equity returns from hybrid bonds involves the following steps:

- We estimate the spread between expected returns of hybrid bonds and senior debt;
- Assuming 50% equity-like characteristics in hybrid bonds, we calculate additional returns from equity attributes; and
- We calculate the cost of equity by adding senior debt returns to the extra returns from equity attributes.[23]

3.4.1 Selection of hybrid bonds

71 Our approach to selecting hybrid bonds is guided by two key considerations.

- **We focus on the yield to next call date at issuance.**

22 The details of analytical treatment can vary between agencies.

23 The spread between debt and hybrids is assumed to reflect the 50% equity-like characteristics of hybrid bonds. Hence, the extra returns of 100% equity compared to debt can be inferred as twice this spread, i.e. Equity returns = Debt yield + 2 x Spread hybrid to debt.

- A call date refers to the date when the issuer can repay the bond for a predetermined call price before its maturity.[24] Hybrid bonds can have multiple call dates. The issuer's decision to exercise the call is influenced by market conditions. For instance, in periods of declining interest rates, the issuer may choose to call the bond to avoid paying interest above the prevailing rate.
- The 'yield to next call date' refers to the estimated annualised rate of return if the hybrid bond is called by the issuer on its next available call date. This can differ from the 'yield to maturity', which provides an estimate over a more extended period. Since call options can imply that the yield of hybrid bonds behaves more like shorter-tenor debt as capital market conditions change, the yield-to-maturity of these bonds may not provide useful insights. Therefore, we look at the yield-to-next-call at the issue date in our cross-check analysis.

- **We prioritise hybrid bonds issued by GB utilities.** We select hybrid bonds secured by GB utilities to ensure we reflect regulatory and operational risk of regulated networks. As a result, the returns from these bonds will accurately mirror the unique risks associated with companies of a similar nature. In Section 3.5 we also discuss how we have ensured the results from the cross-check are applicable to water networks in particular.

72 Table 3 provides a list of hybrid bonds issued by GB utilities, with the tenor to next call date at issue.

[24] At a par or at a premium, depending on the terms stipulated at issuance.

Table 3 List of hybrid bonds for GB utilities

Issuer name	Issue date	Maturity date	Next call date	Tenor (years to call at issue date)
NGG Finance Plc	Mar 2013	Jun 2073	18/06/2025	12.3
NGG Finance Plc	Sep 2019	Dec 2079	05/09/2024	5.0
NGG Finance Plc	Sep 2019	Sep 2082	05/06/2027	7.8
SSE Plc	July 2020	Perpetual	16/04/2026	5.8
SSE Plc	July 2020	Perpetual	14/07/2026	6.8
SSE Plc	Apr 2022	Perpetual	21/01/2028	5.8

Source: National Grid, SSE, Bloomberg
Note: The next call dates listed are all first call dates

73 Among the options, we examine the evidence from the **NGG Finance Plc June 2073 hybrid** (NGG 2073 hybrid). This choice is driven by its longest years to call at issue date, extending beyond a decade (see Table 3).[25] This date maximises the remaining tenor and thereby allows us to measure long-term return expectations. Selecting a security denominated in sterling further avoids currency exchange complications.[26]

74 We place less emphasis on the SSE Plc bonds as SSE has a greater share of activities outside of regulated networks (for example, generation activity), however we do sense check our results against SSE securities in Annex A.2. We find similar, logically ordered outcomes

3.4.2 Measuring the spread of expected returns relative to senior debt

75 We assess the hybrid bond yield spread against a well-known market cost of debt benchmark, the iBoxx £ Utilities index. Specifically, we compare against average of the iBoxx £ 10-15Y Utilities index, which provides a comparable tenor to the NGG 2073 hybrid at issuance.[27] **By comparing the yield of the hybrid bond (5.65%) to that of the iBoxx benchmark (4.14%) as of 18 March 2013, we estimate a spread equal to 151bps at issue**.

25 The liquidity of this bond is also comparable with other conventional corporate bonds as measured by bid-ask spread, and we also find that yield data for this bond changes on a daily basis.

26 At the time of writing this report, we did not find any traded hybrid bonds issued by regulated water networks in England and Wales but have used information specific to water companies in Section 3.5 to ensure applicability.

27 Ofwat (2022) PR24 Final Methodology, Appendix 11, page 58. The NGG 2073 hybrid has a tenor of 12.3 years to the first call at issue, which is broadly consistent with an average tenor of the selected iBoxx index.

76 This spread could be applied to the current long-term iBoxx value, providing an estimate for the yield on a long-tenor hybrid bond in current market conditions. However, when determining the spread that will be applied to the present iBoxx, we consider the relatively higher risk profile of hybrid debt. Hence, we estimate the 'expected return' on the hybrid bond, factoring in the potential for the bond to not deliver the promised cash flows, that is, the default risk.[28] By estimating expected return on the bond, the outputs are more consistent with the expected cost of equity that the spread will imply.[29]

77 We follow the methodology outlined in the UKRN cost of equity study (2018)[30] to estimate the expected returns. This approach uses historical default rate data by credit rating bands and incorporates recovery rate assumptions to determine a downward adjustment to the yield figure.[31]

78 Table 4 displays the results. The spread between the expected return on the NGG 2073 hybrid (5.50%) and the corresponding iBoxx indices at the time of issue (4.14%) is estimated at 136bps.[32] This figure is estimated using expected returns to avoid capturing the default risk premium in the yield.

Table 4 Spread of selected hybrid bond relative to benchmark

Hybrid bond	Yield to next call at issue date	Expected return	Selected index	iBoxx yield at issue date	Yield spread at issue date	Expected return spread at issue date
	(1)	(2)		(3)	(1 - 3)	(2 - 3)
NGG Finance Plc, 2073	5.65%	5.50%	iBoxx £ Utilities 10-15Y	4.14%	1.51%	**1.36%**

Source: Bloomberg, Frontier calculations
Note: The expected return adjustment is based on the 2018 UKRN cost of equity study

79 Our estimate uses the spread at issue, effectively assuming that the spread has remained relatively stable since the bond's issuance. While the spread will have fluctuated since issuance, not least to reflect different levels of business risks at

28 We do not adjust the iBoxx Utilities index since it holds an investment-grade status, indicating a lower default risk and potentially higher recovery rates for constituents. This makes our estimate more conservative as the gap between expected return and yield is narrower than it would have been had we carried out a similar adjustment on the senior debt.

29 The CMA recently highlighted the importance of this adjustment in the Heathrow appeal, FD 6.262 page 212.

30 UKRN (2018), 'Estimating the cost of capital for implementation of price controls by UK regulators', Appendix H.

31 We assume a recovery rate of 80% for the purposes of this adjustment. Our sensitivity analysis shows this spread changes by approximately 10bps for every 10 percentage point change in the recovery rate.

32 A risk of default for an 80% recovery rate and credit rating of BBB- results in a downward of 15bps.

any given time, we cannot accurately disentangle that effect from the general market credit spread conditions. Our approach has the advantage of avoiding the complexity of estimating a meaningful yield to maturity for a security as it approaches a potential call date. However, to ensure that this assumption does not drive the result, we conduct sensitivity analysis looking at historic time-varying spread to construct a range of spreads (see Annex A1).

80 We also consider the spread of other hybrid bonds, using the same methodology set out in Table 4 as a sensitivity. As we discussed earlier, we focus our analysis on the NGG June 2073 bond, as our assessment reveals that it has more favourable characteristics over the available alternatives. However, to ensure the robustness of our analysis, we repeat the calculations in Table 4 on the remaining bonds set out in Table 3.[33]

81 This analysis reveals an average expected return spread of 1.30% for the other National Grid bonds, with a range of 1.08% to 1.53%. Our main results in Table 4 lie towards the centre of this range – suggesting the result is robust to the selection of other bonds. For SSE bonds, the equivalent average spread is 1.93%. We place less weight on this figure given SSE's involvement in other activities such as generation. However, the spread being greater than National Grid equivalent is logical given SSE's significant ownership of non-regulated businesses e.g. generation. This is also in consistent with SSE having a higher beta than National Grid.

3.4.3 Estimating the implied cost of equity

82 Hybrid bonds exhibit characteristics that fall between traditional equity and debt securities, making them a hybrid financial product. Rating agencies typically assign these securities a 50% weight to both equity and debt attributes. To estimate the equivalent returns on equity, we evaluate the spread considering that it is influenced by the equity attributes of the hybrid bonds.

83 In essence, our goal is to calculate the cost of equity by determining the additional returns associated with the percentage of equity-like features in hybrid bonds. The greater the resemblance to equity, the smaller the difference between hybrid and equity returns. This is set out in the following formula:

$$Cost\ of\ equity_t = avg(iBoxx\ Utilities\ yield)_t + \frac{Hybrid\ bond\ spread\ to\ iBoxx}{\%\ equity\ like}$$

84 Where:

[33] Note that we matched the benchmark iBoxx index to the currency and tenor of the hybrid security in question. Full details are set out in Appendix A.2.

- The 'iBoxx Utilities yield' represents the average yield of the iBoxx £ Utilities 10Y+ index over the last recent year;
- The 'hybrid bond spread to iBoxx' remains constant at 136bps, aligning with the expected returns on the hybrid bond at the time of issuance relative to the iBoxx £ indices' yields on the issue date; and
- The '% equity-like' stands for the percentage of equity-like characteristics, assumed at 50%. We set out our sensitivity analysis on this assumption in Annex A1.

85 We estimate the expected long-term returns on senior debt by taking the average of the iBoxx Utilities 10Y+ indices over the last recent year.[34] We take the yields from the latest calendar year, facilitating comparability and replicability of our analysis, and average them to obtain a robust estimate. We note this is different from Ofwat's approach of using one-month average for estimating the cost of new debt. A year timeframe allows us to reflect the near-term future outlook and minimise the impact of short-term fluctuations in debt market rates. We conduct sensitivity tests to assess the reliability of this estimate, establishing a reasonable range for potential iBoxx values (see Annex A1).

3.4.4 Results of the hybrid bond cross-check

86 This section outlines the results of the cross-check using hybrid debt according to the methodology set out in the previous subsections.

87 The table below summarises the outputs for the long-term cost of equity estimate. Our point estimate of the expected returns on equity implied from hybrid debt evidence lies at 8.8% in nominal terms (6.6% in real CPIH terms).

Table 5 Results of the cost of equity cross-check

Value	Estimate
Hybrid bond spread (adjusted for default risk, at issue)	+136bps
iBoxx £ Utilities10Y+ (1Y average)	6.04%
Higher returns on equity (based on 50% equity-like)	+272bps
Nominal cost of equity	**8.76%**
Real cost of equity (CPIH deflated)	**6.63%**

Source: Frontier calculations

Note: Analysis as of 29 February 2024. We consider a 2% inflation assumption to derive CPIH-real cost of equity.

[34] As of 29 February 2024.

88 To provide further comfort around these results, we have undertaken a set of sensitivity tests on the key assumptions of the analysis, summarised below. The details of these sensitivity checks are included in Annex A1.

89 Although the details are not discussed here, the results from those checks are shown in Table 6. As shown, the sensitivities are used to derive a range around the central CPIH real cost of equity of 6.6%. Overall, this results in a low end of the range from the cross-check of 5.8%, and a high end of the range from the cross-check of 8.4%. We note that our point estimate is closer to the lower end than the upper end – this simply reflects the non-symmetric outputs from the sensitivity analysis.[35]

90 Our range reflects plausible high and low scenarios of hybrid spread, equity-like proportions and iBoxx yields, although the lower and higher bounds of our range do not represent the lowest and highest outcome of all of the scenarios compounded, which would have produced implausibly low and high values. Instead, they represent average lower and higher bounds of these scenarios.

Table 6 Summary of sensitivity checks on key assumptions

Summary results	Low	High
Sensitivity on historical hybrid-iBoxx spread	7.8%	10.1%
Sensitivity on the percentage of equity-like	7.9%	11.5%
Sensitivity on iBoxx averaging	8.2%	10.1%
Nominal cost of equity	7.9%	10.6%
Real cost of equity (CPIH deflated)	**5.8%**	**8.4%**
Real cost of equity (CPIH deflated) – point estimate		**6.6%**

Source: *Frontier calculations*

Note: *Results for the cost of equity are obtained by averaging the low and high values of each sensitivity respectively. We consider a 2% inflation assumption to derive CPIH-real cost of equity.*

91 As shown in the table above, we conducted three sensitivity tests on our results

(a) ***Sensitivity on the historical hybrid-iBoxx spread***.

(i) An assumption in our analysis is that the hybrid spread to iBoxx has remained constant over time. We have adopted this approach as spread figure is associated with a long-term hybrid bond yield at issue – making

35 For example, on equity likeness, dividing a constant spread value by different percentage equity-like leads to this results.

it an appropriate observation to use when checking long-term equity returns. It also aids simplicity.

(ii) Nevertheless, we test the sensitivity of our analysis in response to the hybrid spread volatility over time by constructing a range around the 10th and 90th percentile.[36] We obtain a spread between 86bps and 201bps, resulting in nominal equity returns between 7.8% and 10.1%. Applying the CPIH assumption of 2.0% produces a CPIH deflated range of 5.6% to 7.9%. Our main analysis output lies towards the centre of this sensitivity range.

(b) ***Sensitivity on the percentage of equity-like***.

(i) In our main analysis, we have taken the assumption that hybrid bonds stand at the midpoint between debt and equity, specifically, we assume 50% equity-likeness from an analytical perspective. However, we test sensitivities ranging from 75% to 25%.

(ii) This sensitivity tests produces a range of 7.9% to 11.5% (equivalent to 5.7% to 9.3% in real terms). Although the lower end of this range aligns closely with the prior sensitivity, the upper limit exhibits a significant increase in magnitude. This is not surprising since in the upper case a larger multiplier is applied to the hybrid spread to imply the equity premium.

(c) ***Sensitivity on iBoxx averaging***.

(i) In estimating the cost of equity cross-checks from hybrid debt, we considered the average value of the iBoxx £ Utilities 10Y+ during the latest year.[37] This average window, in our view, captures the outlook for debt market in the near future reasonably well whilst smoothing out short-term volatilities on market rates.

(ii) However, we have conducted sensitivity scenarios on the iBoxx yield, and assessed how different dates and 'milestones' in the hybrid bond's trading history could influence the final value.

(iii) When we average across these periods, we find that the iBoxx values range from 5.4% to 7.4%. Consequently, the nominal cost of equity falls between 8.2% to 10.1%, which translates to 6.0% to 8.0% in real terms cost of equity. This aligns with the sensitivities observed in the previous sections.

36 Using traded yield data whereas the main outputs are based on yield at issue data.

37 As of 29 February 2024.

92 In conclusion, our results are a point estimate for the implied cost of equity for 6.6% CPIH-real, within a range of 5.8% - 8.4% CPIH-real.[38]

3.5 Ensuring the findings are applicable to the water sector

93 The results presented above are derived from the NGG bond explained above. However, they are not sourced from water companies in England and Wales. In this section we demonstrate that the results are applicable to the water sector, and therefore can be applied in the context of the PR24 cost of equity. We ensure this in two ways:

- By comparing the characteristics of the networks being considered – both qualitatively and quantitatively; and
- By assessing information on quoted spreads for newly issued water sector hybrid bonds.

94 We discuss each in turn below.

3.5.1 Comparing the characteristics of the networks being considered

95 As set out in Section 3.4, the central result for the cross-check is based on a hybrid bond issued by National Grid. One way to explore relevance for the water sector is to qualitatively compare water companies to National Grid. We consider that, in the context of the hybrid bond analysis, there are several similarities between National Grid and water companies which mean the results are relevant for the water sector cost of equity, these are:

- **Long-lived network assets** – both types of company manage a large network of assets that provide an essential service. A key characteristic of those networks in both cases is long-lived assets.
- **RCV based regulatory models** – both types of network are regulated through a RCV (or RAV to use Ofgem's terminology) model. Both earn a return on capital linked to the RCV value, and have a component of revenue linked to the depreciation of that RCV value.
- **Revenue model** – both types of network operate under a regulator model of allowed revenues, which involve an assessment of efficient costs (totex) and a system of rewards and penalties linked to outcomes.
- **Use of water company data by Ofgem** – when assessing the cost of equity, Ofgem directly considers evidence on the beta of listed water companies (Severn Trent, Pennon and United Utilities) alongside that of National Grid.

[38] As noted above, our point estimate is closer to the lower end than the upper end – this simply reflects the non-symmetric outputs from the sensitivity analysis

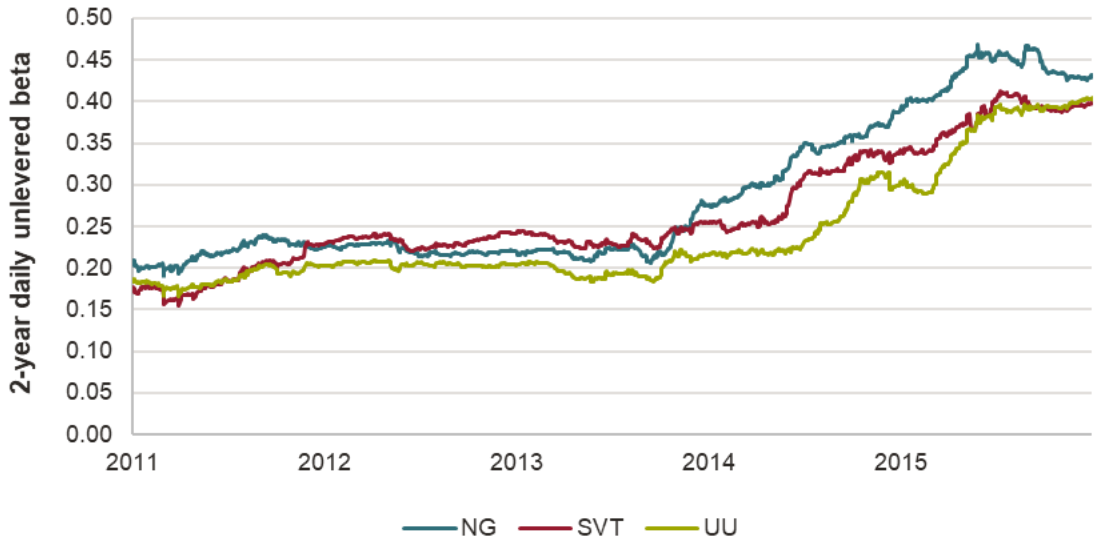
Therefore, Ofgem considers these data points to have sufficient similarity to the networks they regulate to inform its cost of equity allowance.

96 Given these shared characteristics, we consider the results from the cross-check can be utilised in the context of PR24, but have also considered other quantitative data points too.

97 The quantitative data points we consider are focused on how comparable the National Grid was to water companies at the time the NGG 2073 hybrid bond was issued (March 2013). Specifically, by focusing on unlevered beta and gearing estimates from the time, we can ensure there is no large differences in relative risk not being accounted for.

98 Firstly, comparing unlevered beta estimates at the time, we find that there are no large differences. In fact, as shown in Figure 2 below, the unlevered betas for National Grid and two listed water companies were very similar to each other in 2013, with the outputs showed minimal dispersion, between 0.20 and 0.25 at that time.[39]

Figure 2 Beta comparison to water companies



Source: *Frontier analysis, Bloomberg*
Note: *Unlevered betas shown using 2-years of daily data*

99 Secondly, comparing gearing levels at the time, we find that the gearing level (measured by net debt to enterprise value) of National Grid was actually lower than the two water companies around 2013.[40] This suggests, given similarities in

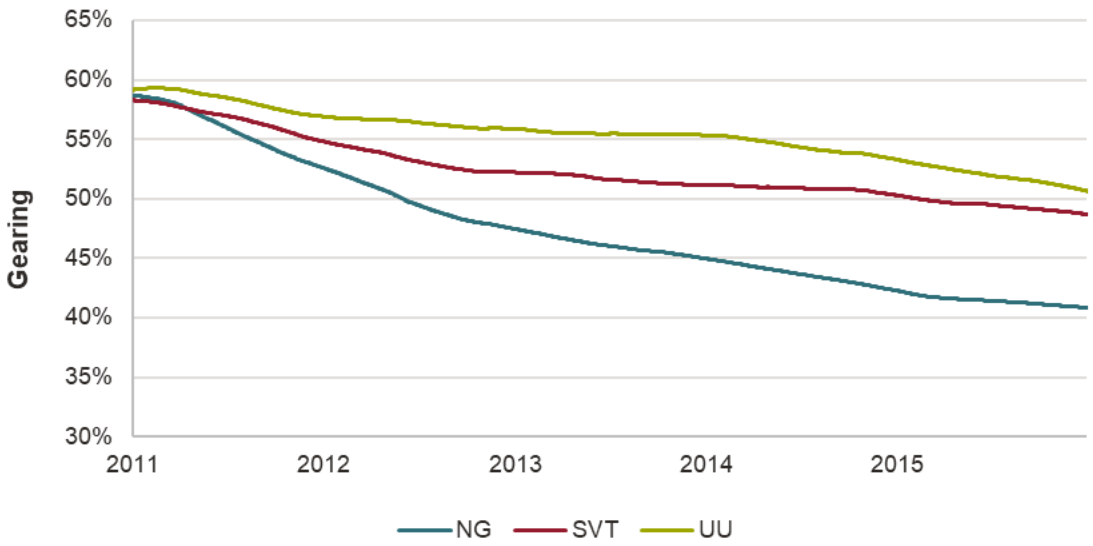
39 Given Pennon's previous holding of waste business assets we do not include this in this analysis.

40 We focus on Enterprise Value rather than RCV/RAV since this is more reflective of an investor's outlook.

unlevered beta, an equity beta for National Grid which happened to be lower than water companies at that particular moment in time. Arguably this implies that the inputs to the cross-check were reflecting risks lower than those present in water network at that time.

100 In addition, we note that around the time of issuance the enterprise value gearing level of National Grid was around 45%. This is significantly lower than Ofwat's PR24 methodology gearing level of 55%.[41]

Figure 3 Gearing comparison to water companies



Source: Frontier analysis, Bloomberg
Note: Enterprise value based gearing, averaged daily over a 2-year rolling period

101 We consider this evidence supports the use of the cross-check in a water sector context. And again, the points of comparison set out above may even suggest that the cross-check is calibrated in a relatively cautious manner.

3.5.2 Quoted spreads for potential water sector hybrid bonds

102 Even though there is currently no hybrid bond issued by water companies, we have considered relevant evidence from new issuance quotes recently provided by financial advisors on behalf of water companies which should reflect market conditions reasonably well. Specifically, Severn Trent have provided us with data on the spread of a new sterling denominated hybrid bond above their senior bonds. This data is from a hybrid bond issuance quote obtained from its investment bank in early 2024.

41 Measured on an RCV basis.

103 The information provided showed that the spread of the new hybrid issuance above senior bonds varied in a range of 155bps to 170bps. Hybrid bonds with a longer number of years to next call (e.g. around 10 years) were at the higher end of the range.[42]

104 Therefore, the higher end of this 155bps to 170bps range is arguably most comparable with the NGG 2073 hybrid bond used in Section 3.4, as this hybrid had around 12 years to the first call date when it was issued.

105 As set out earlier in this section, the spread of the NGG 2073 hybrid bond[43] above the iBoxx Utilities equivalent at issue was 151bps. It is this input to the cross-check methodology that the quote shared by Severn Trent should be compared to.[44] Therefore, we find that this quote for a water hybrid bond is of a very similar magnitude to the inputs used in the cross-check – with the NGG spread sitting just below the quoted new issue range.

106 We consider this is further evidence that the values we have used to estimate the hybrid bond cross-check are suitable in the PR24 context. Indeed, the evidence shows that our assumptions may actually on the cautious side relative to recent market conditions reflected in the quote, which extended to 170bps at longer tenors.

3.6 Conclusion on hybrid bond cross-check

107 Overall, we find the hybrid bond cross-check developed in this section can be applied reasonably well in the PR24 context.[45] It provides a direct reading of the capital market conditions, to which Ofwat should have regard if it were to set a price control package that can successfully attract and retain equity capital for PR24. Our analysis shows a range for the implied cost of equity of 5.8% - 8.4% CPIH-real. Within that range, our central estimate for the implied cost of equity is 6.6%. This compares with an 'early central view' allowed return on equity from the PR24 methodology of 4.14% – a figure which lies outside the cross-check range. This could be due to the CAPM parameters used by Ofwat in its early is to skewed to the downside given that they are mostly based on long-term historic averages

42 Our understanding is that this information relates to the hybrid bond being issued by the opco, and that there is an assumption that the hybrid bonds would receive 50% equity credit (noting that details of that treatment can differ between rating agencies).

43 Also sterling denominated.

44 There is a very minor difference in that the spread for the NGG hybrid was to the iBoxx Utilities, whereas the quote is to Severn Trent senior bonds. However, Severn Trent Water Limited has a credit rating of BBB+/Baa1, meaning any difference will be minor.

45 Some data suggests the cross-check outputs may be cautious.

and the capital markets are currently higher than those levels. We will see an example of this in the next part of this paper where we discuss the TMR.

108 This range has been developed through extensive sensitivity analysis and robustness checks, the details of which are set out in Annex A. Our view is that an allowed return on equity below this range may fail to adequately reflect the new capital market reality – and therefore would be associated with heightened equity financing risks.

4 The process of lowering TMR allowances

109 In helping to understand how regulators can and should adapt the allowed equity return to the current high interest rate environment, we explore how regulators have in the past adapted the allowed equity returns downwards as a response to the previously low interest rate environment. Among other things, the parameter that reflected this regulatory practice the most clearly is the TMR.

110 In this section, we outline how regulators responding proactively to the interest rate environment has been the norm for a considerable amount of time. Namely, we illustrate how the TMR input to the cost of equity has actively been lowered since the Global Financial Crisis (GFC) in response to very low interest rates.

4.1 The process that led to lower allowances for TMR

111 Looking back at past regulatory determinations up to the early 2010s, regulators generally followed established practice (at the time) for determining TMR. This involved placing almost all weight on long-run historical ex post equity market returns, with other approaches mentioned almost as an aside. At that time, historical equity market returns sourced from the Dimson, Marsh and Staunton (DMS) Credit Suisse Global Investment Returns Yearbook dataset supported estimates of TMR above 7% (adjusted for inflation).[46] This focus on a long history of evidence was aimed at promoting a stable framework for remunerating invested equity capital. Most regulators followed broadly this approach and the approach was well understood.

112 However, following the GFC, yields on ILGs started to fall as central banks changed policy to protect their economies, and they kept falling. Regulators in other geographies that adopt a fixed equity risk premium (ERP) model saw their cost of equity allowances decrease automatically as interest rates fell.[47] But in the UK, with its hitherto 'fixed' TMR model, there was no similar automatic lowering of TMR and/or cost of equity, just a second order effect on the cost of equity arising from the decrease of RFR.[48] Regulators needed to find other ways to lower TMR.

113 The consensus approach to TMR which had previously prevailed was therefore tested, arguably to the point where in the last round of price controls, it broke. As interest rates continued to fall regulators responded by placing greater weight on approaches that had previously played a much more limited role (or no role at all) in regulatory determinations. Historical ex post approaches to assessing market

46 It still does, although the inflation index DMS uses has evolved over time.

47 Many European regulators assume that the ERP is fixed, and then calculate TMR based on this fixed ERP plus a contemporaneous estimate of RFR based on a trailing average of government bond yields.

48 Where the equity beta is less than one.

returns were revisited, and reasons were found to develop lower measures. Averaging methods for ex post returns were also revisited, and regulators started to place less weight on measures that were high, and more on those that were low.

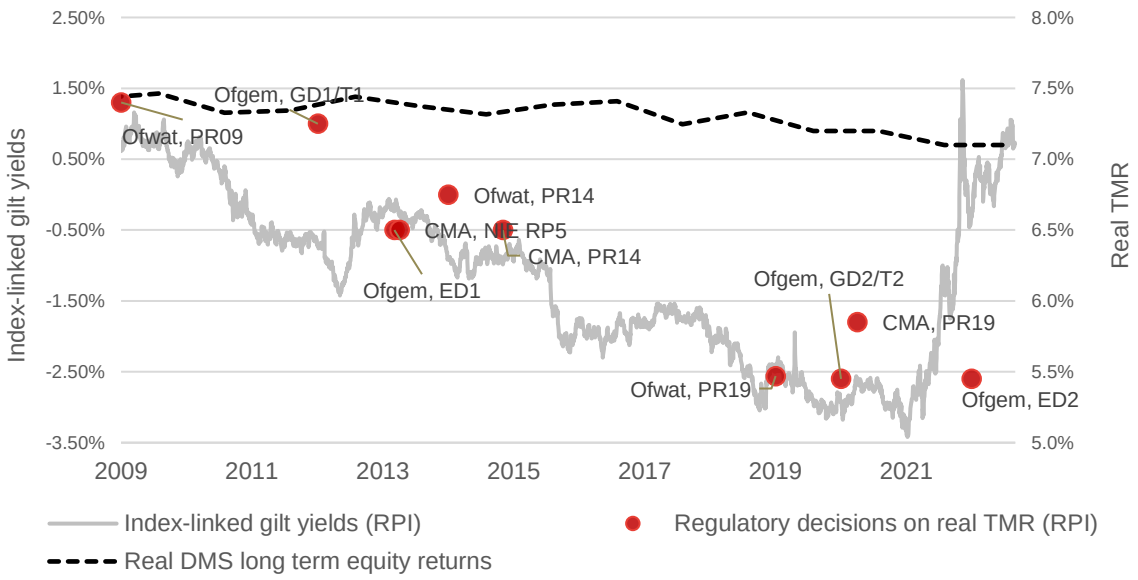
114 As part of this, fresh attention was paid to historical ex ante methods, for example by the CMA as part of its redetermination of PR19. These are expected to produce lower estimates of TMR than historical ex post methods, because they are based on subjective decompositions of historical returns, and a subjective assessment of which aspects of these decompositions are repeatable (and should be included in estimates of TMR) or likely to be one off (and should be excluded from estimates of TMR). By setting aside some proportion of achieved historical returns, it follows that a lower estimate of TMR will result.

115 The recent history of regulatory TMR decisions is illustrated alongside other key evidence in Figure 4 below.

- The dotted red line (right-hand scale) shows the underlying evidence on real long-term equity returns as published by DMS. The estimated long run level has fluctuated in a narrow range roughly between 7.1% and 7.3% (in real terms according to DMS's definition of inflation for the UK), i.e. it has barely changed.
- The grey line (left-hand scale) shows yields on 20-year government ILGs (an often used proxy for RFR), RPI-real.
- The red dots show regulatory decisions on the estimated TMR (also right-hand scale) in the same period, all converted to RPI-real terms for comparison purposes.[49]

[49] We note that some of the TMR decisions were expressed in CPI or CPIH-real (PR19 Ofwat, PR19 CMA, GD2/T2 Ofgem, and ED2 Ofgem). Where this was the case, the UKRN expressed these in RPI-real terms using a RPI/CPI wedge of 1%. Please see: UKRN (2023) Cost of Capital – Annual Update Report, Table 7. Accessible here: https://ukrn.org.uk/app/uploads/2023/08/2023-UKRN-Annual-Cost-of-Capital-Report_080823_minor-editorial-corrections-1.pdf

Figure 4 Long run TMR as estimated by DMS, Regulatory decisions on TMR and yields on 20 year ILGs



Source: Bank of England, DMS, Frontier Economics, UKRN

116 It is clear from this chart that regulators have lowered their estimate of TMR over time in response to the fall in gilt yields. In fact, regulators were explicit that they lowered TMR *because* of their perception of wider market evidence, in particular the change in interest rates.

117 Below we delve further into the linkage between interest rates and TMR by stepping through the timeline described above in more depth.

4.2 Further detail on the links between interest rates and TMR

118 The process of lowering returns began with the Competition Commission's redetermination of NIE Networks RP5 price control (March 2014).[50] The CC lowered its prior standing assumption that TMR was 7% (RPI-real) to an allowance of 6.5% (RPI-real) for RP5. The CC could not have been clearer *why* it was lowering its expectation of TMR – no material changes have occurred to the long run evidence at the time of its decision compared to a similar decision on Bristol

50 Accessed here: https://assets.publishing.service.gov.uk/media/535a5768ed915d0fdb000003/NIE_Final_determination.pdf

Water[51] a few years back, but its assessment of prevailing wider market conditions had.

> *"A forward-looking expectation of a return on the market of 7 per cent does not appear credible to us, **given economic conditions** observed since the credit crunch in 2008 and lowered expectations of returns."*[52] [emphasis added]

119 Ofgem then followed suit. First, in response to the emerging findings of the CC in respect of NIE, Ofgem issued a stand-alone consultation to revisit how it would set the cost of equity for RIIO-ED1. This led to Ofgem following the CC down, for the same reason.

> *"We therefore consider that there are a number of factors pointing towards a lower cost of equity for DNOs, in large part **reflecting current market conditions** as analysed by the CC. Our analysis and advice highlight alternative **interpretations of current market conditions**, although they point our assessment of the cost of equity in the same downwards direction.*
>
> *As a result, we are changing our methodology **to give greater weight to the influence of current market conditions** in relation to the equity market return, specifically in relation to our assessment of its separate components."*[53] [emphasis added]

120 Around the same time as Ofgem's consultation on equity market returns, Ofwat released its 'risk and reward guidance' for its upcoming PR14 price control, within which Ofwat estimated a TMR range of 6.25% to 6.75% (RPI terms). This *was* a large reduction from the 7.4% TMR that featured in its PR09 decision. A key reason Ofwat selected this new range was that:

> *"monetary policy and investor appetite have **significantly reduced Government and corporate bond yields** and put downward pressure on returns across most asset classes"* [54] [emphasis added]

121 This reasoning continued through to RIIO-2, when Ofgem again lowered its estimate of TMR. Ofgem's new estimate was 6.5% but this was on a CPI-real basis – equivalent to approximately 5.5% on an RPI-real basis. Ofgem's decision was prompted by the recommendations of the controversial and much debated 2018 UKRN paper on cost of capital, but also resulted from Ofgem's assessment

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51 CC (2010). Bristol Water plc, Appendix N.

52 CC (2014), Northern Ireland Electricity Limited price determination, para. 13.146.

53 Ofgem (2014), Decision on our methodology for assessing the equity market return for the purpose of setting RIIO-ED1 price controls, p. 4.

54 Ofwat (2014), Setting price controls for 2015-20 – risk and reward guidance, p.14

of then-prevailing wider capital market conditions. For example, Ofgem relied on information from investment managers' forecasts at the time, and other forward-looking measures, to lower its TMR estimate.

> *"We note that each of these [investment managers] forecasts is significantly lower than the 8-9% nominal TMR range we derive from inflating the UKRN Study by forecast CPI. These are in line with lower forward-looking measures and further reinforce the recommendation to reduce the long-term TMR range."*[55]

122 Again, at a broadly similar time, Ofwat produced the final methodology for PR19. There was an extensive discussion of TMR and wider market conditions within the final methodology. Again, there was clear evidence of a link between equity returns and interest rates, with Ofwat saying:

> *"Our draft methodology proposals, together with supporting analysis by PwC, set out evidence from recent market data that* ***the extended period of low interest rates has reduced returns required by UK equity investors*** *to below long-run historical averages of realised returns."*[56] [emphasis added]

123 Going on to note that:

> *"PwC argued that, while some of these factors may unwind over time, any unwinding is likely to be gradual and that low long-term interest rates are likely to persist for the foreseeable future.* ***They are therefore relevant to our efforts to forecast Total Market Return*** *over the period 2020-25."*[57] [emphasis added]

124 Ultimately, this culminated with Ofwat concluding that:

> *"We consider that* ***reflecting recent market conditions in our point estimate of TMR is a continuation of past practice****, which we see as necessary to uphold our statutory duties for financing functions as well as customers. We interpret our financing duty as a duty to secure that an efficient company is able to finance its functions, in particular by securing reasonable returns on its capital. An approach to setting TMR which failed to reflect market evidence on likely financing costs would not effectively support this duty…*

55 Ofgem (2018), RIIO-2 Sector Specific Methodology Consultation: Finance Annex, para 3.78.

56 Ofwat (2017), "Delivering Water 2020: Our methodology for the 2019 price review; Appendix 12: Aligning risk and return; section 5.4.

57 Ofwat (2017), "Delivering Water 2020: Our methodology for the 2019 price review; Appendix 12: Aligning risk and return; section 5.4.

> *… Recent evidence that required equity returns have fallen below their long-term average, together with expectations of weak productivity growth and **subdued interest rate rises**, imply that relying too heavily on long term averages is likely to overstate actual TMR in 2020-25."*[58] [emphasis added]

125 As such, while the basis for the downward shift in TMR allowances has sometimes appeared subjective or opaque, it is evident that regulators have lowered TMR explicitly *because* of their assessment of wider market evidence, including in particular falls in interest rates and reductions in yields on ILGs.

4.3 What now?

126 As illustrated above, UK regulatory practice has over the past decade or more been, de facto, to move TMR down to reflect prevailing market conditions. As interest rates and yields on government bonds fell over much of the last decade, UK regulators responded by lowering their estimates of TMR used to determine the allowed cost of equity.

127 This movement was not one-for-one, i.e. they moved TMR by a proportion of the fall in yields on the government bonds. This "stable but not fixed" policy has been explicitly endorsed by the UKRN.[59]

> *"There is significant alignment amongst regulators in the overall approach to the TMR/ERP, namely that in recent determinations UK regulators assume greater stability in the TMR and therefore estimate it directly from historical equity returns data. In the interests of maintaining consistency across sectors and also across time, continuing with this approach remains preferable. This approach does not imply that regulators should simply pick the same fixed value for the TMR in each decision for all time, but that the TMR would be relatively less variable than the underlying RFR. This would support greater stability in the cost of equity allowances over time. This policy choice seems appropriate in the wider context of the aspiration for greater predictability and transparency in the regulators' methodologies for estimating the allowed rate of return, and one that is fair to investors and customers over time."*

128 Interest rates have now reversed. The very low, deeply negative real interest rates that caused regulators to lower their estimates of TMR over the last decade are no longer observed. On the contrary, interest rates are now materially positive. Available evidence points to materially positive rates persisting.

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58 Ofwat (2017), "Delivering Water 2020: Our methodology for the 2019 price review; Appendix 12: Aligning risk and return; section 5.4.

59 UKRN (2023), UKRN guidance for regulators on the methodology for setting the cost of capital, p. 19.

129 By the same logic that caused estimates of TMR to fall, it is now time for regulators to increase TMR. Section 5 explores how the regulatory TMR should adapt to current market conditions, and proposes a solution.

130 To develop a solution we have explored what the academic literature tells us about the relationship between forward looking estimates of TMR and the yields on index-linked gilts (ILGs). We then follow this literature to develop our own model of the relationship, finding that this can be used to calibrate a 'TMR Glider' i.e. an assessment of what market evidence tells us about the appropriate level of TMR implied by market movements in gilts (used to proxy the RFR).

131 Our view is that TMR not responding to these steep increases in interest rates runs the risk that investors might conclude that 'stable but not fixed' applies only when interest rates are falling, but not when they are rising. This could be detrimental to investor confidence.

5 The relationship between TMR and RFR

132 In this section we step through the TMR Glider we have developed, setting out our estimation and checks against past regulatory decisions. Supporting analytical details can be found in Annex B.

5.1 Developing a TMR Glider

5.1.1 Overview

133 Below we set out the steps we have followed to develop our TMR Glider at a high level. The full detail underlying our methodology is set out in the TMR Glider Annex.

134 Our process can be summarised as follows.

- **Step 1, understanding the relationship between TMR and gilt yields**: we have explored the evidence on the relationship between TMR and interest rates. Our review of the academic literature has shown evidence of this relationship, although we note that different studies report different levels of responsiveness. This is inevitable as studies cover different markets and time periods do not all rely on the same measures of interest rates. Given this, we do not propose to simply adopt the academic literature directly to develop a TMR Glider which is relevant to Ofwat's regulatory context.

- **Step 2, developing a DDM model to estimate short run forward-looking TMR**: the literature we have reviewed suggests that the relevant relationship is between the measure of the RFR as proxied by the yield on safe government assets, and the forward-looking *required equity return*. This is also the relationship of interest for our purposes. We have followed the academic literature and have developed an equity cash flow Dividend Discount Model (DDM) to estimate required returns on a forward-looking basis. We note that this approach has also been adopted by the Bank of England.[60] Owing to data availability constraints, we produce results for the UK market for the period 2006-2023.

- **Step 3, estimating the relationship between DDM-derived TMR and 20-year gilt rates**: we identify the line of best fit between required TMR and yields on 20-year gilts commonly used to proxy the RFR. We have explored a range of potential specifications and time periods, and we have conducted sensitivity analyses to gauge whether and how to account for periods of high financial market volatility that may be outliers. Inevitably, our estimates of the

60 See for example: An improved model for understanding equity prices (2017), Will Dixon & Alex Ratten, Q2 2017 Bank of England Quarterly Bulletin https://www.bankofengland.co.uk/-/media/boe/files/quarterly-bulletin/2017/an-improved-model-for-understanding-equity-prices.pdf

relationship between TMR and nominal gilts is somewhat sensitive to these choices, but not unduly so, i.e. similar conclusions would emerge from all the specifications we have considered.[61]

135 More detail on each of these steps are set out in the following subsections. As a final step, we evaluate whether the relationship we have developed leads to a Glider that is capable of explaining past TMR decisions taken by regulators; this will be covered in Section 5.2.

5.1.2 Understanding the relationship between TMR and ILG yields as a proxy for RFR – the academic evidence

136 The academic literature reveals that there is evidence of a relationship between TMR and government bond yields, which are usually used in the regulatory context to set the RFR. However, we are not able to directly rely on the findings from the academic studies, given that they relate to different markets and time periods. We do not consider that it would be appropriate to rely on these models 'out of sample' to inform the cost of equity in the context of upcoming GB price controls.

137 Nevertheless, our review of the literature has shown that there is a fairly consistent approach to investigating the relationship between expected total market returns and RFRs. This involves first estimating the expected or required TMR via an equity cash flow model such as the dividend discount model.[62] The required TMR values derived from the DDM model can then be used to evaluate whether a relationship can be specified between the required equity market return and the prevailing RFR at the time. We have adopted this approach in our analysis.

138 Details on the academic evidence revealed is set out in Annex B1.

5.1.3 Estimating the required equity return using a DDM

139 In line with the approach set out in the literature, we have developed a Dividend Discount Model (DDM) to estimate a TMR timeseries for the UK from 2006 to 2023.[63] We note that our approach closely mirrors that adopted by PwC in their

61 One question that might be asked is, why not just use DDM estimates of TMR directly to test regulatory decisions? Why fit a relationship to build a Glider? In our view, there would be risks associated with using 'spot' DDM estimates directly in a regulatory context. DDM estimates are volatile, and reliance on them for regulatory purposes would result in a regime where returns may vary materially from period to period. Neither customers nor investors would value such a regime. It would also be out of line with the UKRN guidance set out above, as a regime based on DDM would not deliver stable TMR. However, DDM remains a valid model for constructing expectations on forward-looking required returns, and can serve as a sound foundation for this analysis.

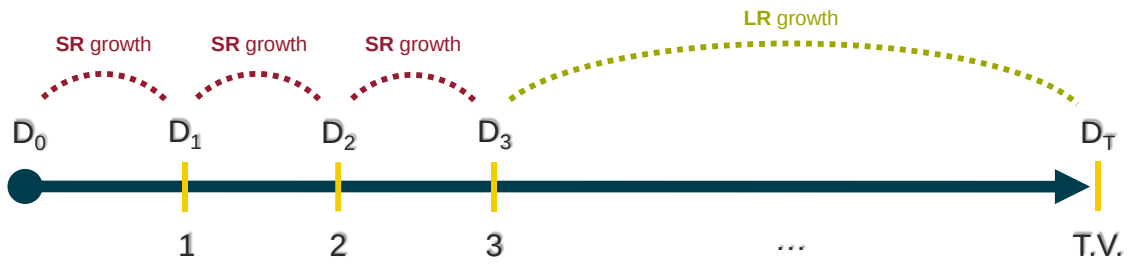
62 In addition to the academic literature investigating the relationship between ERP/TMR and the RFR, the Bank of England have a set of papers using DDM to estimate TMR over time. These papers also support our use of DDM to estimate required returns to equity. We summarise the findings of these papers in Annex A.

63 The data we have used in the DDM model is outlined in Annex B.

study for Ofwat, described above. We also note that in PR19, Ofwat considered DDM evidence when setting the regulatory total market return.[64] However, as we set out in Section 5.1.1, we do not propose using DDM evidence directly, to support a stable regulatory regime.

140 We have also adopted a two-stage growth DDM model. This requires an assumption of a short-run growth rate for the first three periods and a long-run growth rate used in perpetuity thereafter, as illustrated below. The short term growth assumption uses dividend forward rates sourced from Bloomberg. The long term growth rate is the IMF's nominal GDP long-run growth forecast. Our DDM also takes account of share buybacks as part of our assessment of the cash flows that will accrue to equity holders. We consider that accounting for buybacks more accurately reflects the overall cash return for investors, and note that this matches the approach adopted by PwC.[65]

Figure 5 Growth assumptions required to operationalise the DDM model



Source: Frontier internal

141 Using these assumptions, we are able to construct a stream of *expected* equity cash flows for the period 2006-2023. We note that data availability prevents us from extending the analysis back further. The present value of expected equity cash flows are then equated with the level of the FTSE All Share[66] at any given

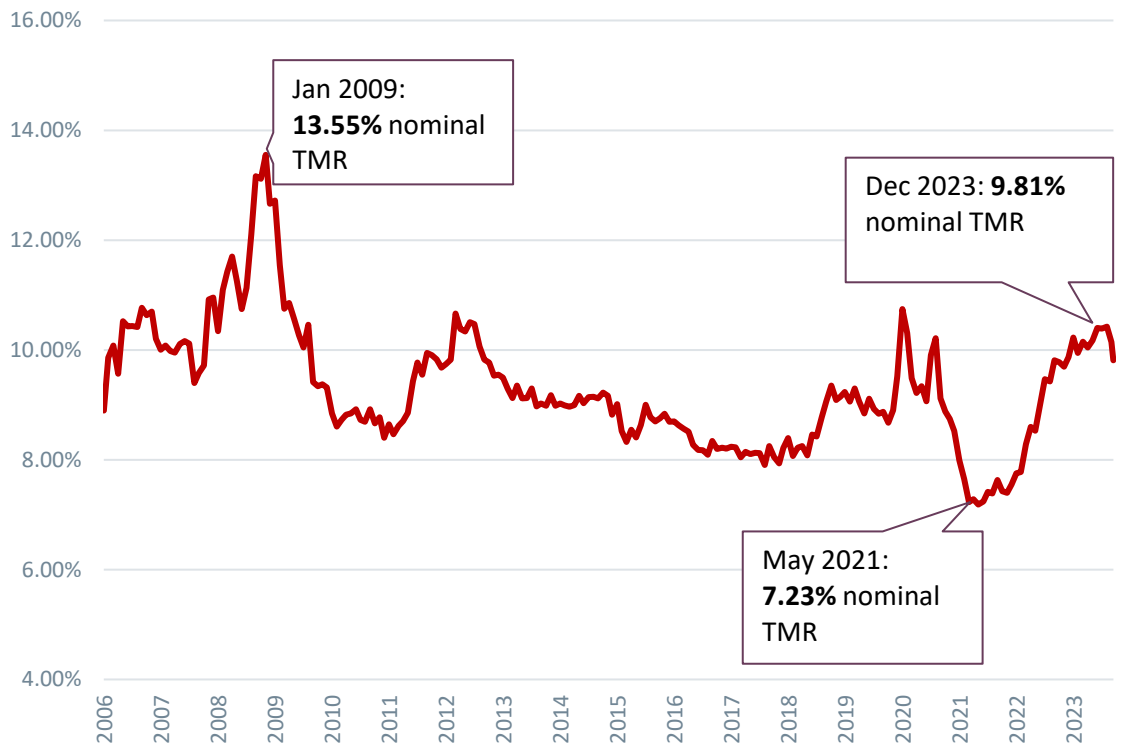
64 See for example: Ofwat (2019) PR19 Final Determinations, Allowed return on capital technical appendix.

65 We have explored a range of further specifications in the course of this work. We find that different specifications make only minor differences to the resulting TMR. For the reasons provided in the main body of this report, we consider that our chosen approach is the most robust and reasonable.

66 More details on the datasets used are given in Annex B. We test the underlying data assumptions for robustness on several dimensions. We use FTSE 100 data rather than the FTSE All Share Index, and find results to be similar. We use quarterly rather than monthly data, and again we find the results to be similar. We use actual dividends data rather than analyst dividend estimates, and we find the results are more robust across the specifications with the estimated data.

point in this time window, to infer the *required* equity return on the FTSE All Share.[67] The model output is illustrated in the figure below.

Figure 6 Estimated TMR from DDM modelling



Source: *Frontier Economics DDM Model output*

Note: *Our preferred specification uses analyst dividend yields and buyback yields to capture shareholder returns, dividend 3Y forward expectations for short-run growth and IMF nominal long-run GDP growth forecasts for long-run growth.*

142 The pattern of this chart fits most of the macro events that one would expect to have affected the TMR over the time period. For example, the height of the global financial crisis saw the peak of the TMR, followed by a second (albeit lower) high during the Eurozone sovereign debt crisis. Further down, the Covid-19 market turbulence marked another high market premium point, while the continued loosening of monetary policy meant that once the market recovered from the Covid-19 shock the TMR was at its lowest in recent history in line with the lowest RFR in recent history. The Ukraine war and the ensuing interest rate hikes by the Bank of England contribute to the recent peak of the TMR, with risk premium and RFR increasing simultaneously.

67 See **Error! Reference source not found.**of this report for a full explanation of the DDM model.

143 We have compared our above DDM TMR output against the output of a similar exercise undertaken by the Bank of England. The results of this comparison can be found in Annex B. We consider this comparison broadly supportive of our DDM approach and findings.

5.1.4 Estimating the relationship between TMR and the RFR

144 Our final step is to evaluate the relationship between the forward-looking required equity return and contemporaneous 20-year gilt yields, i.e. to estimate the observed change in TMR given changes in bond yields.

145 To do this, we identify the line of best fit between required equity returns (TMR) and 20-year gilt yields as a proxy for RFR. More specifically, we estimate the slope (β) and intercept (α) of this line of best fit, per the following equation:

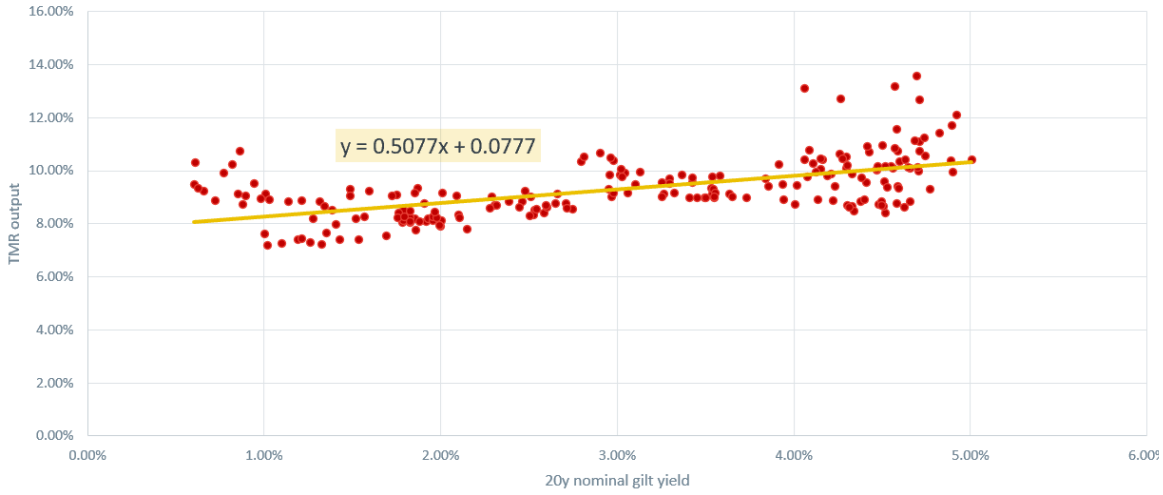
$$TMR_t = \alpha + \beta \cdot 20\ year\ ILG\ ytm_t$$

146 Following the academic literature, the purpose of this analysis is clearly not to provide a fully fitted, multidimensional macroeconomic model that explains the relative importance of all the potential determinants of TMR. Rather, we look to identify the simple relationship between the two variables over time in order to inform our TMR Glider.

147 We have considered three different specifications that result in slightly different parameter estimates.

148 Our first specification (Specification A) simply examines the relationship between our DDM TMR and 20-year gilt yields, over the entire period we have studied and including all observations. The outcome is shown in the figure below. We find that we are able to specify a linear relationship between TMR and RFR which reasonably runs through the data, but for a number of outliers on the top right hand corner of the figure.

Figure 7 Line of best fit between forward-looking required TMR and 20 year gilt yields using DDM



Source: Frontier internal DDM model output

Note: The TMR output is from Specification 3 of the DDM model. The 20y nominal gilt yield is our proxy for the RFR.

149 The line of best fit has an estimated slope of 50.8%, i.e. this evidence suggests a 100bps increase in yields on 20-year gilts is associated with a corresponding 50.8bps increase in the TMR. The intercept is estimated to be 7.8%, i.e. if nominal interest rates were to fall to 0%, the line of best fit would predict a nominal TMR of 7.8%.[68]

150 One possible concern with financial market data is outliers. In Specification B we retain the same simple model as for Specification A, but rely on statistical tests to identify outliers (values lying more than 3 standard deviations from the mean TMR). Five outliers are identified by this test, and these observations can be observed in the top right hand section of the graph. In each case, these points represent periods with estimated nominal TMR of greater than 12.5%. All five of these points occurred during the last quarter of 2008 and the first quarter of 2009. We therefore fit another line of best fit that excludes these outliers, and the results are presented in the table below (Specification B).[69]

151 For Specification C, we consider alternative ways to address potential outliers. Our examination of potential outliers indicates that there are historical events that we may wish to control for, such as the GFC and the Covid-19 pandemic, given that these episodes caused significant volatility in financial markets. To systematically

68 Note that this is an out of sample prediction: there are no observations in our sample with a nominal RFR of 0%. Hence, the TMR prediction for this should be treated with caution.

69 As one would expect, excluding these five outliers leads to the line of best fit becoming marginally shallower and the intercept moving marginally higher (see the results in Table 1).

identify such events, we consider the VIX index to specify which windows of significant volatility should be controlled for.[70] We therefore fit a third line where we control for these events, shown as Specification C in the table below.[71]

Table 7 TMR and RFR relationship results

	Spec A	Spec B (drop outliers)	Spec C (control for shocks using dummies)
Time period	*2006-2023*	*2006-2023*	*2006-2023*
Intercept (nominal)	**7.8%**	**7.9%**	**7.8%**
Slope (nominal)	**50.8%**	**44.5%**	**42.3%**
Other dummies	N	N	Y
Implied TMR today (nominal)	10.0%	9.9%	9.7%

Source: Frontier analysis

152 The three approaches to fitting a relationship between TMR and 20-year gilt yields are shown in the table above. The results suggest that there is a change of 0.4%-0.5% to TMR when gilt yields change by 1%. The intercepts of the lines of best fit also remain in a tight range, between 7.8% to 7.9%.

153 In comparison to the past PwC study, our analysis indicates that TMR is more responsive to changes in gilt yields. We consider that this is likely to be a consequence of the period of analysis – PwC's study ran from 2000 to 2017, whereas ours runs from 2006 to the present (due to data availability). This does suggest that a Glider of this kind should not become a 'fit and forget' kind of mechanism, if it came to play some role in UK regulation, but should be revisited over time.

154 In the following chapter we explore further the results from Specification C. We do however note that our analysis shows that specification choice does not have a particularly material effect on the location of the line of best fit.

71 The VIX index is an index that captures market expectations regarding volatility over a future fixed period, usually 30 or 60 days ahead. The VIX timeseries allows us to identify periods of greater than usual volatility: we define this as VIX levels greater than 2 standard deviations from the mean VIX over our time period. The results as precisely: from 23/01/2008 to 22/04/2009 (the Global Financial Crisis) and from 28/02/2020 – 15/06/2020 (the Covid-19 pandemic). We use dummies to control for these two periods in Specification C..

5.2 Testing past regulatory decisions against the TMR Glider

155 Based on our DDM modelling and analysis of the relationship between the TMR estimates produced by that model and 20 year gilt yields, we have established a candidate Glider calibration. We now consider how well our Glider 'explains' previous regulatory decisions, particularly how those decisions moved down with the decreasing interest rate since the global financial crisis.

156 Below we show a comparison between our TMR Glider and regulatory decisions taken since 2009. This captures a reasonable number of regulatory decisions, tarting from the last decisions taken before the start of the era of low interest rates, and before regulatory TMR decisions began to be lowered (starting with the CMA NIE RP5 decision). The figure shows:

(c) The TMR Glider (dotted line) i.e. the level of TMR consistent with varying levels of the 20-year nominal gilt yield, used as a proxy for the RFR. This is the relationship estimated above using specification C, controlling for outliers from high volatility events.

(d) We then plot regulators' decisions along the TMR Glider line. We locate each dot on the basis of each regulator's own decisions for both TMR and RFR. We regard these as a matched pair, reflecting the choice each regulator made regarding TMR in the light of what they thought the wider interest rate environment was at the time. To illustrate how each dot has been located:

(i) Ofwat in its PR14 decision determined that the TMR was 6.75% and the corresponding RFR was 1.25%. Both of these values are in RPI-real terms, and for the PR14 decision, Ofwat expected RPI inflation to be 2.8%.

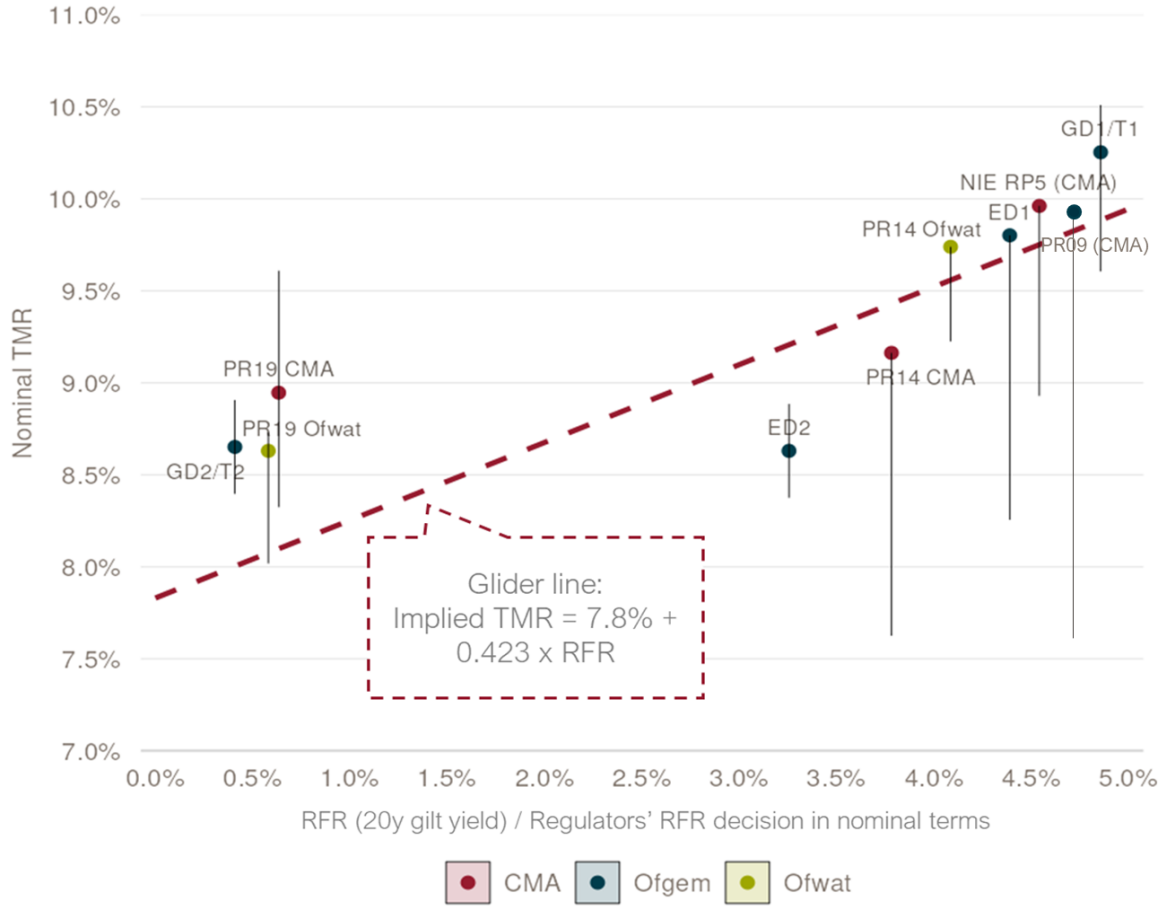
(i) Hence, given Ofwat's inflation expectation, it considered the nominal RFR and TMR were 4.1% and 9.74% respectively.

(ii) Therefore, the PR14 (Ofwat) decision point is located at 4.1% on the X-axis, and 9.74% on the Y-axis.

(iii) We repeat this process for the regulatory decisions made since 2012 to locate each decision along the Glider line.

157 For each regulatory decision, we also show the TMR range: this is represented by the solid black line running through each of the regulatory TMR point estimates (dots) in the figure. Where the dots lie at the top of the line, this demonstrates that the regulator had aimed up; where the dots lie in the middle of the line, this shows that regulators had aimed straight.

Figure 8 TMR Glider against regulatory TMR and RFR decisions



Source: Frontier economics analysis of regulatory decisions, Ofwat, Ofgem, CMA

158 Our assessment is that the Glider is able to explain past regulatory TMR decisions, given each regulator's assessment of RFR, reasonably well. Most points lie close to the Glider line.

159 The implication of this is that past regulatory decisions have indeed responded to interest rate developments. While the UK regulatory regime has often been presented as relying on a fixed TMR construct, it seems that the prevailing UKRN guidance, which focuses on TMR being stable but not fixed, appears to be an accurate characterisation.

160 We also observe that to understand past decisions one must also consider aiming up. In the past it was common for regulators to aim up – over this period we see aiming up when interest rates have been high. This practice has actually aided

regulators in sticking to the line, i.e. by aiming up they have better reflected prevailing interest rates.[72]

161 Conversely, when interest rates were low, regulators appeared to have 'aimed straight' (Ofgem GD2/T2, Ofwat PR19). This has (obviously) tended to lower TMR versus historical decisions, and has been part of the reason why regulatory decisions on TMR have followed rates down.[73]

162 A final insight we can draw from the figure is with regards to the PR19 CMA redetermination, which appears to represent the final attempt at implementing a long-term, 'fixed' TMR model. The PR19 redetermination included a lengthy debate on TMR, but we note there was a significant shift in approach and range between the draft and final report,[74] where the final report represented a higher TMR point estimate. This change may have reflected the tension between fully upholding the long-term model (with more emphasis on 'fixed' TMR) in the face of a continued low interest rate environment, which prevailed during the redetermination process.

163 While there is always important context and detail around any price control decision, these historic records show that the Glider performs reasonably well in terms of characterising regulatory decisions on TMR taken in the past decade. On this basis, we think that the Glider provides useful guidance and insight on how the TMR can be set for future price controls. In fact, using the TMR Glider would represent a consistent approach to how regulators have set TMR so far. We discuss this in the following section.

5.3 Implications for future TMR decisions based on the TMR Glider

164 Above we have shown that our candidate TMR Glider is able to explain, to a reasonable degree of accuracy, past TMR decisions given the regulators' assumptions of RFR, albeit with the need to understand some context. Given this, we now ask what the Glider would imply for current and future regulatory decisions, and whether the Glider can facilitate regulatory decision making going forward.

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72 Regulators have aimed up at PR09 (CMA), GD1/T1, NIE RPG (CMA), ED1, PR14 Ofwat, and PR14 CMA.

73 ED2 appears to be something of an anomaly – it embodied a TMR decision materially below the line. The ED2 decision (dated 30 November 2022) came approximately a year after the CMA found Ofgem's RIIO-2 cost of equity calibration was "not wrong" at ELMA 2021, and the ED2 process was also concluded during a highly volatile period for capital markets. The TMR Glider suggests that the ED2 decision on TMR was too low, based on the high risk-free rates at the time of the decision, but the decision may have been judged closer to the line based on the interest rates that prevailed as the price control was being designed.

74 We also note that this change in approach was largely unexplained in the PR19 redeterminations Final Report, and it is our understanding that the final position on TMR was established in closed Working Groups that took place after the publication of the Draft Report.

5.3.1 TMR Glider predictions for the current environment

165 Using the various Glider specifications we explored, we show below what the TMR Glider predicts the TMR should be given current RFR levels.

Table 8 TMR Glider predictions based on current RFR

	Spec A	Spec B (drop outliers)	Spec C (control for shocks)
Time period	*2006-2023*	*2006-2023*	*2006-2023*
Intercept (nominal)	**7.8%**	**7.9%**	**7.8%**
Slope (nominal)	**50.8%**	**44.5%**	**42.3%**
Implied TMR today (nominal)	10.0%	9.9%	9.7%
Implied TMR today (CPI-real)	**7.86%**	**7.71%**	**7.55%**

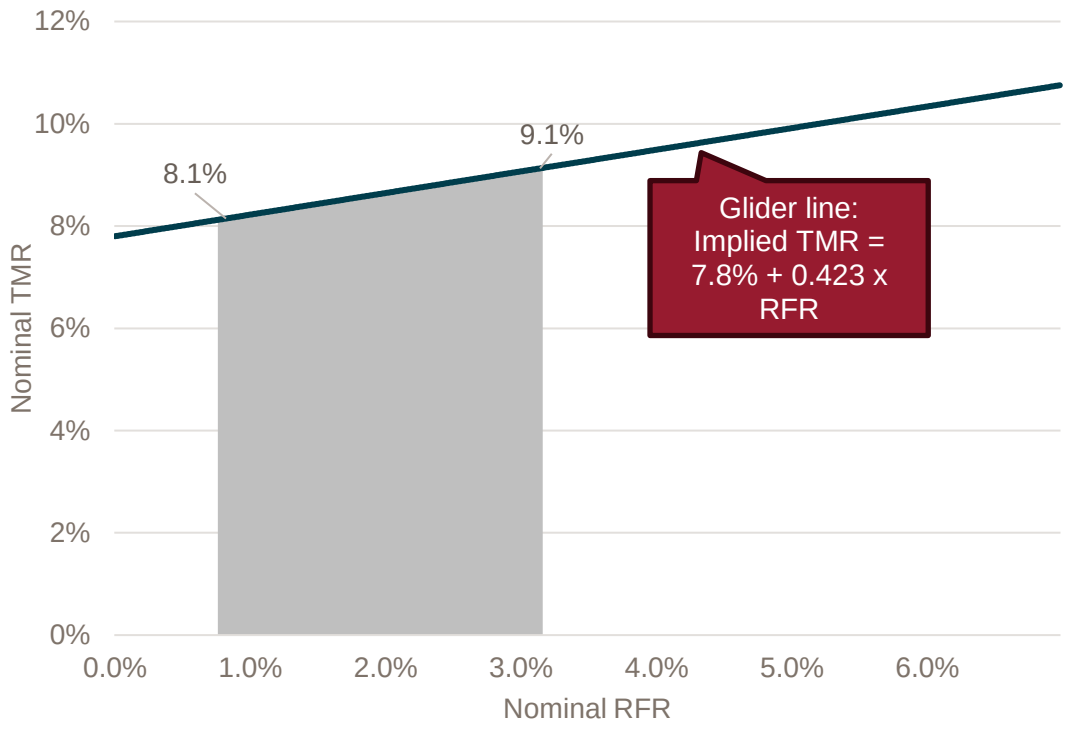
Source: Fronter analysis

Note: The Risk Free Rate is the UK 20Y Gilt from 31 January 2024, which was 4.49% in nominal terms.

166 All Glider specifications predict a current TMR above 7.5%, in the range of 7.55%-7.86%. Given that interest rates at prevailing levels have not been seen for decades, and the stable but not fixed regulatory construct that has emerged, it is perhaps not surprising that the predicted TMR is considerably higher than observed in most recent decisions.

167 While we would not propose that the Glider should be used mechanistically to set TMR, this brings a key insight. If the present interest rate environment, or something like it, is expected to persist, then, it could be that the TMR range proposed in Ofwat's PR24 Final Methodology (6% - 7% CPIH-real) could be inconsistent with past regulatory decisions and current interest rate levels. This is shown in the figure below.

Figure 9 Ofwat's PR24 Final Methodology TMR decision against the TMR Glider



Source: Frontier Economics, Ofwat

168 Ofwat's PR24 Final Methodology decision is 6% - 7% CPIH-real, which translates approximately to 8.1% - 9.1% nominal, assuming a 2% CPIH assumption. The Glider shows that such a TMR decision would have been consistent with a nominal RFR of approximately 1% - 3% (shaded grey in the figure above), which is much lower than the RFR observed in the current market environment, which is closer to 5% nominal.

Interpretation of the Glider prediction

169 Based on the current interest rate environment, rigid adherence to the TMR Glider would suggest a TMR of 7.55%-7.86% would be more appropriate. This would be broadly consistent with the line of best fit that emerges from our analysis of short-term market conditions, and, based on our tests, in line with past regulatory practice.

170 A higher TMR would also go some way towards the allowed cost of equity being closer to the cost of equity range suggested by the hybrid bond cross-check.[75]

171 However, the balance of evidence presented in this paper would support a TMR towards the top of the historic decisions taken by the regulators in the past decade based on. It is clear from Figure 8 that regulators had indeed given regard to the prevailing interest rate when setting the allowed TMR.

172 Based on this work, we find that a TMR decision of 6.46% CPIH-real, as set out in the PR24 Final Methodology, would represent a departure from both market evidence and established regulatory precedent. Therefore, it runs the risk that investors might conclude that 'stable but not fixed' applies only when interest rates are falling, but not when they are rising. This could be detrimental to investor confidence. A TMR at 6.46% is therefore a direct contributor to Ofwat's overall cost of equity estimates being too low, supported by our hybrid bond cross-check evidence.

173 This work aims to provide a tool through which regulators can re-appraise past decisions on the TMR, focus on how market evidence has influenced those decisions, and, hopefully, help to inform a proportionate and appropriate TMR decision for future price controls. Given the scale of investment water and wastewater networks need to deliver in the period ahead, it is important to set the cost of equity at a suitable level, as we consider that using this tool help support the interests of both investors and customers.

75 Although, this is just one component to estimating the overall cost of equity and we have not considered the other components in this report.

6 Conclusion and implications for the PR24 allowed return on equity

174 This report provides two specific tools which can be used by Ofwat to help gauge the appropriate cost of equity for PR24. These tools have been developed so that the regulatory framework is able to adapt to the challenges posed by the new capital market environment which has emerged.

175 Both tools are able to capture the impact of this new environment as their inputs are directly sourced from capital markets. This means they are transparent, simple to apply, and they are also tailored to the UK regulatory landscape.

(a) The outputs from the hybrid bond cross-check show a need to significantly revise the CAPM inputs used in the PR24 methodology to calculate the cost of equity. More specifically, our hybrid bond cross-check suggests a market-implied cost of equity of 5.8% to 8.4% while the 'early central view' from the methodology is an allowed equity return for PR24 at 4.14%. Without revision there are heightened risks to the sector in terms of the equity capital is able to raise.

(b) The TMR Glider provides a guide for how the TMR CAPM input can be revised in a proportional manner that is consistent with regulatory guidance and the wider capital market environment.

176 We note that there are other CAPM inputs which may also require revision in order to reach an appropriate cost of equity PR24 – such as beta. But those other inputs are beyond the scope of this report.

177 Investors clearly have a key role to play in the next five-year period. Significant sums of capital are required to make the investments set out in long-term plans a reality. However, capital cannot be transformed into assets if the sector cannot attract that capital in the first place.

178 By considering all available evidence there is a greater likelihood of striking an appropriate balance between customers and investors. We therefore invite further engagement with Ofwat on the tools set out in this report and the fresh perspectives they provide for the PR24 cost of equity.

Annex A - Hybrid bonds

A.1 In the Annex set out the sensitivity checks we have undertaken on key assumptions used in the hybrid bond cross-check (Annex A1). We then outline additional robustness checks that we have undertaken on the cross-check (Annex A2).

A.1 Sensitivity checks on key assumptions

Sensitivity test on historical hybrid/iBoxx spread

A.2 A key assumption in our analysis is that the hybrid spread to iBoxx has remained constant over time. We have adopted this approach for its simplicity, which allows us to address the complexities that could emerge as the bond approaches its first call date. During this time, investor perceptions about potential early calls and shorter maturities could influence price dynamics, making the comparison with iBoxx potentially problematic for measuring long-term expectations. In this section, we relax this assumption and check how the results vary within a reasonable range of scenarios.

A.3 We measure the spread **over time**, allowing for comparisons as maturity approaches.

A.4 **First, we calculate the expected returns of the NGG 2073 hybrid to exclude compensating for higher risk.** We account for the fact that this hybrid bond's credit rating declined over the years (from BBB- to BB+ in March 2021, with 4 years remaining to next call). Table 9 provides an overview of the adjustments over time for BBB- and BB+ credit ratings following the methodology in UKRN (2018). Costs of default risk decrease as securities approach maturity and becomes less likely. At 4 years to maturity, the reduction to yields should shift by -0.06% to -0.14% following the BB+ route to align with the new rating. However, in the interest of simplicity, we take a conservative approach and adjust yields by -0.15% over the hold period. This corresponds with value applied to the hybrid yield at issue.

Table 9 Default risk adjustments for BBB- and BB+ credit rating

Credit rating	Years to maturity											
	1	2	3	4	5	6	7	8	9	10	11	12
BBB-	-0.04%	-0.05%	-0.07%	-0.08%	-0.09%	-0.10%	-0.11%	-0.12%	-0.13%	-0.14%	-0.15%	**-0.15%**
BB+	-0.07%	-0.09%	-0.12%	**-0.14%**	-0.16%	-0.17%	-0.19%	-0.20%	-0.22%	-0.23%	-0.24%	-0.24%

Source: Frontier calculations following UKRN (2018).
Note: Assuming 80% recovery rate.

A.5 Next, we establish a new iBoxx benchmark. For each day, we match the bond's expected returns with the corresponding iBoxx £ Utilities index according to its maturity to next call (July 2025).[76]

A.6 Finally, we calculate the daily spread as the difference between the two measures (NGG 2073 hybrid expected return net of the iBoxx benchmark).

A.7 We test the sensitivity of our analysis in response to the spread volatility over time by constructing a range around the 10th and 90th percentile. **We obtain a spread between 86 and 201bps, resulting in nominal equity returns between 7.8% and 10.1% (Table 10).** The expected return spread at issue of 136bps lies towards the centre of this sensitivity range.

Table 10 Sensitivity test on historical hybrid/iBoxx spreads

Cost of equity	Low	High
Historical hybrid bond spread to iBoxx	86bps	201bps
iBoxx £ Utilities 10Y+ (1Y average)	6.0%	6.0%
Higher returns on equity (based on 50% equity-like)	1.7%	4.0%
Nominal cost of equity	**7.8%**	**10.1%**
Real cost of equity (CPIH deflated)	**5.6%**	**7.9%**

Source: Frontier calculations

Note: Analysis as of 29 February 2024. We consider a 2% inflation assumption to derive CPIH-real cost of equity.

A.8 Based on this analysis, we conclude that the spread at issue on our chosen National Grid hybrid bond is a reliable and reasonable measure of the long-term differentials between hybrid and debt returns over time. In this instance, the simplified approach of taking spread at issuance can be considered robust in respect of the historical spread.

Sensitivity test on the percentage of equity-like

A.9 In our main analysis, we have taken the assumption that hybrid bonds stand at the midpoint between debt and equity, being assigned 50% equity-like from an analytical perspective. This is an approximation made by credit rating agencies based on investors' expectations. However, we test some sensitivities, ranging from 75% to 25%.

[76] For example, in 2013, we compare it to iBoxx £ Utilities 10-15, and in 2021, which is four years away from maturity, to iBoxx £ Utilities 3-5.

A.10 Table 11 presents a span of nominal equity returns from 7.9% to 11.5% (equivalent to 5.7% to 9.3% in real terms). Although the lower end of this range aligns closely with the prior sensitivity, the upper limit exhibits a significant increase in magnitude. This is not surprising since in the upper case a larger multiplier is applied to the hybrid spread to imply the equity premium. All in all, we consider the resulting range is reasonably tight given the fact we are stretching the limit of the plausibility on the equity proportion assumption.

Table 11 Sensitivity test on the percentage of equity-like

Cost of equity	Low	High
Spread to iBoxx at issue	136bps	136bps
iBoxx £ Utilities 10Y+ (1Y average)	6.0%	6.0%
Higher returns on equity (based on 75-25% equity-like)	1.8%	5.4%
Nominal cost of equity	**7.9%**	**11.5%**
Real cost of equity (CPIH deflated)	**5.7%**	**9.3%**

Source: Frontier calculations
Note: Analysis as of 29 February 2024. We consider a 2% inflation assumption to derive CPIH-real cost of equity.

Sensitivity test on iBoxx averaging

A.11 In estimating the cost of equity cross-checks from hybrid debt, we considered the average value of the iBoxx £ Utilities 10Y+ during the latest year.[77] This average window, in our view, captures the outlook for debt market in the near future reasonably well whilst smoothing out short-term volatilities on market rates.

A.12 However, we have conducted sensitivity scenarios on the iBoxx yield, and assessed how different dates could influence the final value. We do so by constructing a number of different reference points for the iBoxx yield:

- **Transition (2 year average).** From late 2021, interest rates started rising in response to the central bank's efforts to control inflation. This shift was gradual but persistent and within the space of one and half years took the economy out of the era of favourable borrowing costs, into the current higher interest rate environment. A two year average captures this transitional period and reflects a reasonable low bound we could expect in the medium term future

[77] As of 29 February 2024.

should the monetary policy soften in response to potential macro-economic environment.

- **Maximum (12 Oct 2022).** This reflects the point in time when the iBoxx Utilities yields reached their highest level during the recent upward trend. We consider this as a credible upper bound which could be "retested" by the market should conditions worsen and revert back to more stringent tightening of the policy.
- **Settlement (since 12 Oct 2022 to present)**. After reaching the peak, interest rates began to decline gradually but remained relatively high. Therefore, this period can be considered to represent a stable phase following the peak, which could be interpreted as a representation of the "high interest environment period to date".

A.13 Figure provides an overview of the iBoxx £ Utilities 10Y+ evolution since 2013, indicating these key timeframes.

Figure 10 Evolution of the iBoxx £ Utilities 10Y+, 2013 to 2024

Source: Markit

A.14 When we average across these periods, we find that the iBoxx values range from 5.4% to 7.4%. Consequently, the nominal cost of equity falls between 8.2% to 10.1%, which translates to 6.0% to 8.0% in real terms. This aligns with the sensitivities observed in the previous sections.

Table 12 Sensitivity test on iBoxx averaging

Nominal equity returns	Transition	Settlement	Maximum
Spread to iBoxx at issue	136bps	136bps	136bps
iBoxx £ Utilities 10Y+	5.4%	5.9%	7.4%
Higher returns on equity (based on 50% equity-like)	2.7%	2.7%	2.7%
Nominal cost of equity	**8.2%**	**8.6%**	**10.1%**
Real cost of equity (CPIH deflated)	**6.0%**	**6.5%**	**8.0%**

Source: Frontier calculations
Note: Data as of 29 February 2024. We consider a 2% inflation assumption to derive CPIH-real cost of equity.

A.15 The hybrid bond implied cost of equity from our point estimate, based on the latest year average iBoxx yield, stands at 6.6% in CPIH real terms, which is closely aligned with the middle scenario in our sensitivity test (settlement period).[78]

A.16 Overall, we consider our point estimate of 6.6% implied cost of equity is robust to the sensitivity test of plausible iBoxx scenarios, and because it is based on a one-year average, is not subject to extreme short-term movement of the bond market.

Summary of sensitivity checks on key assumptions

A.17 Summarising the three ranges we produced based on the scenarios, we construct an overall range for the hybrid bond implied cost of equity. Taking the average of the lower bounds and higher bounds, we obtain a range of **7.9% to 10.6% in nominal terms (5.8% to 8.4% in CPIH-real terms).** Our point estimate of 6.6% CPIH-real falls within this range, leaning towards the conservative side as it is closer to the lower bound.

78 Furthermore, we'd get a similar results even if one took the latest monthly average of iBoxx yield as of the time of writing of this report (February 2024 average), the resulting implied cost of equity would be 6.3% in CPIH-real terms.

Table 13 Summary of sensitivity checks on key assumptions

Summary results	Low	High
Sensitivity on historical hybrid/iBoxx spread	7.8%	10.1%
Sensitivity on the percentage of equity-like	7.9%	11.5%
Sensitivity on iBoxx averaging	8.2%	10.1%
Nominal cost of equity	7.9%	10.6%
Real cost of equity (CPIH deflated)	**5.8%**	**8.4%**
Real cost of equity (CPIH deflated) – point estimate		**6.6%**

Source: *Frontier calculations*

Note: *Results for the cost of equity are obtained by averaging the low and high values of each sensitivity respectively. We consider a 2% inflation assumption to derive CPIH-real cost of equity.*

A.2 Additional robustness checks

A.18 In this section of the annex, we conduct additional analyses to assess the robustness of our hybrid bond results. These tests provide us with additional reassurance regarding our findings and conclusions.

Comparison of hybrid/iBoxx spreads for securities issued by GB utilities

A.19 As an input to the cross-check, we obtained a spread of 136bps between the NGG 2073 hybrid and the iBoxx Utilities benchmark. To check that this result is not specific to this one bond, we expand the analysis to include the remaining NGG Finance and SSE hybrid bonds. The results of this comparison are detailed in Table 14. As shown, the benchmark we consistently apply for the purposes of this robustness check is the iBoxx Utilities index matched to the currency of each hybrid bond.

Table 14 Spread of GB hybrid bonds relative to benchmark

Hybrid bond	Yield to next call at issue date	Expected return	Selected index	iBoxx yield at issue date	Yield spread at issue date	Expected return spread at issue date
	(1)	(2)		(3)	(1 - 3)	(2 - 3)
NGG Finance Plc, 2079	1.63%	1.49%	iBoxx € Utilities	0.42%	1.21%	1.08%
NGG Finance Plc, 2082	2.13%	1.95%	iBoxx € Utilities	0.42%	1.72%	1.53%
NGG Finance average						**1.30%**
SSE Plc (ISIN XS2195190876)	3.51%	3.41%	iBoxx £ Utilities 5-7	1.29%	2.22%	2.13%
SSE Plc (ISIN XS2195190520)	3.00%	2.90%	iBoxx € Utilities	0.79%	2.21%	2.11%
SSE Plc (ISIN XS2439704318)	3.97%	3.80%	iBoxx € Utilities	2.24%	1.73%	1.56%
SSE average						**1.93%**

Source: *Bloomberg, Frontier calculations*
Note: *The expected return adjustment is based on the 2018 UKRN cost of equity study*

A.20 We obtain similar results using NGG Finance's Euro denominated bonds.[79] **The range of spreads from NGG Finance hybrid bonds is 108bps to 153bp, with an average of 130bps.** In both cases we match the tenor and currency of the iBoxx to the characteristics of each bond. Using the iBoxx Euro Utilities benchmark approximately matches to the tenors-to-next-call of 5.0 and 7.8 years of the 2079 and 2082 hybrid bonds, respectively.[80]

A.21 **For the SSE hybrid bonds, spreads range from 156bps to 213bps, with an average of 193bps.** These spreads are higher than the spreads observed for the National Grid hybrid bonds, but this is not surprising as the implied cost of equity for SSE is expected to be higher due to its significant ownership of non-regulated

79 Note that both were issued in Euro currency so are compared to Euro denominated iBoxx indices.

80 The average years to maturity on this index has been relatively stable at around 6 years.

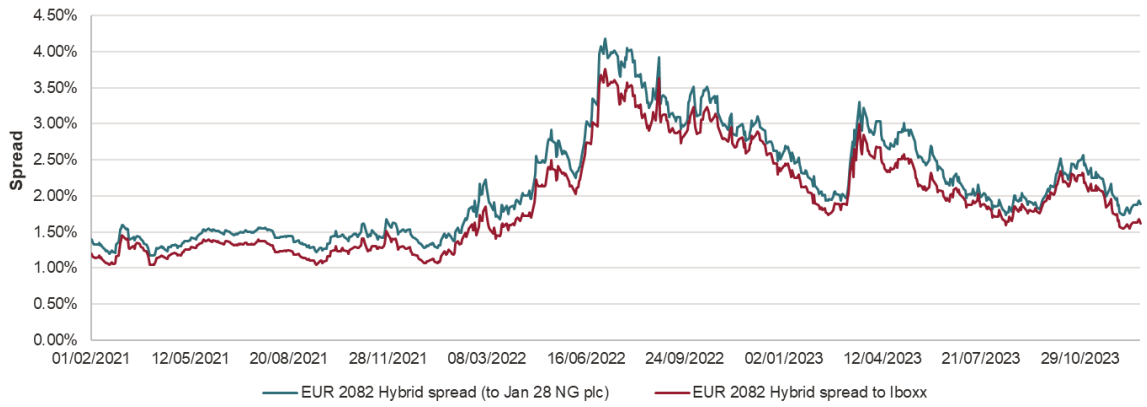
businesses. This is also in line with SSE having a significantly higher beta than NG.

A.22 Overall, we find these robustness checks are supportive of our analysis.

Comparison between hybrid/iBoxx and bond/iBoxx spreads

A.23 In this exercise, we assess the spreads of hybrid-to-iBoxx compared to NG plc bonds-to-iBoxx. We focus on the NGG 2082 hybrid, denominated in EUR, to ensure a direct comparison with NG plc bonds which are also issued in Euros.

Figure 11 Spread of yield to next call (Jun 2027) on the NGG Finance 2082 Hybrid to the iBoxx € Utilities



Source: Frontier calculations based on Bloomberg and Markit data
Note: Both series are Euro denominated

A.24 The results in Figure show that the spread between National Grid hybrid and National Grid senior debt follows similar pattern as the spread over iBoxx in our main analysis. We note that the spread to National Grid senior debt is almost always higher than the € iBoxx utilities index.

A.25 This suggests that there is unlikely any systematic over-estimation of the hybrid spread when we use market benchmark, in comparison with the senior debt issued by the relevant company. This is also consistent with the finding using SVT's hybrid bond quotes.

Comparison of National Grid's regulatory gearing from FY2013

A.26 In our main analysis, we have used National Grid specific hybrid bond data from March 2013 as a key part of the methodology for the hybrid bond cross-check. As this cross-check is being used as a point of comparison with allowed equity return based on a notional gearing assumption, we have checked if National Grid's GB network regulatory gearing (RAV based) from the same time period which

underpins the hybrid bond has roughly the same level of gearing as is being applied by regulators today.

A.27 In the table below we set out regulatory gearing for National Grid's electricity transmission and gas business as of March 2013, using figures from the regulatory accounting statements for each. As shown, the actual gearing figures from those business are around 60%. This aligns with the gearing assumptions adopted by Ofwat for PR19, and by Ofgem recently. Albeit it is slightly higher than Ofwat's PR24 methodology figure of 55%. when calculating the cost of equity – both on a network specific basis, and in total.

A.28 As a matter of principle, one would ideally re-gear the outcome of this cross check to match the notional gearing adopted in the relevant price control, in order to ensure a completely like-for-like comparison. However, given that actual gearing is close to the notional gearing as well as the actual gearing of UU and SVT at the time the hybrid bond was issued, we have not undertaken this step at this stage. This could be considered in future work.

Table 15 Gearing of National Grid's network activities, as of 31 March 2013

Activity	Net debt (£m)	RAV (£m)	Gearing
Electricity transmission	5,919	10,145	58%
Gas transmission	8,669	5,340	63%
Gas distribution		8,330	
All activities	**14,588**	**23,815**	**61%**

Source: *Annual Report and Accounts 2012/13 National Grid Electricity Transmission plc; and National Grid Gas plc NTS Regulatory Accounting Statements 2012/13*

Note: *Net debt combined for both gas businesses*

Annex B - TMR Glider annex

B.1 In the Annex we set out the details which support the TMR Glider analysis.

- In Annex B1 we set out the academic evidence reviewed;
- In Annex B2 we provide an introduction to the DDM analysis undertaken;
- In Annex B3 we outline the Bank of England's approach to DDM;
- In Annex B4 we compare our approach with the Bank of England; and
- In Annex B5 we set out our DDM data sources.

B.1 The academic evidence covering the relationship between TMR and ILG Yields (as a proxy for the RFR)

Harris and Marston (2013)[81]

B.2 Harris and Marston examine whether there is evidence that the equity risk premium (ERP) is not constant, and consider whether there are any implications for estimating the cost of capital. Using data from US markets, Harris and Marston found that the equity risk premium varies over time. They found that these changes in the ERP could be linked to changes in long term interest rates, credit spreads on corporate bonds and anticipated volatility in equity markets.

B.3 More specifically, Harris and Marston use a discounted cash flow model (DCF) with US market data from 1986 to 2010 in order to estimate forward-looking market required returns.[82] The market required return is defined as the sum of the return on the risk-free asset and the market risk premium. In other words:

179 *Total Market Return (TMR) = Risk-free rate (RFR) + Equity risk premium (ERP)*

B.4 Given that Harris and Marston aim to examine the evolution of the ERP over time, they derive the forward-looking ERP by subtracting the RFR from the forward-looking TMR.

B.5 The authors use regression analysis to investigate the extent to which changes in their estimated ERP moves with changes in long term interest rates. They find a coefficient of -0.79%. They suggest that this coefficient can also be interpreted to

81 Changes in the Market Risk Premium and the Cost of Capital: Implications for Practice (2015), Robert S. Harris & Felicia C. Marston. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2686739

82 Harris and Marston (2013) Equation 2. The authors use a static Dividend Discount Model (DDM). The data used includes SP500 dividend paying stock and individual analysts' forecasts of long-run growth in earnings.

mean that the coefficient between the change in TMR and change in interest rates would be +0.21%.

B.6 These findings support the premise that changes in TMR are related to changes in the RFR. However, we cannot consider Harris' and Marston's analysis directly for the purposes of specifying the TMR Glider. This is because Harris and Marston examine the relationship between changes in ERP and changes in RFR, which is related to our enquiry but not exactly the same.[83] Nevertheless, this study provides evidence that the required equity risk premium does change alongside changes in RFRs, which provides a foundation for further considering a TMR Glider.

PwC for Ofwat (2017)[84]

B.7 PwC prepared a report for Ofwat that aimed to examine the balance of incentives introduced at Periodic Review 2014 (PR14), and potential improvements for the next periodic review (PR19). As part of this, PwC also examined the potential impacts of the 'lower for longer' interest rate era on estimating equity returns. The 'lower for longer' era was defined in a UK market context, as a period wherein the Bank of England was likely to keep the cost of borrowing very low for a prolonged time.[85]

B.8 PwC sought to understand whether the 'lower for longer' environment justified a potential adaptation in Ofwat's approach to setting TMR, i.e. whether there was any reason to consider more current market evidence in addition to the conventional approach of relying on long term historical equity returns.[86] The consideration of current evidence would mean that the resulting cost of equity would be calibrated according to both short term market dynamics and long term market expectations.[87]

B.9 Following Harris and Marston, PwC used a dividend discount model (DDM) to estimate a market-implied TMR for the UK market, covering the period 2000 to

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83 Associating *changes* in *MRP* and *changes* in the RFR, cannot be transformed in a straightforward manner into a comparable coefficient for *levels* analysis. This is because the changes regression is identifying the rate of change of the slope of the line of best fit between the MRP and the RFR. This (i) suggests that the modelled overall relationship is non-linear, and (ii) a starting point for both the MRP and the RFR would be needed to identify the corresponding actual slope at one point on this non linear line of best fit.

84 PWC (2017) Refining the balance of incentives for PR19. Accessible here: https://www.ofwat.gov.uk/wp-content/uploads/2017/07/PWC-Balance-of-incentives-June2017.pdf

85 PWC (2017), Refining the balance of incentives for PR19, Appendix B.

86 PWC (2017), Refining the balance of incentives for PR19, state that the approach to setting the cost of equity (including the choice RFR, EMRP and the TMR) on the basis of long run averages relies on the assumption that any current divergences are "temporary or exceptional in nature" (p77). They argue that if market conditions persistently deviate from the long run averages such as in the 'lower for longer' era, long run averages will overstate required returns (the inverse to be true if rates were higher than the long term rates).

87 PWC (2017), Refining the balance of incentives for PR19, p81.

2016.[88] The PwC DDM model found the TMR value that equates the equity value today with the present value of future dividends. The authors relied on a multi-stage DDM growth model, in which there is a short term (5 year) growth rate of dividend value and an expected long term growth rate, used to calculate a "terminal dividend value".[89]

B.10 The dividend data used in the model are from the UK FTSE All-Share Index over the period January 2000 to December 2016. We also obtain data on the initial market value of the FTSE index and the observed cash yield. This dataset is combined with data on estimations for stock buyback yields. The expected short and long term growth rates are based on nominal growth rates calculated from forecast real GDP growth rates and forecast inflation (thus making the assumption that GDP growth is a reasonable proxy for this whole-market approach).

B.11 The DDM model is run on a monthly basis and hence solves for monthly estimated TMR spot rates from 2000 to 2016. To provide an illustration of the results, the spot rate for December 2016 is 8.3% (in nominal terms).[90] The 5 year average of the DDM outputs for TMR is 8.8%.

B.12 The monthly TMR timeseries is in turn used to derive a monthly ERP by subtracting yields on UK nominal bonds, a proxy for RFR.[91]

B.13 The final step of the PwC analysis investigates the relationship between the RFR and the ERP. The authors plot these two variables over time (see the Figure below). They fit a linear relationship between the two variables, and report the gradient of this relationship for the full period of analysis, and separately for the later part of the period only (2010 to 2016). The best fit line has a gradient of approximately -0.76 for the period 2000 to 2016, suggesting that a 100 bps drop in the RFR is associated with a 76bps increase in the ERP. For the period 2010 to 2016 the equivalent figure was approximately -0.88.

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88 The authors use a multi-stage Dividend Discount Model (DDM). They use data from the UK FTSE All-Share Index. The expected short- and long-term growth rates are nominal growth rates calculated from forecast real GDP growth rates and forecast inflation (this relies on the assumption that GDP growth is a reasonable proxy for their whole-market approach).

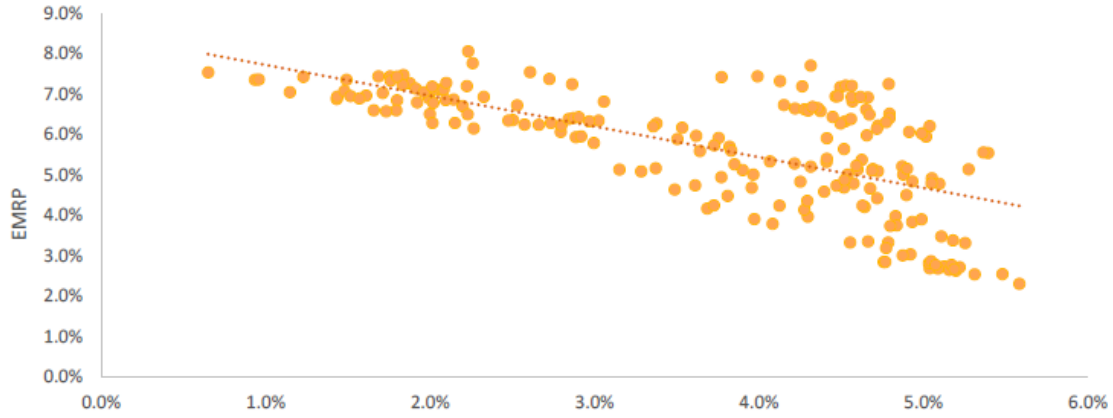
89 The underlying equation is as follows: $V_0 = \sum_{t=1}^{\infty} \frac{D_t}{(1+k_e)^t}$ where *V* is the intrinsic value (price today), *D* is the dividend value and *k* is the cost of equity.

90 The authors note that DDM outputs can be sensitive to the choice of data inputs, and therefore conduct sensitivity analyses; these analyses test the sensitivity of the TMR estimates to:

- The real growth rate of dividends and forecasted inflation: adding 1% to each of these increases the TMR by approximately 2%, reducing each of these by 1% decreases the TMR by approximately 1.5%.
- Share buybacks assumption: adding 1% to buybacks increases the TMR by approximately 1%, whilst excluding buybacks decreases it by approx.. 1%.

91 Two alternatives are used for the RFR: the spot yield on 10 year UK nominal government bonds and on 20 year UK nominal government bonds.

Figure 12 Reproduction of Figure 23 from PwC's report, relationship between risk-free rate and EMRP from implied DDM (2000 to 2016)



Source: PWC

B.14 PwC infer (based on their analysis) that if current market conditions are expected to diverge from long-run historical averages for an "extended period" of time, then one must consider the suitability of the long-run historical averages for calibrating price control returns.[92]

Damodaran (2020)[93]

B.15 In his 2020 paper Professor Damodaran considered the determinants of ERPs and provides a review of the techniques for estimating ERPs. He identified three approaches: survey premiums, historical premiums or implied equity premiums (including those estimated from discount cash flow models, default spread based ERPs or option pricing model based ERPs).

B.16 Damodaran used a variety of discounted cash flow models populated with US market data over the period 2008 and 2020. Damodaran compares the ERPs estimated using these methods with ERPs estimated using historical methods. Although this comparison is the focus of the paper, Damodaran notes the results of a series of simple regressions investigating the implied ERPs' relationship with other macroeconomic variables.[94] In particular, as an adjunct to his main analysis,

92 PWC (2017) Refining the balance of incentives for PR19, p79.

93 Damodaran (2020) Equity Risk Premiums (ERP): Determinants, Estimation and Implications – The 2020 Edition Accessible here: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3550293

94 Damodaran (2020) Equity Risk Premiums (ERP): Determinants, Estimation and Implications – The 2020 Edition, Table 21.

Damodaran looks at the relationship between estimated ERP and interest rates, economic growth, inflation rates and exchange rates.

B.17 Damodaran does not find evidence of a significant relationship between the implied ERP and long term interest rates, although this finding is not explored or tested in great detail and, as noted, identifying the relationship between ERP and gilt yields was not the primary focus of the paper.[95] Damodaran's findings would however be consistent with a finding that TMR and gilt yields move together in line with the other academic studies we have reviewed, and the study does provide a potential further approach to testing the elasticity of TMR against RFRs.

B.2 Introduction to the Dividend Discount Model

What is the dividend discount model

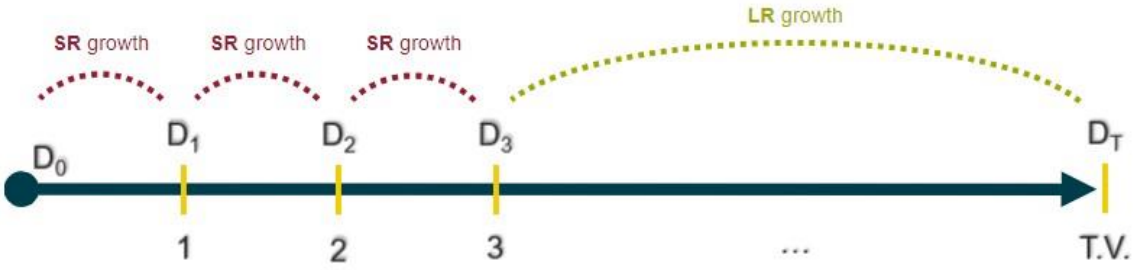
B.18 The DDM is a standard method for calculating the expected forward-looking return on a security, based on the fundamental assumption that the present value of a dividend is the sum of all its future dividends discounted to the present. The model is used in one of two forms; (i) a constant growth model, or (ii) a two-stage DDM.

B.19 As discussed in the main body of the report, we consider it appropriate to take account of share buy backs in a DDM, as such buy backs are an important form of cash received by equity investors.

The two stage DDM

B.20 The two-stage model is used to calculate the current present value of expected future dividends (or current index price), P_0, for a stock that is expected to grow dividends at different rates over different periods.

B.21 The following diagram shows a model which assumes a short-run growth rate for a company to determine dividends in the first three years, and then a long-run growth rate to determine a terminal dividend value from year 3.



95 Damodaran (2020) Equity Risk Premiums (ERP): Determinants, Estimation and Implications – The 2020 Edition, p105-107.

B.22 The below formula is used to solve for the expected return:

$$P_0 = \left\{ \frac{D_1}{1+r} + \frac{D_2}{(1+r)^2} + \frac{D_3}{(1+r)^3} + D_3 \frac{(1+g)}{(r-g)(1+r)^3} \right\}$$

Find the **r** that equates the **index price today** to the **sum of future dividends** in present value terms

B.23 D_1, D_2, D_3 represent the expected dividends per share for each of the first three periods, calculated using the initial dividend value and the short term growth rate, *f*:

$$D_1 = D_0 * f$$
$$D_2 = D_1 * f$$
$$D_3 = D_2 * f$$

r is the required rate of return.

g is the expected future growth rate in perpetuity.

Usefulness of the DDM and its limitations

B.24 Many academic papers agree that the DDM is an effective method to infer a forward-looking TMR, since it reflects current stock prices (that should embody the investors' best view of value) plus upcoming market and future growth expectations. For example, Damodaran (2016) found that the use of DDMs resulted in the best predictive power of actual returns in the US market, and a 2015 working paper by the Bank of England found similar results.

B.25 By estimating the forward-looking growth rate, the model provides insights into how expected future earnings growth contributes to the equity risk premium. Its long term focus and flexible framework make it a more realistic model than a model using historic dividend returns to estimate forward-looking returns.

B.26 The two-stage model in particular takes a more realistic view than the constant growth rate model, as it recognises that a company's growth rate in dividends varies over time, and captures the transition period that a company may face when moving from the short-run to the long-run.

B.27 The main drawback of DDM analysis is its sensitivity to key assumptions. Changes in the assumptions underlying the discount rate, growth rate and dividend payouts can have significant implications to the DDM. Forecasting future dividend growth rates can also be a challenging aspect of DDM analysis, especially for companies with unstable earnings. However, sensitivity analyses can be performed on the

model to assess the impact of any changes in the inputs, and how these could change the estimated stock value.

B.3 Bank of England's use of DDM

B.28 In addition to the academic literature investigating the relationship between ERP/TMR and the RFR, we note the Bank of England's work on using DDM to estimate TMR over time. This work supports our use of DDM to estimate required returns to equity.

B.29 A 2015 working paper by Chin and Polk at the Bank of England seeks to evaluates two measures of expected returns: (i) Campbell's 1991 vector autoregression model (VAR) which looks at the relationship between short-term returns and other variables; and (ii) a DDM model. Specifically, the authors test whether the VAR and DDM models can forecast realised returns in a range of tests. They then compare the two models' performance against a range of traditional predictor variables such as the price-earnings ratio and term spread.

B.30 They find that both VAR and DDM perform favourably in simple forecast regression tests, where they significantly predict realised returns at a range of horizons. In-sample, they generate substantially lower forecast errors compared to the alternative predictors. Out-of-sample, they compare the range of forecast variables to a historical average benchmark forecast and find that the VAR and DDM offer economically and statistically significant forecast improvements. This paper therefore provides support for the appropriateness and accuracy of using DDM to estimate expected market returns.

B.31 We also note that a speech by Martin Taylor (External Member of the Financial Policy Committee of the Bank of England) in 2016 references DDM analysis that the Bank of England conducted (to investigate ERP rather than directly the TMR).[96] This speech commends DDM as a useful method to measure contemporary ERPs.

B.32 In 2017, Dison and Ratten published an article in the Bank of England Quarterly Bulletin, [97] updating the Bank's DDM analysis from the model that had been in use since 2010. In the next section, we compare this output to our own DDM output.

B.4 Comparison of Frontier and Bank of England DDM Outputs

B.33 Helpfully, the Bank of England's 2017 paper includes outputs from the BOE's own DDM modelling. We find that our model outputs closely resemble the BOE's, as shown in the figure below. The BOE's paper does not report TMR, but rather ERP.

96 Banking in the tundra (2016) Martin Taylor https://www.bankofengland.co.uk/-/media/boe/files/speech/2016/banking-in-the-tundra.pdf

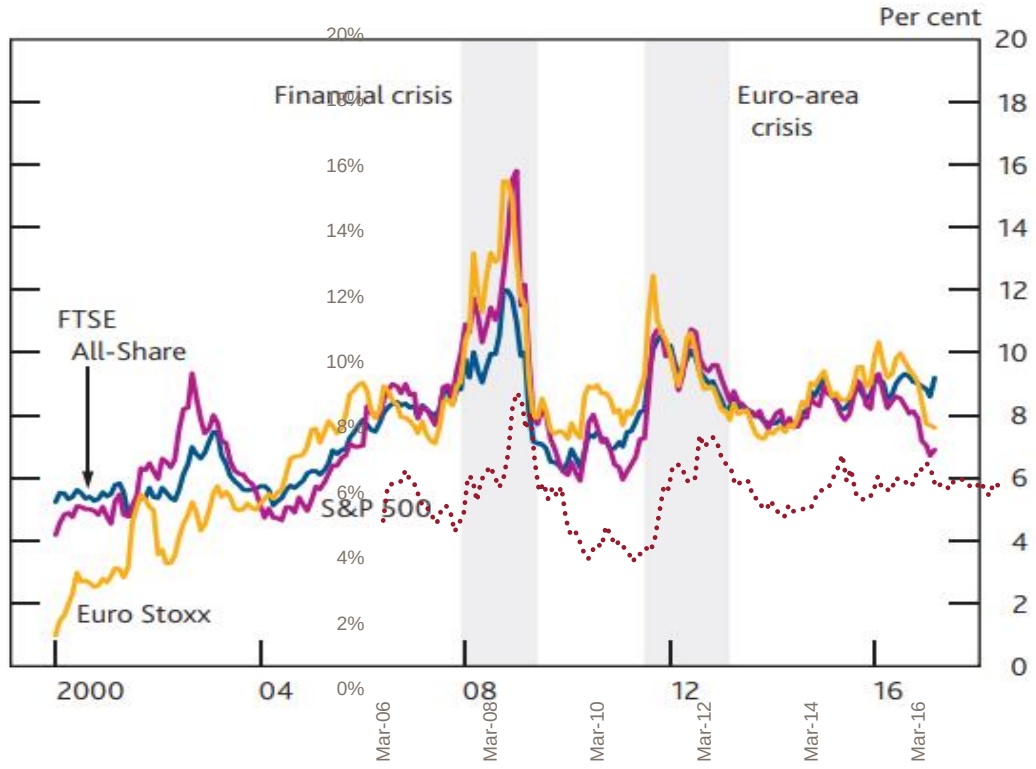
97 Bank of England (2017), Quarterly Bulletin, An improved model for understanding equity prices.

To conduct a high-level check of our modelling output, we first calculated the implied ERP, by subtracting the 20-year gilt yield from the required TMR reported by our DDM model.[98]

B.34 Note that we did not have access to the BOE's source data. As such, we simply super-imposed our DDM outputs alongside the BOE's, as a high level cross-check. Our DDM outputs are represented by the red, dotted line in the chart.

B.35 We observe that our DDM model outputs match the BOE's model outputs very well in terms of the rise and fall of the expected TMR, and our DDM outputs can almost be described as being a constant distance from the BOE's outputs. We understand that the difference between the outputs lies in the difference in RFR assumptions.

Figure 13 ERP, Our DDM outputs and BOE's 2017 DDM modelling



Source: Frontier Analysis, Bank of England (https://www.bankofengland.co.uk/-/media/boe/files/quarterly-bulletin/2017/an-improved-model-for-understanding-equity-prices.pdf)

B.36 Our understanding is the BOE's modelling attempts to use a RFR which is proxied by the yields of extremely long-dated government bonds (longer than 20 years, which is what we have considered), to approximate the perpetual nature of equity.

98 The output from our DDM model is shown in Figure 4. To derive the ERP, we subtracting the 20-year gilt yield from the TMR values shown in Figure 4.

The BOE also noted that actual gilts covering such long term maturities do not exist, and the yields for this had to be extrapolated.[99]

B.37 Given the differences in RFR assumptions we consider that our modelling should produce a different result to the BOE's, but the similarities of both model outputs provides us a degree of comfort in the manner in which we have specified our DDM model for the analysis set out in this paper.

B.5 Frontier's DDM data sources

B.38 We use the following data sources for our main DDM analyses and DDM sensitivities. We note that the results of our primary DDM model and the sensitivity analyses are similar and therefore we focus our discussion on the results derived from our primary DDM model. Nevertheless, we have also listed the data sources we considered for our sensitivity modelling in the table below (flagged in italics).

[99] Bank of England (2017), Quarterly Bulletin, An improved model for understanding equity prices, p8.

Table 16 DDM and Glider data sources

Data item	Data item name	Data fields and granularity	Data provider
Expected equity cash flow	FTSE Allshare index, analyst dividend yield consensus estimates	Monthly	Bloomberg
	Buyback yields	Calculated from shares buyback actual yields, at a monthly frequency	Bloomberg
Current index price	FTSE Allshare total returns index	Actual last price, at a monthly frequency	Bloomberg
	FTSE 100 total returns index (sensitivity)	*Actual last price, at a monthly frequency*	*Bloomberg*
Short-term growth rate (f), used for dividend growth in the first 3 years	Dividend 3 year forward rates	Calculated from analyst forecasts, at a monthly frequency	Bloomberg
	Blended rate from 3 sources (sensitivity)	*Nominal GDP growth, at a monthly frequency*	*HMT* *Bank of England* *IMF*
Long-term growth rates, used for dividend growth in perpetuity after 3 years (g)	Long run nominal GDP growth forecast	Monthly	IMF
Risk free rate	Nominal UK gilt spot curve for 20 year maturity	Monthly	Bloomberg

Source: Frontier Economics