



Use of Market-to-asset ratios (MARs) as a cross-check in the context of regulatory price controls

Report for Water UK

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Glossary

AER	Australian Energy Regulator
AMP	Asset Management Plan
CAPM	Capital Asset Pricing Model
CMA	Competition and Markets Authority
CoD	Cost of Debt
CoE	Cost of Equity
DCF	Discounted Cash Flow
DNO	Distribution Network Operator
EV	Enterprise Value
GDN	Gas Distribution Network
IMH	Inelastic Market Hypothesis
MAR	Market-to-Asset Ratio
MFM	Multi-Factor Model
NPV	Net Present Value
ODI	Output delivery incentive
Ofgem	Office of Gas and Electricity Markets
PAYG	Pay As You Go
PR	Price Review
RCV	Regulatory Capital Value
RoRE	Return on Regulated Equity
SVT	Severn Trent
TV	Terminal Value
UKRN	UK Regulators Network
UU	United Utilities
WaSC	Water and Sewerage Company
WoC	Water only Company

Important notice

This Report has been prepared by KPMG LLP ('KPMG', 'we' or 'our') for Water UK on the basis of an engagement contract between Water UK and KPMG (the "Engagement Contract"). Water UK commissioned the work to assist Water UK in its considerations regarding Ofwat's Draft Methodology Consultation for the Price Review 2024 (PR24). The agreed scope of work is set out in Section 1.1 of this Report. Water UK should note that our findings do not constitute recommendations as to whether or not Water UK should proceed with any particular course of action.

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Executive summary

Context and objectives

In July 2022, Ofwat published its Draft Methodology for the 2024 price reviews, which sets out how Ofwat will determine the allowed revenues for water companies from 2025 to 2030. Ofwat proposed to rely on Market to Asset Ratios (MARs) as the main cross-check in determining its allowed cost of equity. Ofwat stated that it considers MARs to be important, given the readily available share price for some water companies and some data available on the pricing of equity stakes in private transactions of regulated water companies.

KPMG has been commissioned by Water UK to review and explore the use of MARs as a cross-check on the cost of equity in the context of regulatory price controls, to help inform Water UK's consultation response to the draft methodology. This Report investigated the appropriateness of using MARs to inform the allowed rate of return and in particular:

- examined MARs by reference to the first principles, compared them to other potential cross-checks against a set of criteria for good regulation;
- explored the extent to which MARs, as an indicator, meet the requirement for efficient pricing, particularly in reference to efficient market theory, to test if they could provide an unbiased and efficient estimator of the required return; and
- analysed market evidence on MARs and their characteristics in market data to assess the information embedded in MARs in practice.

Regulatory precedent

The use of MARs as a cross-check has been tested at recent regulatory determinations for water and energy industries in GB, by Ofwat, Ofgem and the CMA. There was also a parallel consideration of the issue by the Australian Energy Regulator in determining its rate of return instrument.

MARs have been considered by regulators as a tool to inform the allowed rate of return because they provide independent market information about the value of regulated companies, which, in turn, is assumed to be linked to companies' returns. MARs rely on the data that is often publicly available, and, in some instances, even time series data covering longer periods of time.

Despite these apparent features, the regulatory precedents involve many stakeholders, including academics, noting significant limitations of MARs and specific problems with using and interpreting this data to inform regulatory determinations of the allowed returns. In the circumstance when it is relied on, as a sense check, for regulatory determinations, it was associated with lacking precision, likely biases, and the risks of wrong interpretation based on unsupported hidden premises and assumptions. Still, some regulators argued that after controlling for various factors, there is still useful information that can be inferred from MARs.

In Australia, it was deemed inappropriate to use MARs to inform regulatory precedents due to the level of subjectivity and uncertainty in the assumptions used to disaggregate the observed ratios. MARs have also not been used deterministically to inform the cost of equity estimate by the CMA in the latest RIIIO-2 determinations, but were recognised as one possible cross-check in a suite of others, albeit not one exclusively to rely on.

On the PR19 water re-determinations, the CMA emphasised problems with MARs and did not use them to estimate the required returns.

Criteria for cross-checks

A good, unbiased, precise and independent cross-check can be an effective tool in an economic regulator's toolkit to assist in the calibration of regulatory determinations. However, not all cross-checks are effective and robust. Therefore, there is a need to assess each cross check against a set of relevant criteria that can distinguish between them and inform a view on their strengths and effectiveness. This report provides a synthesis on MARs by assessing MARs against a clear set of criteria to conclude on that basis whether MARs can be relied upon to inform the estimates of the required returns for the sector.

In developing the cross-check criteria, a four-step process was followed to identify principles that could characterise a regulatory tool. The process reviewed the existing regulatory guidance such as the principles of good regulation,¹ the UK regulated networks' cost of capital principles,² the context and issues that regulators (CMA, Ofgem and Ofwat) have historically considered when using cross-checks in making their regulatory determinations and finally a step to consolidate and distinguish between principles that could characterise a regulatory tool versus ones that would describe how a regulator regulates.

Based on this process, a defensible cross-check would be transparent, targeted, objective, incentive compatible, and consistent with regulatory precedent and academic literature.

It is important to acknowledge that any cross-check is subject to limitations, and it is unlikely that a single cross-check would perfectly satisfy all five elements of the criteria. The criteria are intended to guide the assessment and ensure that a given cross-check is as robust and effective as possible. The criteria developed in this Report are then used to assess MARs and other cross-checks.

The use of MARs

For water price control determinations, the use of MARs has been explored in PR14,³ PR19⁴ and now in PR24⁵ to test the estimate for the cost of equity. While MARs are a market-based measure of the expected cashflows of the firm versus its regulatory capital value, which is largely driven by investors' expectations, this Report explores whether a MAR that is above or at 1 can be relied upon deterministically or with some level of precision and confidence to decide on a lower or higher allowed cost of equity sector-wide.

We consider the robustness of MARs from a top-down perspective, being informed by academic research and empirical evidence. This view is later supplemented with the detailed bottom-up quantitative analysis.

For MAR to be 1, the enterprise value for a regulated network must reflect the present discounted value of the allowed cashflow and the allowed rate of return must be equal to an investors' assumed cost of capital. If it is assumed that a business's operational performance (totex and output delivery incentives), economic conditions and finance assumptions will be precisely consistent with the current and future regulatory regime and allowances over the valuation period, then the market value of the business will be equal to the RCV, which results in a MAR of 1 and neutral NPV.⁶ However, in practice, these assumptions are not plausible and do not hold, particularly in the context of incentive-based regulation, where

¹ Better Regulation Task Force, Principles of Good Regulation available [here](#). Ofwat must have regard to these principles according to the Water Industry Act 1991 Section (2)

² UKRN, Cost of capital and price controls. See [here](#).

³ CMA, PR14 Bristol Water – Final decision, p.336.

⁴ CMA, PR24 Anglian Water Services, Bristol Water plc, Northumbrian Water Limited and Yorkshire Water Services Limited price determination – Final report, p.1087.

⁵ Ofwat, PR24 Draft methodology – allowed return on capital – Appendix 11, July 2022, p.24.

⁶ Oxera, 'Do market-to-asset ratios provide reliable evidence on the cost of capital? Note prepared for gas distribution networks', 2007.

companies are incentivised to outperform on the regulatory allowance for the benefit of consumers.

All factors that might affect the market price or the enterprise value—and assumed performance scenarios for these factors—are estimated with uncertainty in future periods. This means that isolating the contribution, or ‘peeling away’ from assumed outperformance on the allowed cost of equity is inherently difficult and needs to be interpreted with caution.

Market efficiency is also an important consideration in terms of the robustness and reliability of the pricing signals embedded in traded and transactions-based MARs. In markets that are not fully efficient, selective observed price signals often do not reflect a fair market value of assets (single market price), and so cannot be relied upon to inform estimates of such prices.

Transactions of non-listed companies are very infrequent and suffer from a significant selection bias as to when they occur, and which assets are traded. They do not reflect the true underlying market price that would be revealed from continuous, efficient and liquid market, as opportunities arise on a sporadic bespoke basis at isolated points in time carefully chosen by the sellers, which results in a significant selection bias. The ability of private transactions’ MARs data to explain the fundamentals of a particular asset, including the regulatory price control parameters determining its cash flows, not to mention informing specifically a single input parameter, is therefore significantly compromised.

Empirical and academic evidence suggests that public stock markets are much more efficient than the private markets, but still exhibit varying degree of inefficiencies due to supply-demand imbalances, exposure to economic and market cycles, low demand elasticity and behavioural biases. It is near-impossible to determine to which extent the stock price at a particular point in time is affected by these factors. Drawing conclusions from traded MARs about an investor-assumed discount rate is not sufficiently robust without appropriate adjustments that ensure that MAR reflects only the fundamental value drivers.

Given that there are many factors that could influence MARs, several of which are very difficult to measure (such as management quality, behavioural biases), it is not possible objectively to strip out the effects of all these other drivers and isolate the implied cost of equity with any degree of precision. This is consistent with the academic literature, which notes that market prices, or the enterprise value, of firms are endogenous and are affected by many factors that make it difficult to find a relation between valuations and transactions.⁷

The complexity increases further, when observing private transaction MARs, as there are additional factors that are likely to influence the MAR values in such transactions. These factors include the dynamics of a private auction set up and including winners’ curse, implications of private value, management biases, and control premia and capturing a non-representative one-time snapshot that is affected by the economic situation of the specific time chosen for the transaction. In addition, private transactions could be highly confidential, and the information is not available in a timely and transparent manner.

All these factors create the complexity and uncertainty that ultimately undermines reliability of the approach based on peeling away all relevant drivers to isolate the impact of a single parameter (the allowed rate of return) on MARs.

Quantitative analysis

Quantitative analysis presented in this report considers whether, based on the bottom-up, stylised sensitivity analysis and actual MARs’ data decomposition, it is possible to arrive at a single conclusion about a given input parameter (even if it is a range), or whether it can support multiple and diametrically opposite conclusions that can be derived from the same data, subject to assumptions about the underlying investor inputs including their required

⁷ Habib and Ljungqvist, Firm value and managerial incentives: a stochastic frontier approach – Journal of Business, 2005.

return on equity. The bottom-up analytical approach numerically confirms the conclusions arrived at when exploring MAR challenges from a top-down perspective.

We examine, using a quantitative analysis, MARs from three perspectives: first, a sensitivity analysis of the enterprise value and MARs to the various regulatory parameters; second, a review of the drivers of recent transaction MARs, based on the publicly available data; and finally, a view of equity analysts on the observed traded MARs, including their key drivers, based on the published broker reports.

To analyse the sensitivity of MARs to common regulatory and valuation assumptions, the report presents a sensitivity analysis that tests the impact of regulatory and valuation variables. This is aimed at understanding the scenarios that contribute to MAR being greater than 1, particularly when comparing the impact of investors' discount rate to other regulatory levers.

At a high level, the analysis concludes that it is possible to have MAR above 1 even if the discount rate exceeds the allowed cost of equity, with other variables contributing to the upward valuation. The analysis also shows that it is not possible to estimate the impact that changes in the discount rate make on MAR with any degree of accuracy, unless there is certainty about all the other assumptions related to operational and valuation assumptions over the valuation period.

Considering private transactions, it is observed that they generally exhibit significant premia to RCV, largely through the bidder-specific prices for a given asset. It is noticeable that the implied MARs from private transactions are mostly higher than the traded companies' MARs. This supports the conclusion that various factors affecting private transactions mentioned above (selection bias, timing, private value, auction design, etc.) have a significant impact on prices.

The review of analysts' sum-of-the-parts valuations on the traded water companies, Severn Trent Group (SVT) and United Utilities (UU), since March 2021 shows a wide range of assumptions about the contribution to each company's total enterprise value from different sources, including an estimated premium to RCV, the non-regulated and retail businesses, and any pension surplus or deficit. Decomposing the average observed MAR with the range of these components indicates that the underlying regulatory MAR varies from 0.88 to 1.30 for SVT and from 0.74 to 1.18 for UU.

This broad range of values provides uncertainty as to the consistency and repeatability of the underlying assumptions that are used to derive the RCV premium. There are also broad ranges for the component parts. For example, a consolidation of analysts' report derives a range of 1.01 to 1.11 and 1.00 to 1.10 for the impact of non-regulated businesses on MAR for SVT and UU respectively. This indicates that there is neither a consistent view about the total value and therefore the implied MARs that can be used as a starting point, nor are there consistent views about the decomposition of the observed MARs into constituent value drivers.

Evaluation of MARs and other cross-checks against the established criteria

Based on this information and analysis, the use of MARs as a regulatory cross-check for the allowed return on equity has been assessed against the five criteria identified above:

- **Transparent**, whether the approach uses widely observed information, which gives replicable results. On this basis, as while the input information to derive traded MARs is generally available, that for transactions MARs is not (especially in the case of private companies), it appears that MARs only **partially** fulfil the criterion of transparency.
- **Targeted**, whether the indicator can accurately isolate the desired effect from other factors. The target of the cross-check in this instance is to assess and provide a

measure of whether the allowed return on equity is sufficient, but not excessive. However, there are many unknowns in the determination of a company's value, and the calculated MAR cannot be solely attributed to a difference in investors' assumed return of equity from the allowed return, suggesting that MARs **do not** meet this criterion.

- **Objective**, whether the cross-check can be relied upon as an unbiased indicator. Transaction MARs are by their nature biased towards the winning bidder's aims, assumptions, and strategic advantages. Traded MARs (when taken in aggregate rather than one individual assessment) do reflect a much broader set of market expectations and assumptions for the company and could thus be considered to having a wider, more informed view of the various valuation assumptions. In this regard it would suggest that MARs **do partially** meet this criterion.
- **Incentive compatible**, whether the indicator could distort regulatory incentives. The application of MARs by the regulator to revise the allowed cost of equity (whether up or down) could cause regulated companies to behave in ways which were not intended and not in the best interests of consumers. Specifically, if it was feared that any outperformance – whether in totex, ODIs, or financing – which pushed the company's MAR above 1 would subsequently result in a further reduction in the allowed cost of equity, this could further dampen incentives for improved performance as companies may fear that any rewards gained during a price control will be clawed back in part at the next price control through a reduced cost of equity. This potential ratchet effect would tend to suggest that MARs are **not** incentive compatible as a cross-check.
- **Consistent**, whether the indicator is consistent with established regulatory precedent and academic research. MARs have been adopted and accepted as a cross-check on a varying basis over time by regulatory authorities, however only as one of a broad suite of other cross-checks. Academic literature and research has been generally clear that MAR cannot be used to observe cost of equity without controlling for other factors which influence companies' values. On this basis, while MARs have been occasionally used by regulators as a cross-check among other indicators, the academic dismissal of them as a basis for the cost of equity would suggest that they **partially** meet the consistency standard.

A comparison of MARs against other potential cross-checks for the cost of equity, specifically multi-factor models (MFMs), financeability tests (as conducted by the CMA), hedge ratios and quantification of risk exposure, has also been undertaken. This has been carried out at a high-level to provide an indication of whether there are other cross-checks that might be more appropriate than MARs.

In general, the assessment suggests that there are better options than MARs for use as cross-checks on the allowed cost of equity in regulatory price control determinations. There is a risk that if MARs are used to inform the allowed cost of equity, mainly based on the most recent private transactions or from listed utilities in GB, this may be incentive incompatible and may result in an estimate of the required rate of return on equity that is biased.

Overall, the analysis presented in this Report leads to the conclusion that the use of MAR as a cross-check is unlikely to assist regulators in determining an allowed cost of equity estimate in an unbiased and efficient way, one that facilitates investments, while furthering consumers' interests.

1 Context

In July 2022, Ofwat published its Draft Methodology for the 2024 price control reviews (PR24).⁸ The Draft Methodology sets out Ofwat's proposal for how it will set the allowed revenues for water companies from April 2025 to March 2030.

As per previous price reviews, Ofwat has indicated that it will use the Capital Asset Pricing Model (CAPM) to derive a cost of equity estimate. Ofwat has now also indicated that it may consider Market-to-Asset Ratio (MAR) ratios reported in the market as a cross-check in deriving the allowed cost of equity. This must concern MARs as reported in the media because MARs on many transactions are either not in public domain or not possible to verify.

Ofwat has stated that it considers MARs to be an important cross check, given share prices available for some water companies and (some) information available on the pricing of equity stakes in private transactions of regulated water companies.⁹

MAR is the ratio of the enterprise value (EV) of a company to its regulatory capital value (RCV). The EV can be derived from the observed share price or from the value of the transaction if and when reported in the media or otherwise revealed. MAR is effectively a special form of the market-to-book ratio, which is used in corporate finance as one valuation metric.

For PR24, Ofwat proposes to use MAR analysis as evidence that could support an adjustment to the CAPM-derived mid-point estimate of the allowed return on equity. Ofwat notes that there should be a high evidential bar to move away from the mid-point estimate. As part of its methodology consultation, Ofwat's Q7.4 requests stakeholders to respond whether they agree with the proposed approach in setting allowed return on equity.¹⁰

1.1 Scope

KPMG has been commissioned by Water UK to assess the potential suitability of MARs as a cross-check on the allowed rate of return in the context of regulatory price controls, to inform Water UK's response to the draft methodology. This report examines:

- the level of consistency between the theoretical model and the real-world valuation of assets, which includes an exploration of why MAR may vary from 1;
- the advantages and challenges of drawing inferences from MAR, based on general theory and specifically from occasional private transactions and share prices; and
- a quantitative analysis, which explores the extent to which the allowed rate of return can be linked to MARs given different contributors to MARs for listed entities and in private transactions.

1.2 Structure of this report

This report is structured as follows:

- **Section 1** sets out the context, scope and precedent surrounding the use of MARs in regulatory determination.

⁸ The Draft Methodology is out for consultation with a closing date of 7th September. See <https://www.ofwat.gov.uk/consultation/creating-tomorrow-together-consulting-on-our-methodology-for-pr24/>.

⁹ Ofwat, PR24 - draft methodology – allowed return on capital – Appendix 11, July 2022, p.24.

¹⁰ Ofwat, PR24 - draft methodology – response template, July 2022.

- **Section 2** identifies criteria that could be used to assess suitability of cross-checks for determining the allowed rate of return.
- **Section 3** explores whether MAR could be used to inform the allowed rate of return, how this relationship is reflected in the economic theory and in the real world. This section draws on academic literature review and considers also various consultants' reports on the matter.
- **Section 4** quantifies the potential determinants of MAR values as a result of the considerations identified previously. This section presents the results of a stylised sensitivity analysis which tests the impact of different regulatory and valuation assumptions, including equity discount rate, on the modelled MAR for a hypothetical water company. In addition, it considers two listed water companies' traded MARs and the range of analyst reports' views on the various value contributions (such as the impact on non-regulated business, retail premium, etc) on the observed MAR values, and some recent transaction MARs in the regulated utilities sector.
- **Section 5** concludes the report by assessing MAR against the cross-check criteria from Section 2. This section also considers how MAR compares to other cross-checks.

1.3 Regulatory precedent

It is commonplace for economic regulators, in the UK and internationally, to rely on various sources of evidence to support and test the reasonableness of their modelling and the associated forecasts in making their regulatory price determinations. The use of a cross-check as supporting evidence on the bottom up derivation of the cost of capital estimate can sometimes provide further confidence that an estimated variable is reasonable and reflects updated and relevant information; equally it could introduce a bias and result in wrong estimates.

The use of MARs as a cross-check has been explored and tested at recent regulatory determinations for water and energy industries in GB. Similarly, there was a parallel consideration of the issue by the Australian Energy Regulator (AER) in determining its 2018 binding rate of return instrument for gas and electricity regulated networks.¹¹

This section sets out the regulatory precedents of the use of MARs in the price setting process.

RIIO-2 methodology consultation

For the RIIO-2 sector specific methodology consultation in 2018, Ofgem noted that it exercised some caution when considering MARs. First, as there may have been limited information in listed share prices as these stocks could have, particularly in the short run, been influenced heavily by wider market "noise". Second, as noted in the UKRN Study, any premium on corporate transactions could, at least in part, reflect (i) a control premium; or (ii) a winner's curse.¹²

RIIO-2 final determinations

For the RIIO-2 final decision for transmission and gas distribution, Ofgem considered MAR to be a strong piece of evidence, when having regard to trading premiums for UU, SVT, National Grid (NG) and SSE. Ofgem inferred that based on the traded MARs either the actual cost of equity was below estimates and/or there was an expectation that companies

¹¹ AER, Rate of return guidelines – explanatory statement, July 2018. Please note that MARs are referred to as regulatory asset base (RAB) multiples in Australia.

¹² Wright, Burns, Mason and Pickford (2018), Estimating the cost of capital for implementation of price controls by UK Regulators (CGL1/C/22), page 13.

would outperform. It re-iterated that cross-checks should be applied carefully and weighted appropriately but disagreed that no weight can be placed on them at all.¹³ Ofgem's MAR cross-check, alongside other cross-checks, supported an estimate for the cost of equity below the mid-point estimate. Despite this, Ofgem decided to allow a cost of equity above the mid-point but stated that the cross-checks provided it with confidence that its estimates were appropriate.

CMA appeals on RIIO-2 final determinations

As part of the appeals regime for energy, which is merit-based and different to the water industry, several regulated networks¹⁴ highlighted incorrect inferences from Ofgem's use of MAR, such as that a MAR greater than 1 did not imply necessarily that the allowed rate of return was above the company's cost of capital.¹⁵ Ofgem opined that MARs were not perfect but could provide a powerful directional cross-check. It added that the reliance on a range of cross-checks was something that the CMA was unable to do for PR19 redetermination, given the information at the time.

The CMA concluded that Ofgem was not wrong to use MAR as a cross-check for its cost of equity estimate. The CMA recognised various problems with making inferences from MARs for the allowed rate of return but agreed that Ofgem's cross-check indicated that Ofgem's allowed return on equity was not too low.¹⁶

Australian rate of return determination

In Australia, as part of the development of the binding rate of return instrument in 2018, the AER considered and consulted on the use of MARs (also referred to as RAB multiples) as a cross-check for its allowed rate of return.¹⁷ This included the consideration of input from expert evidence, consumer groups, Energy Networks Australia and regulated networks.

The AER decided not to rely on MARs, given the level of subjectivity and uncertainty in the assumptions used to disaggregate observed ratios. It concluded that it was not appropriate to inform its rate of return forecast. The AER deduced that there was a need to control for many factors, including any interaction between them, such as outperformance of expenditure, unregulated revenue, control premium, possible over-optimism of assumptions and the economic circumstances at the time of the transaction.¹⁸

UK Regulators Network (UKRN) cost of equity study

As part of the UKRN cost of equity study in 2018,¹⁹ Phil Burns undertook a MAR analysis (also referred to as bid premia) on the contemporaneous energy network transactions. He cited several factors that could contribute to the observed premium including outperformance on costs, outputs, cost of debt, financial restructuring, tax arbitrage²⁰ as well as cost of equity outperformance. Burns also noted that premia may result from unobserved investor assumptions that may be considered unrealistic or optimistic but are nevertheless the reality behind the premia. Burns concluded that:

¹³ Ofgem, RIIO-2 Final determinations – Finance Annex, 3 February 2021, page 54.

¹⁴ Cadent Gas Limited, National Grid Electricity Transmission plc, National Grid Gas plc, Northern Gas Networks Limited, Scottish Hydro Electric Transmission plc, Southern Gas Networks plc and Scotland Gas Networks plc, SP Transmission plc, Wales and West Utilities Limited.

¹⁵ CMA, [Final determination – Volume 2A: Joined Grounds: Cost of Equity](#), 28th October 2021, page 203.

¹⁶ CMA, [Final determination – Volume 2A: Joined Grounds: Cost of Equity](#), 28th October 2021, page 222

¹⁷ AER, Rate of return guidelines – explanatory statement, July 2018.

¹⁸ Ibid.

¹⁹ Wright, Burns, Mason and Pickford (2018), Estimating the cost of capital for implementation of price controls by UK Regulators (CGL1/C/22), specifically Appendix J.

²⁰ Burns noted that Evidence from MARs for quoted pure-play utilities are generally not subject to the issues of control premium and winner's curse, though there remains the challenge of understanding the unobserved investor assumptions.

“fundamentally, the analysis highlights the challenges that arise in seeking to use transaction premia evidence to make inferences about the cost of equity...Overall, evidence from transaction premia is less reliable and much harder to interpret than other sources of evidence on the cost of equity.” [emphasis added]

In the same UKRN study and in the context of relying on CAPM-WACC to determine the regulated return, Wright et al argue that even though regulated companies have achieved efficiency gains, for consumers’ benefits, the magnitude of the observed premia suggests that the market assess the returns to not be commensurate with the risks. They note that the market likely expects this situation to persist into the future.

PR19

For PR19, Ofwat’s draft methodology indicated that market expectations about equity returns could be drawn from MARs.²¹ Ofwat pointed to evidence from listed companies (UU and SVT) to say that trading premia are not explained by outperformance alone. The analysis was support by a PwC report.²² In the PR19 final determination, Ofwat used MAR evidence (c.15% premium over RCV for UU and SVT) to indicate that the package (including the rate of return) is stretching but achievable.

Ofwat indicated that MARs indicate outperformance potential for companies, both for the top performers and their peers.²³ This was subject to a CMA redetermination, as part of the appeals regime. This is the last relevant regulatory precedent for water companies. The CMA did not give MAR analysis weight in coming to a final view on the point estimate for the cost of capital noting that it remained “cautious about using market prices to determine the point estimate for the cost of equity or overall cost of capital”.²⁴

The CMA highlighted the difficulties in correctly interpreting MAR data and has acknowledged that there is a wide range of reasons why prices may rise and fall over time.²⁵ The CMA referenced Europe Economics’ analysis, which estimated a MAR premium of 2 per cent for United Utilities and 18 per cent for Severn Trent, the wide range raised doubt as to whether that premia alone implies that the allowed cost of equity should be higher or lower than determined. In addition, the CMA also noted concerns with relying on methodologies that consider outperformance over one or two price control periods rather than long-term cashflow of a water company.

On balance, the CMA concluded that MARs did not present sufficient evidence of the WACC estimate’s appropriateness for the entire water sector.

PR14

For PR14, the CMA considered MARs as a potential crosscheck in its re-determination for Bristol Water. The CMA stated that “[in] principle, the market prices of asset transactions relative to the regulatory asset value (either M&A activity or traded share prices) can also provide an indication of the value of the cost of capital as a whole, and in particular whether the cost of equity appears to be consistent with observed market”.²⁶

However, the CMA noted that in considering MARs, there are a number of assumptions that are required, the largest of which are: (a) investor assumptions on future trends in the cost of capital beyond the current review; (b) investor assumptions on the potential for outperformance on other aspects of the regulatory framework; and (c) implied values for

²¹ Ofwat, PR19 Draft methodology, Appendix 10, page 15.

²² PwC report on refining the balance of incentives for PR19, page 87.

²³ Ofwat, PR19 final determination – allowed return on capital – technical appendix, p.27.

²⁴ CMA (2021), PR19 Final Report (CGL2/7), para. 9.1358

²⁵ CMA (2021), PR19 Choosing a point estimate for the Cost of Capital – Working Paper (CGL1/C/36), para.90)

²⁶ CMA, Bristol Water plc – A reference under section 12(3)(a) of the Water Industry Act 1991 – report, 6th October 2015, para 10.201.

other parts of the business, where the traded shares include both unregulated and regulated businesses.

The CMA noted that there are a number of reasons why investors may value assets at figures greater than that implied by the RCV and did not use MARs to make any explicit adjustment to its estimates for the allowed cost of equity. However, the CMA did state that it received some comfort from the fact that the ratios it considered indicated that the allowed cost of capital for Bristol Water was consistent with its statutory duties.

Summary

Based on the regulatory precedents, some regulators have tried to use MARs as one of a range of overall cross-checks, despite many stakeholders highlighting problems with this approach, noting their limitations, and general recognition that any conclusions drawn must be treated with caution and careful consideration.

It appears that all parties recognise MARs' limitations in informing the allowed rate of return. This includes lack of transparency as all the data required to draw such inferences is almost never available; subjectivity, as it is affected by other factors such as control premium or unregulated businesses; the uncertainty in the assumptions used to disaggregate observed ratios; the difficulty in interpreting the observed values; potential presence of optimistic or unrealistic investors' assumptions or 'noise' that could not be observed and finally its degree of reliability. At the same time there is certain apparent appeal of MARs as direct market evidence that regulators are keen to explore.

Regulators have used MARs on occasions to respond to criticisms that the allowed rates of return they set are too low. In the regulatory precedent, MARs have not been used deterministically to inform the cost of equity estimate and the analysis of precedents indicates that, when MAR as a cross-check was used, it was always heavily criticised by at least some stakeholders and was used as a part of a cross-check suite rather than on its own.

Overall, contrary to other methods such as CAPM, precedents indicate that there is no consensus on either the use of MARs to inform the allowed rate of return, or the method that should be employed in such an analysis.

2 Criteria for evidence to inform setting of allowed rate of return

One of the common objectives of public utility regulation is to ensure that investors are sufficiently remunerated, but not more than necessary, for the funds they provide to a regulated firm.²⁷ This ensures that investors have adequate incentives to invest in regulated public utilities, but consumers are not paying more than required for the services they receive.

Regulators rely on a range of cross-checks to come to their view of elements that make up regulated companies' allowed rate of return, as a way to test the robustness of their estimates. For example, Ofgem used the Modigliani-Miller cost of equity inference and MARs to support its cost of equity estimates in the RIIO-2 determinations for gas distribution and gas and electricity transmission networks.²⁸ Other forms of cross-checks, which were used to sense check cost of debt, include relying on alternative forecasting approaches, such as the use of a bottom-up approach (balance sheet approach) to test a top-down approach (benchmark index approach).²⁹

Cross-checks can be an effective tool in an economic regulator's toolkit to assist in the calibration of regulatory determinations. However, not all crosschecks are effective, accurate, or unbiased. Therefore, there is a need to develop a set of criteria that can distinguish and judge the reliability and effectiveness of different cross-checks.

The cross-check criteria can be developed to check if the evidence can be relied upon to support many estimates, including the cost of equity. The principles identified aim to be robust, defensible and in line with established economic regulatory framework. The process for developing the criteria used in this report was as follows:

First, we had regard to existing regulatory principles, particularly best practice guidance that is legislated in the current water economic regulation framework. The principles of good regulation, that are prescribed in legislation include the following: **proportionality**, **accountability**, **consistency**, **transparency** and **targeting**.³⁰ The essence of three of these principles is relevant for consideration of robustness and effectiveness of cost of capital cross-checks.

Second, we considered the principles that UKRN have regard to in determining the cost of capital, which are designed to ensure that regulators take an effective and efficient approach in setting the cost of capital in all their respective sectors. The cost of capital principles include **consistency** between regulators, being **risk reflective**, whereby the reward reflect the allocation of risk, relying on **evidence**, facilitating **investment** in the interest of consumers, being clear and transparent in **communication** and **review** the principles and approaches regularly so that they are in line with **good practice**.³¹

Third, recent regulatory determinations were reviewed, such as decisions by Ofwat, Ofgem and the CMA, to infer how cross-checks were used, the intent and the context surrounding their use. The review provided guidance on the current issues, including contention surrounding their use and the resulting outcomes. For example, in the CMA's RIIO-2 final decision on the cost of equity, concerns around cross-checks related to lack of transparency,

²⁷ This is in reference to the financing duty of Ofwat. Water Industry Act 1991 Section 2.

²⁸ CMA, Final determination: Volume 2A: Joined Grounds: Cost of equity, October 2021.

²⁹ Ofwat, PR19 final determinations – Allowed return on capital technical appendix, December 2019.

³⁰ Better Regulation Task Force, Principles of Good Regulation available [here](#). Ofwat must have regard to these principles according to the Water Industry Act 1991 Section (2)

³¹ UKRN, Cost of capital and price controls. See [here](#).

their interdependence on the variable they are intended to assess or their inconsistency with regulatory precedent.³² Relying on recent regulatory determinations means that the criteria is contemporaneous and is in line with regulatory best practice.

Fourth, a cross-check is a regulatory tool that would support the mechanism that discharges regulators' financing and consumer duties. The focus was to consolidate and identify the principles that would characterise a regulatory tool rather than what would describe the manner with which a regulator regulates (i.e., the principles of proportionality and accountability were deemed to be more pertinent to the regulator's approach to economic regulation rather than a regulatory tool criterion).

Based on the four-step process above, the developed set of criteria below is objective and can be used to evaluate cross-checks in any upcoming price control review. The test used is whether a given cross-check would be:

- **Transparent** in that it would use information that can be widely observed and verified, and the results can be replicated consistently, including its approach and calculation methodology. For a cross-check to be transparent, any of the underlying calculations and mechanics need to be traceable, verifiable and the variation in outcomes (if any) explainable by reference to plausible and defensible assumptions. Transparency is an important element of the criteria as it ensures that all parties understand how any given assumptions influence a cross-check, which is in line with clear and transparent regulatory determinations.
- **Targeted**, which is the extent to which the indicator can isolate the effect in question from other factors and can therefore give accurate results. It would mean that there is limited to no doubt that the cross-check is assessing what is supposed to be assessed. Significant associated noise, surrounding the assessed variable, would render it difficult to distinguish between what is being measured and other non-relevant factors and would not be robust justification and evidence. In addition, it would provide an indication of accuracy, or how close the observed value is to the true value.
- **Objective** and can be relied on as an unbiased indicator. Objectivity ensures that the cross-check's underlying assumptions do not skew towards a specific pre-determined outcome and that there is a degree of independence between the cross-check and the variable that it is intended to assess.
- **Incentive compatible**, particularly whether it is compatible with regulatory objectives, one that facilitates investment in consumers' interests. Incentive based regulation is based on a series of carefully calibrated incentive mechanisms applied to costs and service levels. All incentives are designed to provide an economic motivation for companies to apply additional effort where the cost of that effort is less than the benefit to consumers. This aligns incentives between consumers and network companies to promote overall welfare gains for both. An indicator that is likely to distort incentives, or one that is associated with a ratchet effect,³³ or discourage investments in infrastructure that consumers want is unlikely to be incentive compatible.
- **Consistent** with established regulatory precedent and academic research. Consistency as a principle is largely based on the principles of good regulation, cost

³² For example, the use of nominal gilts as cross-check to estimate and the use of SONIA swap as a cross check for the RFR. See CMA, Final determination: Volume 2A: Joined Grounds: Cost of equity, October 2021

³³ Ratchet effect is a term that is used to describe the approach of using current performance as a partial basis for setting future targets, which creates a dynamic incentive problem for the enterprise. Martin L. Weitzman, [The "ratchet principle" and performance incentives](#), the Bell Journal of Economics.

of capital principles and is an important consideration for investors, regulated entities, and regulators alike. It ensures that cross-checks would be used in a predictable way that provides certainty and stability to those who are regulated. It would also provide confidence that regulatory approaches are best practice, or in the case of new regulation that it considers international precedent if any.

The criteria set out above are used to evaluate MARs and also to compare them with other forms of cross-checks (such as multi-factor modelling and financeability) in Section 5 of this report.

Finally, it is important to acknowledge that any cross-check will be necessarily subject to limitations, and it is unlikely that a single cross-check could fully satisfy all five criteria. The criteria used are intended to guide the assessment and ensure that a given cross-check is sufficiently robust that it can be reasonably relied upon without the risk of introducing additional bias or noise to the estimates.

3 The use of MARs

This section assesses the potential suitability of MARs as a cross-check on the allowed cost of equity in the context of regulatory price controls. It sets out the determinants of MARs, based on theory and practice, and also considers economic fundamentals, such as market efficiency and the design of auctions and how these could affect the observed MAR values.

For water price control reviews, the use of MARs has been explored in PR14,³⁴ PR19³⁵ and now in PR24³⁶ to test the estimate for the cost of equity.³⁷ MARs have been considered by regulators as a tool to inform the allowed rate of return because they appear to provide independent market information about the value of regulated companies, which, in turn, must be linked to companies' returns. Some of their benefits include the reliance on data that is publicly available, and, in some instances, time series data covering longer periods of time. However, regulatory precedent has noted MAR's limitations, and suggested that conclusions are drawn with caution and careful consideration.

Therefore, this section explores whether a MAR that is above or at 1 could be actually relied upon deterministically to inform on a lower or higher cost of equity, having regard to the determinants of MAR and the relevant cross-check criteria.

3.1 Determinants of MAR

3.1.1 Theoretical framework of MAR

MARs are the ratios between the observed enterprise value (EV) of a company and its regulatory RCV. It is derived by having regard to standard corporate finance and the regulated companies' building block model. MARs could be deduced from either the outcome of singular private transactions (**transaction MARs**) or based on utilities that are listed stocks, which is subject to continuous trading by multiple market participants (**traded MARs**).

Standard corporate finance theory – Equation 1

One of the common ways of valuing an asset is by reference to the discounted cashflow over time. For each annualised cashflow for year i , CF_{t+i} , there is a corresponding cost of capital $R_{t \rightarrow i}(CF_{t+i})$. The EV is the discounted value of the expected future cashflows, which reflects the amount that a rational investor should pay to acquire an asset:

$$EV_t = \frac{\text{Annual Cashflow}}{\text{Cost of Capital}} = \sum_{i=1} \frac{E_t(CF_{t+i})}{(1 + R_{t \rightarrow i}(CF_{t+i}))^i}$$

This means that enterprise value of a firm or a company is equal to the sum of all future cashflows, which is discounted by the investors' cost of capital.

Regulated network building block model – Equation 2

For regulated utilities, the revenue allowance of a regulated firm is determined using the RCV. It reflects the amount that the regulated network owes to its investors, where $AROR_{t \rightarrow i}(CF_{t+i})$ is the allowed regulated rate of return.

³⁴ CMA, PR14 Bristol Water – Final decision, p.336.

³⁵ CMA, PR24 Anglian Water Services, Bristol Water plc, Northumbrian Water Limited and Yorkshire Water Services Limited price determination – Final report, p.1087.

³⁶ Ofwat, PR24 Draft methodology – allowed return on capital – Appendix 11, July 2022, p.24.

³⁷ Ofwat, PR19 final determination – allowed return on capital technical appendix, p.27.

$$RCV_t = \frac{\text{Annual Cashflow}}{\text{Allowed regulated rate of return}} = \sum_{i=1} \frac{E_t(CF_{t+i})}{(1 + AROR_{t \rightarrow i}(CF_{t+i}))^i}$$

This is similar to Equation 1, but specifically for regulated utilities. It is by design, that the sum of the future cashflows, which simply is revenue minus expenditure, when discounted by the allowed rate of return is equal to the RCV.

Derivation of MAR – Equation 3

Equation 3 means that MAR represents the ratio between the EV and its regulated capital value.

$$MAR = \frac{EV_t}{RCV_t}$$

In theory and under strict assumptions, the ratio between EV (Equation 1) and RCV (Equation 2), would be equal to 1, only if the allowed cashflow and allowed cost of capital is precisely equal to actual cashflow and actual cost of capital.

If MAR is greater or less than 1, then it can be deduced that the allowed rate of return is greater or less than ‘true’ rate of return, only if cashflows are precisely equal the allowed revenues without any deviation. In addition, if financing assumptions (such as cost of debt and gearing) is assumed to be fixed, then theoretically MAR could be an indicator of how the allowed return on equity compares to actual return on equity.

3.1.2 One equation and many unknowns

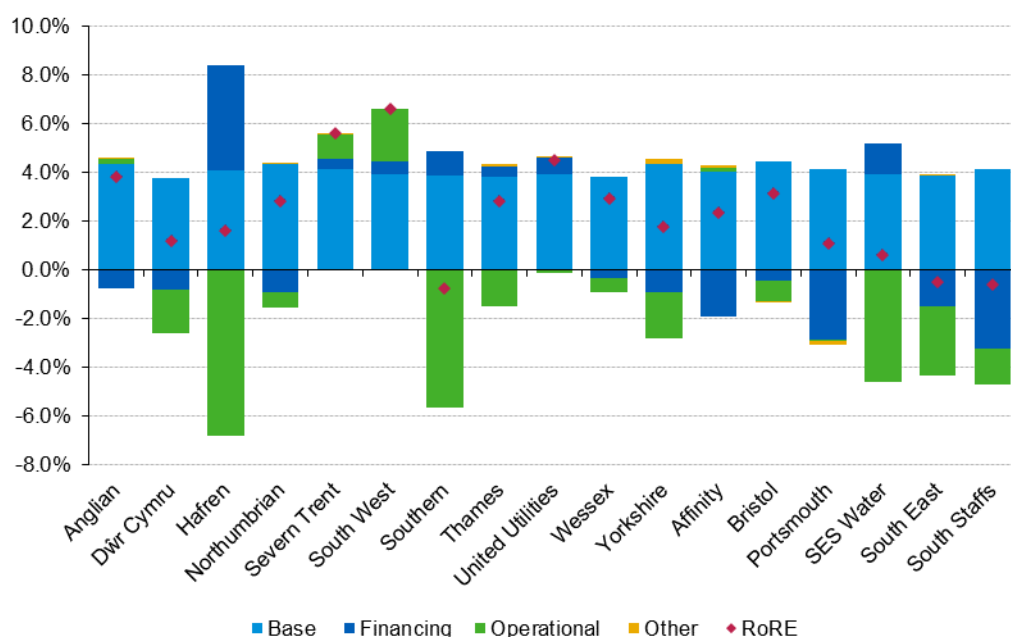
This section explores whether a theoretical MAR of 1 can reasonably hold in practice. It also examines whether MAR as a cross-check is likely to satisfy the **targeted** criterion, particularly when considering all the elements that could influence a regulated entity’s cashflow.

For MAR to be 1, the expected annual cashflows must be equal to the future allowed revenues and the allowed rate of return must be equal to an investors’ assumed cost of capital, as per equation 3. However, in practice, the EV of a regulated utility is affected by many variables, which could be contributing to a MAR being greater than or less than 1. It could be due to one or a combination of factors that influence a regulated entity’s cashflows.

Performance

The regulatory regime is explicitly designed to reward/penalise out or under performance as part of incentive-based regulation. The outperformance varies per regulated network and would vary year-on-year. Figure 1 shows the RoRE performance for 2021 only, which illustrates the variation from base RoRE for all water companies. The current and future stream of cashflows will depend on the actual and forecast performance of a regulated entity.

Figure 1: Water company performance against base returns 2020-21 (RoRE by source)



Source: Ofwat, monitoring financial resilience report 2020-21, Return on Regulated Equity, Notional Structure

Operational performance and actual expenditure, that is higher or lower than expected due to both management actions and exogenous factors, will impact the current and future cashflow of a regulated entity. Academic literature notes there is a significant dependency between value and the quality of management, governance and management’s incentives.³⁸ In addition, investors will have differing assumptions on an individual company’s performance against its regulatory settlement. In practice, when investors value a company, they will have regard to the estimated cashflows over time and their potential ability to influence the cashflows, so that the investment is NPV positive. Their investments will also likely go beyond over multiple price control periods, so it does not align with the price control period.

Similarly, operational performance, that is higher or lower than expected due to management control as well as exogenous shocks will also influence the current and future cashflow of a regulated entity. This could manifest itself in different ways through a given price control period, it could occur via changes in government policies, changes in demand forecasts or changes in the macroeconomic conditions or unforeseen events (natural events, pandemic, etc).

Financial performance that is higher or lower than allowed will also influence current and future cashflows of an entity. The assumptions about ability of regulated companies to outperform the notional allowed cost of debt has historically contributed to an out/under performance, therefore, accounting for this source of out/under performance is important when considering the overall change in cashflow.

As operational out or under performance, which includes expenditure, financing and other determinants (such as output delivery incentives) will impact the cashflow of a regulated entity and therefore, it will have an impact on any observed MAR.

³⁸ Habib and Ljungqvist, Firm value and managerial incentives: a stochastic frontier approach – Journal of Business, 2005.

Non-regulated or non-wholesale parts of the business

Companies' non-regulated³⁹ and non-wholesale businesses, which contribute to the enterprise value, but are not included in the RCV, will affect an entities' cashflows, so will likely impact the observed MAR values. For example, a review of analysts' sum-of-the-parts valuations on the traded water companies, SVT and UU, since March 2021 shows an estimated premium to RCV, particularly from the non-regulated and retail businesses that ranges between 1.2 to 11.4 per cent for SVT and one that ranges between 0 to 10.5 per cent for UU.

In order for the MAR values to be consistent with the theoretical MAR of 1, any influence of the non-regulated and non-wholesale parts of the business would need to be adjusted for as it could inflate the MAR premium.

Summary

If one assumes that, after controlling for all other factors unrelated to the business performance itself that might be relevant for valuation, a business' operational performance, economic conditions and finance assumptions will be exactly consistent with current and future investors' assumptions, in perpetuity, then the market value of the business will be equal to the RCV, which results in a MAR of 1 and neutral NPV.⁴⁰ However, based on what is described above, in practice, there is significant variability in companies' performances over time as reflected in investors' assumptions, which would mean that MAR will not be equal to 1.

In practice, all factors that might affect the market price or the enterprise value—and assumed performance scenarios for these factors—are estimated with uncertainty in future periods. This means that isolating the contribution from assumed outperformance on the allowed cost of equity is inherently difficult and needs to be interpreted with caution, consistent with regulatory precedent.⁴¹

Even in the current price control period for which regulatory targets/revenue allowances are known, investors take a view on all different sources of performance against regulatory targets, which are individually and together estimated with uncertainty. The uncertainty increases the longer the period covered by the analysis. Both traded and transaction MARs rely on an extensive set of assumptions which are individually and together estimated and/or assumed with significant uncertainty.

As such, as there are many unknowns that build up a company's value, and the calculated MAR cannot be solely attributed to a difference in investors' assumed return of equity from the allowed return, suggesting that MARs do not meet the targeted criterion, without ensuring that all of its determinants are known with certainty.

3.1.3 Analogies with Tobin's Q

This section tests whether the use of MARs is consistent with academic literature, particularly in reference to a well-known valuation measure (Tobin's Q). Tobin's Q is the ratio between market value of an asset to their replacement value or cost. As MARs are a special form of the market-to-book ratio or price-to-book ratio, as they specifically relate to regulated companies (book value is based on the RCV). These ratios are closely related to Tobin's Q.

This section explores how the academic literature views the determinants of Tobin's Q as an analogy for the use of MAR in setting price controls.

³⁹ AER, Draft – Rate of return guidelines – Explanatory Statement, July 2018.

⁴⁰ Oxera, 'Do market-to-asset ratios provide reliable evidence on the cost of capital? Note prepared for gas distribution networks', 2007.

⁴¹ Ofgem, RIIO-2 Sector specific methodology consultation, 2018, paragraph 3.127.

Given the importance of understanding what drives value, there is substantial literature on the determinants of Tobin's Q. The literature finds that Tobin's Q depends on a wide range of factors beyond the cost of equity.

For example, McConnell and Servaes presented an analysis that shows a significant positive relationship between Q and the fraction of shares owned by institutional investors.⁴² This presents additional consideration for the drivers of Tobin's Q and analogously MAR. McConnell and Servaes control for all other variables such as research and development intensity, financial leverage, advertising intensity and the replacement value of assets.⁴³

Edmans, Goldstein and Jiang identified that there are many variables that affect determinants of value for firms such as growth, leverage, actual turnover, market share, firm's age and the relative research and development expenses compared to sales.⁴⁴ Edmans, Goldstein and Jiang argue that market prices, hence valuations, are endogenous and are affected by many factors that make it difficult to find a relationship between market prices and takeover activity.⁴⁵

These two research papers alone reference a wealth of other analysis on the topic, which present that Tobin's Q, and analogously MAR, depend on a wide range of factors. The academic literature suggests that to deduce or establish a meaningful correlation between enterprise value and one specific determinant, one has to control for all other variables, which have to be quantifiable and controllable. This is not possible in the case of MARs.

3.2 Market efficiency

The use of MAR as a cross-check for cost of equity implies that MAR provides reliable information in relation to an asset's fair market value, based on robust pricing signals derived from an efficient market, i.e., that MARs represent an efficient pricing signal.

This section considers whether the assumption that MARs are market efficient pricing signals holds true, both by reference to literature and from an empirical perspective, since that would define the degree to which MAR could be relied upon in policy decisions. In the event that the assumption is not true, it would question whether MAR as a cross-check satisfies the objectivity and transparency criteria for a robust and reasonable cross-check.

3.2.1 Efficient market theory

Efficient market theory is a concept developed by Eugene Fama in 1970, whereby three different forms of market efficiency were identified: strong form, semi-strong form, and weak form. In a strong form, the highest level of market efficiency, prices reflect all public and private information. As new information arises, the market absorbs the news almost in real time, and the prices of stocks and other securities adjust along with it. In a semi-strong form, prices reflect only publicly available information about economic fundamentals, including the public market data, as well as the content of financial reports, economic forecasts, company announcements, and so on. In a weak-form efficient market, public data is only partially reflected in prices.

⁴² It was observed that Tobin's Q could change depending on the structure of equity ownership of firms, namely there was a curvilinear relationship (essentially MAR values ramped up and then down after a certain peak at 40-50%). McConnell and Servaes, Additional evidence on equity ownership and corporate value – Journal of Financial Economics, January 1990.

⁴³ McConnell and Servaes, Additional evidence on equity ownership and corporate value – Journal of Financial Economics, January 1990, page 605.

⁴⁴ Edmans, Goldstein and Jiang, The real price effects of financial markets: the impact of prices on takeovers – the Journal of Finance, June 2012.

⁴⁵ Habib and Ljungqvist, Firm value and managerial incentives: a stochastic frontier approach – Journal of Business, 2005.

An efficient capital market could be defined as the one where prices change rapidly in response to changes in demand and supply, thus producing “fair” prices at any time. An efficient market benefits from the perfect, complete, costless, and near-instant transmission of high quality and reliable information among participants. As well as information, an efficient capital market will usually require liquidity through a large enough collection of buyers and sellers to accurately influence prices. Pricing information in such a market robustly reflects both the underlying market conditions and company fundamentals.

Conversely, an inefficient market is one in which asset prices do not accurately reflect true value of assets, which may occur for several reasons. Market inefficiencies may exist due to information asymmetries, a lack of buyers and sellers (i.e., low liquidity), high transaction costs or delays, market psychology, and human emotion, among other reasons.

The general consensus is that it is unlikely that markets are strong-form efficient since they might not reflect some of all of the private information. This would be relevant for the observed traded MARs. At best, some argue that the market is semi-strong-form efficient. This is also confirmed through empirical observation: most markets do display some level of inefficiencies, as demonstrated by investor ability to consistently outperform markets over long periods, which by definition is impossible in strong form efficient markets. This is a useful lens when observing the long history of traded MARs. Informational efficiency of stock prices varies across markets and from country to country, based on the transparency of information, number of participants, liquidity, the effectiveness of regulation, and the likelihood that rational arbitrageurs will drive out noise traders.

In relation to the use of MARs specifically for the UK regulated assets, it is relevant to consider the level of market efficiency implied in the transactions-based and publicly traded MARs, to understand whether the MARs satisfy the objective and transparent criteria.

3.2.2 Inefficiencies related to private transactions

Private markets have historically significantly outperformed public ones for similar regulated assets, suggesting that there may be other factors other than assets’ fundamentals that affect prices and that there is ‘one price’ in the market. This might be associated with a number of specific factors, such as private transactions process set-up (including the impact of winner’s curse), high transaction barriers and relatively few participants, private information and illiquid assets at a certain size of the equity cheque. There are also additional idiosyncrasies such as management determination to succeed, the use subjective and optimistic assumptions related to future operational and financial performance, agency problems, the control premium effect.

Auction theory

We consider whether the typical set-up of a process around a private transaction of an equity stake in a utility can be assumed in around to result in an efficient price, particularly where such prices are considered to be relied on to derive a MAR a cross-check on the allowed return. This is tested through a review of the academic literature on auction theory and the analysis of the auction set-up in transaction processes.

The set-up of a private transaction can be either in the form of sealed bid or open auctions. Each has a different formal process, which has a different design. The hypothesis on whether they result in different outcomes has been the subject of academic research since the 1960s.

The literature notes the outcome of an auction will be influenced by a number of factors such as bidder heterogeneity, entry costs, collusion, correlation in bidders’ values, risk aversion,

transaction costs and revenue maximisation or efficiency.⁴⁶ In addition, if the information bidders receive during a sealed auction is not perfectly consistent with other bidders, then bidding behaviour will be affected.⁴⁷

Specifically in the UK regulated utility sector, transactions have typically followed a multi-stage sealed bid auction approach, which is particularly attractive to sellers as it offers the greatest potential to secure higher revenue as indicated by academic literature and seen in practice, although it may attract a smaller number of bidders. (There are sometimes bilateral negotiation processes, but these typically apply to situations where existing shareholders have pre-emption rights to acquire other shareholders' stakes before an open process.)

The first phase will often be open to a range of credible interested parties, with a common information memorandum provided by the seller (and sometimes a benchmark valuation model). The bidders will be required to submit a non-binding offer based on this relatively limited information and their assumptions, often on a relatively short timescale which can restrict the opportunity to overcome the inherent information asymmetry between seller and buyer.

The seller will then shortlist a subset of the bidders for a more detailed second stage in which more thorough due diligence can be undertaken. In this, more detailed vendor due diligence (VDD) reports prepared by the seller and their advisors will be provided, as will access to key company information (internal financial, tax, accounting information, contracts, growth plans, etc.) in a data room, and also meetings with company management to address any key issues and questions. At the end of this stage, the shortlisted bidders will submit a binding offer in competition with each other. It is at this point where bidder's individual biases for the asset may be revealed through the need to "bid up" in order to win the auction.

The most attractive bid will then usually be taken through to a final negotiation phase. The detailed terms will be agreed with further opportunities to revise the price, and for the seller to achieve as high a price as possible (e.g., "best and final offer", "put up or shut up" requests).

The way transactions are set-up, whether through an open auction, sealed bids or private negotiations will have an impact on the observed values. Particularly as bidders are unlikely to be heterogenous, entry costs vary significantly and there is likely to be information asymmetry between bidders. Therefore, the values derived from private transactions are unlikely to meet the objective criterion, as they are likely to be biased by the auction set-up and are unlikely to represent the efficient price.

Winner's curse

Common-value auctions, where the value of the object is the same for all bidder but is not known at the time of the auction, is associated with the widely acknowledged phenomena known as the 'winner's curse'.⁴⁸ The 'winner's curse' results from the bidders' failure to account for the adverse selection problem inherent in winning auctions for items that are uncertain in value, meaning that the bidders' estimate may be overly optimistic.⁴⁹ By default, the highest bidder, the winning bid, is the one with the most optimistic estimate of the item's value, hence the curse.⁵⁰ This is different to irrational behavioural over-paying, which are discussed in the context of general behavioural biases and could be a result of path dependence or over-extrapolating or over-optimism.

⁴⁶ Susan Athey, Jonathan Levin, Enrique Seira, Comparing open and sealed bid auctions – national bureau of economic research, December 2008

⁴⁷ David J Salant, A primer on Auction Design, Management, and Strategy, December 2014.

⁴⁸ Koch and Penczynski, The winner's curse: conditional reasoning and belief formation – Journal of Economic theory, December 2017.

⁴⁹ Kagel and Levin, Common value auctions and the winner's curse – Princeton University Press, August 2002.

⁵⁰ Ibid.

In a hypothetical private transaction situation, even if the enterprise value of a regulated utility perfectly reflects the discounted value of the future stream of cashflows, the 'winners curse' suggests that the winning bidder will overpay by a factor that exceeds the RCV, which will result in a MAR that is greater than 1. The 'winner's curse' thus creates further uncertainty around the observed MAR values. For a MAR to be consistent with the theoretical model, it would be necessary to measure, capture and remove the winner's curse factor to obtain a clean MAR.

High transaction barriers (ease or difficulty with which transactions are made, including costs)

High initial costs, relatively large amounts of capital required, the knowledge needed to assess assets, and the necessary contacts (in the industry and relevant advisors such as investment banks) to be informed when assets become available all create significant barriers. Investing in the UK regulated utilities requires expert levels of knowledge of the regulatory framework and the associated businesses to be able to appropriately price the risk.

There are high barriers to entry in terms of having to undertake extensive due diligence to assess historical and plausible future performance as there is limited information in the public domain and companies are not widely covered by sector analysts. Transaction costs associated with an acquisition are also high compared to investing in public (secondary) markets due to the legal, banking, and advisory fees.

Few participants and low frequency of trades

High transaction barriers restrict the number of participants and transactions in private markets. This leads to low frequency of trades, which is a source of major market inefficiency, because an efficient capital market requires liquidity through a large enough collection of trades to accurately influence prices. Investors are unable to sell assets at any point they like, which means that they usually require an illiquidity premium.

In the UK regulated utilities space, the majority of investors have a medium- to long-term investment horizon, sometimes due to the nature of the corresponding liabilities they manage (e.g., pension funds and insurance companies). The limited number of participants and relatively long holding periods mean that transactions do not come up frequently and that whenever they do, these could be subject to many behavioural biases and specific circumstances in terms of the strategy of a buyer, point in the economic and regulatory cycle, etc.

A small cohort of potential buyers and sellers in these situations is less likely to result in an efficient price. These transactions are point-in-time estimates that are prone to biases rather than continuous market pricing signals indicating the level of return at which the market would commit capital to the sector in general.

Availability of data

Private markets are characterised by the ability to control what type of information can be made available. There is generally less regulation that requires their full transparency, as opposed to public markets. This creates information asymmetry and limits market efficiency.

Any analysis of MARs from auction transactions is necessarily speculative since only the successful bidder knows the exact assumptions and rationale behind their bid price. Often the exact terms of the sale are not publicly disclosed, and only speculated or inferred in press commentary. The assumptions made by bidders are estimated with uncertainty and may not be a true reflection of the underlying parameters and, by definition, will not match the assessment made by other bidders that arrived at their own valuations.

Additional idiosyncrasies for transaction MARs

There are additional idiosyncrasies associated with transactions for non-listed regulated companies which impact the MAR:

- Bidders are often **driven by a management determination to succeed in a transaction** (often reinforced by remuneration practices) and optimism bias. Investors develop views about specific sources of value that often increase valuations (such as outperformance, growth rates, exit multiples, etc.) but these are specific to each transaction and not consistent over time.
- Investors **use subjective and optimistic assumptions related to future operational and financial performance**, which do not necessarily reflect past performance. This is particularly noticeable in terminal value (TV) assumptions which are often typically a premium to the RCV, determined from previous transactions with the assumption that high exit multiples will be achievable in the future.
- There is also an **“agency” problem** associated with MARs in that the individuals leading the acquisition process and making the assumptions on future performance are predominantly interested in securing an asset. They are unlikely to be responsible for the MAR outturn at the exit as it would typically happen many years in the future.
- **Seller’s expectations will also be conditioned by the outcome of previous similar transactions** and their unwillingness to sell at a loss. The price they are willing to accept will normally only be at a MAR greater than 1. Similarly, if they had assumed a premium to RCV in their valuation on their original acquisition, they would have an imperative to recover that on exit.
- **Individual bidders may be willing to pay a “control premium”** over and above the fundamental value of the company when acquiring a majority stake which reflects the ability to exercise control over the company’s operations and hence increase expected cash flows.

Industry players will often be able to identify areas of operational overlap with the potential for cost savings and synergies which could justify a higher valuation than non-sector participants. This may be tempered by regulatory constraints or requirements to ensure that they can continue to regulate effectively.

Summary

Overall, a range of characteristics and limitations of transaction processes indicate that private markets are subject to very material inefficiencies that constrain their ability to provide efficient pricing signals in relation to an asset’s fair value.

Transactions for non-listed companies do not reflect a continuous, efficient and liquid market as opportunities arise on a sporadic bespoke basis at isolated points in time. For regulated utilities, this may often coincide with the finalisation of a price determination which provides a degree of short-term certainty on revenues and returns.

The fact that sales are initiated and concluded at particular, idiosyncratic points in time means there is a significant selection bias in choosing the time of the transaction. An expected MAR in excess of 1 must be realised otherwise the seller would rationally wait for a better opportunity in order to avoid reporting a loss. This means the sample is statistically biased through the existence of only successful transactions at prices sellers are willing to accept for what are generally long-term holdings.

The ability of private transactions’ MAR data to explain the fundamentals of a particular asset, including the regulatory price control parameters determining its cash flows, is therefore significantly compromised and do not satisfy the objective or transparency criteria.

3.2.3 Inefficiencies related to public markets

Public stock markets benefit from many participants and transactions, resulting in reasonable liquidity. Transactions are completed instantly and with minimal commission, and details for each stock are readily available. There are also specific rules and regulations related to the frequency of reporting and information transparency of the listed companies. These features enhance efficiency of public markets compared to the private ones.

Empirically, this could be observed through the difference in the traded MARs and MARs derived from the recent transactions. The average MARs of the listed companies, Severn Trent and United Utilities, were around 1.22-1.33 during the last eighteen months, while the MARs from the UK water sector transactions during the same period were around 1.44-1.51 (Bristol Water, Northumbrian Water). The RCV premiums derived from private transactions are c. 1.5-2.0 times higher than those coming from public markets. This is before any correction for the differences in the operational and financial performance of these companies, which would further increase the gap, as both United Utilities and Severn Trent reported sector-leading performance in FY2021.

Although public stock markets are more efficient than the private ones, their overall ability to reflect assets' fair values is a subject of academic debate. Empirical evidence suggests that even the most competitive markets are not strictly efficient. Price histories can be used to predict near future returns with a probability better than random chance. Many markets can be considered as favourable games, in the sense that there is a small probabilistic edge that smart speculators can exploit.⁵¹ There are investors who have beaten the market, such as Warren Buffett, whose investment strategy focused on undervalued stocks made billions and set an example for numerous followers. There are portfolio managers who have better track records than others, and there are investment houses with more renowned research analysis than others.

There are factors that, according to the academic literature, contribute to public markets being less than the semi-strong form efficient. The factors are supply-demand imbalances, economic and market cycles, low aggregate and demand elasticity and behavioural biases.

Supply-demand imbalances and asset bubbles

Public shares are subject to the basic laws of supply and demand. When demand is greater than supply, prices rise, and when supply is greater than demand, prices fall. The major factors that impact the demand for stocks are economic data, interest rates, and corporate results but supply and demand can also be reflecting behavioural factors that are not related to companies' fundamentals. The supply of stock tends to change at a slower pace than the demand, which can pick up or drop in response to corporate news or other one-time events.

Imbalances in stock supply and demand could be caused by a myriad of factors and could significantly impact stock prices. As a result, market prices would be only partially explained by the fundamentals, with stocks being significantly over or under-valued. This could be observed empirically and is documented in the academic research exploring asset price distortions.⁵²

In extreme cases, stock price deviation from its fair values could lead to asset bubbles. During a bubble, investors continue to bid up the price of an asset beyond any real, sustainable value. This occurs when investors think that there is not enough supply of a given asset. Eventually, the bubble "burst" when prices crash and demand falls, for example, as was the case with the 1987 stock market crash, when the Dow Jones Industrial Average fell by over 20% in a single day.

⁵¹ Zhang, Y.-C. (1999), Toward a theory of marginally efficient markets, *Physica A* 269(1), 30–44.

⁵² The Journal of Finance • Vol. LXV, No. 4 • August 2010, "Presidential Address: Asset Price Dynamics with Slow-Moving Capital" by Darrell Duffie

Bubbles are hard to distinguish in real-time because investors cannot easily judge if the market pricing reflects the prediction of future values or merely collective enthusiasm.

Economic and market cycles

Supply-demand imbalances could result from macroeconomic conditions and changes in global markets,⁵³ as these represent one of the major demand drivers. All markets go through the same phases and are cyclical. They rise, peak, dip, and then bottom out. When one market cycle is finished, the next one begins. It is extremely difficult to accurately predict the end of the current market phase and the start of the next one. That is why realised returns are especially poor indicators of expected returns prior to turning points in the business cycle.⁵⁴

Economic cycles could explain capital flows in and out of entire asset classes. An example of a booming demand in the infrastructure asset class in the last decade is relevant as it includes regulated utilities. A long period of ultra-low interest rates and large-scale asset purchases by central banks between 2009 and 2021 have led to an abundance of cheap money. This excess liquidity inflated the valuations of financial assets, leading to near all-times high equity markets and near historic low sovereign bond yields in the developed economies. The search for yield remained the norm for over a decade and led to a strong demand for infrastructure as an asset class given its defensive characteristics, driving up valuations.

The attractiveness of the infrastructure asset class relative to other equities and lower yielding bonds is shown in Table 1. Infrastructure assets have a higher Sharpe ratio than equities despite being lower risk, indicating a lower variability in their returns and hence greater certainty which is attractive to certain classes of investors who require stable, predictable returns even if lower than theoretically achievable elsewhere (such as pension funds and insurance companies).

Table 1: Comparison of Preqin infrastructure index with equities and bonds (USD returns) for 2008-2019⁵⁵

Asset class	Return	Risk	Sharpe ratio ⁵⁶
Preqin infrastructure index	8.0%	7.0%	1.15
Equities	11.7%	16.5%	0.71
Bonds	2.7%	5.7%	0.48

Changes in the global markets and macroeconomic environment could lead to other asset classes, for example fixed income or property, to become more attractive to investors, triggering a decrease in the valuation multiples in the infrastructure space. In fact, rising interest rates have already led to higher sovereign and corporate bond yields⁵⁷ and have also surged to the top of the list of challenges for infrastructure investors.⁵⁸

⁵³ Fama and French (1988) found that stock returns could be impacted by the economic cycles

⁵⁴ November 2004 Financial Review 39(4):527-547, "Stock Returns and the Business Cycle" by Michael DeStefano

⁵⁵ Preqin, Datastream: Equities (Russel 3000), Bonds (Bloomberg Barclays Aggregate), all quarterly total returns in USD; Preqin data is net of fees; Period: Q2 2008 – Q4 2019

⁵⁶ The Sharpe ratio is a measure of the performance of an investment compared to a risk-free asset after adjusting for its risk, calculated as the ratio of the investment's returns over the risk-free rate and the standard deviation of its returns.

⁵⁷ The Big Picture, Global Asset Allocation 2022 Q3 Quarterly update from Invesco's Global Market Strategy Office

⁵⁸ Preqin investor outlook: alternative assets, H2 22

Overall, these market drivers are related to a specific point in the economic cycle and have little to do with the asset fundamentals, yet they could have a significant bearing on asset valuations and, in the case of regulated utilities, MAR.

Low aggregate demand elasticity

The ability of the public stock markets to provide robust pricing signals has been disputed since the 1960s, with the new academic research, such as the Inelastic Market Hypothesis (IMH),⁵⁹ taking the debate further. While the traditional asset pricing model does not expect any impact on the asset pricing from the mere fact of an investor making an investment, the IMH proves that this assumption is deeply flawed, both theoretically and empirically.

IMH demonstrates that when an investor sells one unit worth of bonds and buys one unit worth of stocks, the market's aggregate value goes up by about five times. That means that the demand's aggregate elasticity is around 0.2: if the price of the equity market portfolio goes up by 5%, demand falls by only around 1%.

The direct implication of the IMH is that stock market prices reflect not only the fundamentals, but the overall level of investment, and so could not be entirely relied upon to measure asset fair values.

Behavioural biases

In some circumstances, markets do not determine the correct value of assets because of behavioural biases. Behavioural science literature suggests that markets are not always rational or price assets with perfect accuracy. Asset price is an indication of how investors perceive the enterprise value, but that could vary from the 'true' theoretical value, whether above or below.

The reason for the difference includes path dependence or over-extrapolating, which places a strong emphasis on past growth or to depend on previous outcomes rather than current conditions. Path dependence explains the continued use of an investing approach based on historical preference or use. An investor may persist in using a known strategy even if newer, more efficient alternatives are available. Path dependency occurs because it is often easier or more cost-effective to continue along an already set path than to create an entirely new one. The other behavioural biases could include overoptimism or simply equating a good investment with a well-run company irrespective of price.

Empirical evidence has identified another systemic pattern of expectation errors, which excessively tied past to future growth.⁶⁰ This seminal paper on this topic notes the following:

'Individual investors might focus on glamour strategies for a variety of reasons. First, they may make judgement errors and extrapolate past growth rates of glamour stocks, even when such growth is highly unlikely to persist in the future. Putting excessive weight on recent past history, as opposed to rational prior, is a common judgement error in psychological experiments and not just in the stock market'⁶¹

Given that there are many factors that could influence the MAR, several of which are very difficult to measure (such as behavioural biases), it is not possible to strip out the effects of all these other factors on the MAR and isolate the implied cost of equity completely away from other factors, meaning that MAR is unlikely to satisfy the targeted criterion.

Summary

Empirical and academic evidence suggests that public stock markets could exhibit varying degrees of inefficiency due to supply-demand imbalances, exposure to economic and market

⁵⁹ "In Search of the Origins of Financial Fluctuations: The Inelastic Markets Hypothesis" by Xavier Gabaix and Ralph S.J. Koijen, May 12, 2022

⁶⁰ J Lakonishok, A Shleifer and Robert W. Vishny, Contrarian Investment, Extrapolation and Risk, 1994.

⁶¹ Ibid

cycles, low demand elasticity and behavioural biases. It is near-impossible to determine to which extent the stock price at a particular point in time is affected by these factors.

Drawing conclusions from it about a particular driver of cash flows, or in the case of MAR, about a discount rate assumed by an investor, may not be sufficiently robust without other supporting evidence that triangulates the cost of equity ranges.

For a MAR to be consistent with the theoretical model, it would be necessary to measure, capture and remove the impact of traded MAR elements not related to the fundamental value drivers to obtain a clean MAR. Only then traded MAR would express a firm's true value.

Predicting the power of MAR could be overestimated. Research suggests that the fact that companies have a high MAR does not necessarily mean that these companies will outperform their current performance into the future or that the allowed rate of return is different from actual rate of return for regulated companies. There may be expectation errors. It was observed that high MAR companies subsequently underperform analysts' expectations and low MAR companies outperform. This could also be observed in analysts' report, which values MAR and the underlying component parts. There is a further discussion of the analyst valuations in Section 4.3.

4 Quantifying the determinants of MARs

The purpose of this section is to rely on quantitative analysis to provide further considerations of whether MARs meet the criteria for a reasonable cross-check. This section explores:

- the extent to which the various regulatory drivers can affect a company's MAR, individually and in conjunction with each other, compared to the corresponding impact on MAR of a reasonable range for the equity discount rate. This will illuminate the extent to which MARs can be considered a targeted and incentive compatible cross-check. A stylised decomposition, based on a bottom-up sensitivity analysis, is used to show how different assumptions for regulatory inputs can impact company valuations, supporting the "one equation and many unknowns" premise.
- whether MARs observed in private transactions can be considered free from potential biases, and hence objective as a cross-check for the cost of equity. This is examined by observing MARs in private transactions, which sets out the range of headline UK regulated utility transaction MARs since 2020.
- to what extent equity analysts' valuations support the conclusion that the decomposition of MARs informs the required rate of return compared with the regulatory allowance. It also examines whether that can be objective and lead to clear results that enable the impact of allowed returns on price to be clearly isolated, i.e., whether the use of MARs is transparent. This is tested by reviewing the variation in equity analysts' assumptions on value components of the traded water companies, and the resultant impact on the observed traded MARs, which helps to confirm some of the previous known limitations of MARs, that the values are subjective and can be influenced by a number of variables.

4.1 Stylised sensitivity analysis

This section sets out a sensitivity analysis for how a range of factors (such as company's performance, discount rate and terminal values) affect MAR based on a discounted cash flow (DCF) valuation model.⁶²

The analysis was done on a stylised basis. It is designed to explore the sensitivity of MARs to a potential reasonable range of assumptions around regulatory drivers. As various factors could be varying at the same time or in opposite directions, depending on when MAR is observed, the analysis investigates:

- whether a MAR range due to changes in various regulatory or valuation levers has a similar quantum compared to the range derived from changes to discount rate only; and
- whether MAR could be greater than 1, even when the discount rate is higher than allowed cost of equity due to the impact of other variables, while relying on plausible assumptions / valuation parameters.

If it is possible to generate MAR values consistent with these two questions then the use of MARs as a cross-check will fail the consistency, transparency and objectivity criteria.

⁶² The model relies on standard regulatory modelling assumptions and all input assumptions are based on publicly available information.

Assumptions

The assumptions that were used in the analysis are set out in Table 2 below. All the assumptions are based on standard regulatory assumptions, historical performance or final determination allowances that were adopted in PR19.

Table 2: Assumptions used in the stylised sensitivity analysis

Issue	Assumption	Rationale
Valuation period	April 2021 – March 2048	Considers a reasonable period of 27 years, which incorporates the impact of multiple AMPs, consistent with the CMA decision of having regard to long-term cashflow rather than one or two price control periods only. ⁶³
PAYG rate	50%	Consistent with the PR19 regulatory determination. ⁶⁴
Allowed totex	PR19 allowed totex (constant over the valuation period)	PR19 regulatory determination.
WACC	PR19 final determination	PR19 regulatory determination.
Sharing factor	50%	Standard regulatory assumption
Notional gearing	60%	Standard regulatory assumption
Terminal Value	The range is between 1.1 – 1.4	Subjective value estimated by investors. The range is based on previous TV values that bidders have incorporated in past valuations. ⁶⁵
RoRE range	The range is between -2.5% to 2.5%	Consistent with the observed range of performance in 2015-2021. ⁶⁶ This is a conservative assumption as there are actual observed values that are higher and lower than this range. ⁶⁷
Equity discount rate	The base case is 7.0%. The range is incremental between 5.0 – 9.0%	Subjective value estimated by investors.

Variance due to regulatory and valuation levers

This section explores the combined effect of outperformance and terminal value assumptions to test what a plausible range for MAR values might be when the allowed cost of equity is equal to investors' discount rate.

Investors acquiring an underperforming business will generally assume they can improve it and make it at least average and investors acquiring an outperforming business might assume that they can keep it in that position (e.g., assume 1% operational performance). This asymmetry in assumptions may show a degree of the control premium but it may nonetheless drive valuations. The effect of RoRE out and under-performance combines all various aspects of operational and financial performance, including totex, ODIs, financing, retail costs, business plan incentives and revenue incentive mechanisms.

⁶³ CMA (2021), PR19 Final Report (CGL2/7), para. 9.1360

⁶⁴ Ofwat, PR19 final determination – aligning risk and return technical appendix, p.64.

⁶⁵ The range was also informed by Societe Generale's equity analyst reports (March 2021 to June 2022) for the traded water companies in the DCF valuations where they assume a TV as a premium to the final year RCV ranging between 15% and 26%. However, the sensitivity analysis tested the impact beyond this range.

⁶⁶ Ofwat, monitoring financial resilience report 2020-21, 30 November 2021 and Ofwat, monitoring financial resilience report 2019-2020, 2 December 2021.

⁶⁷ For example, the average RoRE performance for Portsmouth was 3.1% over 2015-2020 and the average RoRE performance for Southwest was -5.6% over 2015-2020. Ofwat, monitoring financial resilience report 2019-2020, 2 December 2021.

In addition, valuation models usually assume a certain valuation period. Beyond this, assumptions are made for a terminal value (TV), typically through an EV / RCV multiple. The presence of a terminal value assumption greater than 1 could reflect a range of factors including: path dependency by which previous outcomes influence future expectations, the value of any non-regulated businesses, and an expectation of gaining a control premium in a potential future sale or a combination of all these factors. It should be noted that TV assumptions concern expectations for company performance far into the future, well beyond the immediate price control periods.

The analysis tested a symmetrical RoRE performance combined with incremental terminal values to explore the sensitivity of MAR to these scenarios. The results are shown in Table 3. The variance due to the combined change in RoRE and TV is between 0.90 and 1.15.

The assumed RoRE under and out-performance of +/- 2.5% is a conservative value and is based on historical performance,⁶⁸ as such, the deduced MAR range could be even greater if the maximum under and out-underperformance values over the 2015-2020 regulatory years are used.

Table 3: Impact of performance and TV assumptions on MAR

Scenario	RoRE change Δ	Equity discount rate	Terminal Value	MAR
Base	0%	7.0%	1.0	1.00
Scenario 1.1	+2.5%	7.0%	1.0	1.10
Scenario 1.2	+2.5%	7.0%	1.2	1.13
Scenario 1.3	+2.5%	7.0%	1.4	1.15
Scenario 1.4	-2.5%	7.0%	1.4	0.96
Scenario 1.5	-2.5%	7.0%	1.2	0.93
Scenario 1.6	-2.5%	7.0%	1.0	0.90

Source: KPMG analysis

Variance observed due to equity discount rate

This section reports how sensitive the MARs are to the difference between the allowed rate of return and the assumed equity discount rate.

An incremental change to the discount rate between 5% to 9% results in a MAR range between **0.92** and **1.12**, as shown in Table 4.

The derived MAR range, due to the change in discount rate assumptions, is consistent with the outcomes derived from Scenarios 1.1 to Scenarios 1.6 above (meaning the impact of other regulatory and valuation levers). This increases the doubt as to whether MAR is a targeted indicator.

By using MAR, without knowing the exact contributors at the time of an observation, one could be making inference on the allowed cost of equity, when the observed premia could be due to investors' assumptions (such as TV assumption and/or assumed medium- or long-term outperformance assumptions). This suggests that the use of MAR is unlikely to meet the targeted criterion.

⁶⁸ For example, the average RoRE performance for Portsmouth was 3.1% over 2015-2020 and the average RoRE performance for Southwest was -5.6% over 2015-2020. Ofwat, monitoring financial resilience report 2019-2020, 2 December 2021.

Table 4: Impact of equity discount rate on MAR

Scenario	RoRE change Δ	Equity discount rate	Terminal Value	MAR
Base	0%	7.0%	1.0	1.00
Scenario 2.1	0%	5.0%	1.0	1.12
Scenario 2.2	0%	6.0%	1.0	1.05
Scenario 2.3	0%	8.0%	1.0	0.96
Scenario 2.4	0%	9.0%	1.0	0.92

Source: KPMG analysis

Combined outperformance and discount rate

An additional consideration to the outcome of changes in RoRE, discount rate and terminal values at the same time, is that, in practice, it is unlikely for one variable to change in isolation, but rather the observed MARs will be a result of the variables changing simultaneously.

Without explicitly considering behavioural type effects, which may not be quantifiable, or the impact of non-regulated businesses (including the retail portion), the analysis derives a MAR that ranges from **0.85** to **1.28**. A number of these regulatory inputs and assumptions could be up or down at any given point, as it could also depend on investors' assumptions, specifically for variables such as equity discount rate and terminal values.

Scenario 3.7 and Scenario 3.8, as shown in Table 5, show that a MAR could be greater than 1, even when the discount rate is greater than the allowed cost of equity. This indicates that the use of MAR as a cross-check is unlikely to meet the targeted criterion as it may not be able to isolate the effect in question from other factors and would not give accurate results.

It also indicates that the use of MAR would not be incentive compatible. Specifically, if it is of concern that any outperformance—whether in totex, ODIs, or financing—that pushed the company's MAR above 1 would subsequently result in a further reduction in the allowed cost of equity, it would introduce the 'ratchet effect'. This would further dampen incentives for improved performance as companies may fear that any rewards gained during a price control will be clawed back at the next price control through a reduced cost of equity.

Table 5: Combined outperformance and discount rate⁶⁹

Scenario	RoRE change Δ	Equity discount rate	Terminal Value	MAR
Base	0%	7.0%	1.0	1.00
Scenario 3.1	-2.5%	5.0%	1.2	1.05
Scenario 3.2	-2.5%	6.0%	1.2	0.98
Scenario 3.3	-2.5%	8.0%	1.2	0.89
Scenario 3.4	-2.5%	9.0%	1.2	0.85
Scenario 3.5	+2.5%	5.0%	1.2	1.28
Scenario 3.6	+2.5%	6.0%	1.2	1.20
Scenario 3.7	+2.5%	8.0%	1.2	1.07
Scenario 3.8	+2.5%	9.0%	1.2	1.02

⁶⁹ The terminal value assumed was consistent with equity analyst reports.

Summary

The sensitivity analysis tests the impact of key regulatory variables on MARs to quantify some of the determinants of value in a stylised setting. The analysis demonstrates that investors' assumptions, whether they are correct or not, will have a very significant impact on MARs. This is consistent with the premise of one equation and many unknowns, that there are many factors that might affect the EV, which are estimated with uncertainty in future periods. Isolating the contribution of assumed outperformance from the allowed cost of equity is inherently difficult and needs to be interpreted with caution, consistent with regulatory precedent.

Overall, the sensitivity analysis has derived a MAR range that is between **0.85 and 1.28** which supports the uncertainty over the potential underlying assumptions that could be associated with the observed premia from traded or transactions MAR. In addition, the sensitivity analysis has identified that:

- it is possible to have MAR above 1 even if the discount rate exceeds the allowed cost of equity, with other variables contributing to the upward valuation. This suggests that the use of MAR as a cross-check is neither targeted nor incentive compatible.
- estimating the impact of cost of equity assumptions on MAR is not possible with any degree of accuracy, unless there is clarity about all the other assumptions related to company performance, which is forecast into the medium and long term. Some of the determinants of the observed premia (such as behavioural biases which have been discussed in this report) may not be quantifiable.
- MAR is sensitive to the subjective terminal values that are assumed by investors. As terminal values are usually assumed as a multiple of the RCV, it is asymmetric and consistently contributes to MAR being above 1, rather than below 1.

4.2 Transaction MARs

This section examines publicly available information on recent transactions in UK regulated utilities to assess whether it is possible to obtain a clear signal about company valuations in the context of the efficient market principles laid out in Section 3.2, and whether the observed MARs can be reliably used as a cross-check on the implied return on equity in particular against the transparent, objective and targeted criteria.

There have been five private transactions involving UK water companies since the start of 2020: the takeover of Bristol Water by Pennon, a majority equity injection in Southern Water by Macquarie, and sales of minority stakes in Thames Water, Anglian Water and Northumbrian Water. Transactions' activity tends to follow the price control cycles.

In the wider regulated utility space, there have been a further three transactions in this timeframe: National Grid's purchase of an electricity distribution network operator (DNO), Western Power Distribution, and later sale of a majority stake in the national gas transmission network operator (National Grid Gas Transmission), and the sale of a 50% ownership stake in a gas distribution network (GDN), Scotia Gas Networks.

Details of the water transactions based on public reports are listed in Table 6 below.

Table 6: UK water company transactions since 2020

Target	Buyer	Date	Stake	Transaction Value, £m	Implied EV, £m	RCV, £m	MAR (EV/RCV)
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Target	Buyer	Date	Stake	Transaction Value, £m	Implied EV, £m	RCV, £m	MAR (EV/RCV)
Bristol Water	Pennon	Jun 21	100%	425	814	556	1.44 ⁷⁰
Southern Water	Macquarie	Aug 21	majority stake	1,073	-	5,111	-
Thames Water	USS	Dec 21	8.8%	Undisclosed	-	15,025	-
Anglian Water	OTPP	Jan 22	15.6%	Undisclosed	-	7,943	-
Northumbrian Water	KKR	Jul 22	25%	867	6,866	4,548	1.51

Notes: RCV and net debt (for the implied EV) have been taken as of the date of the transaction (i.e. at the previous March financial year-end).
Source: Company press releases; KPMG analysis.

This review of the most recent transactions involving UK water companies highlights the various factors arising in private transactions as discussed above.

Few participants and low frequency of trades

An efficient market will usually require liquidity through a large enough number of buyers and sellers such that the pricing information robustly reflects both the underlying market conditions and the individual company fundamentals.

With just eight transactions over the past two-and-a-half years, there is a very limited opportunity for investors to participate in this space, with this scarcity thus having the potential to drive up prices for assets when they do come to market.

The high barriers to entry (high initial costs, relatively large amounts of capital required, expert levels of knowledge of the regulatory framework needed to assess assets, high transaction costs compared to investing in public markets) restrict the number of potential buyers. Nonetheless, there is still a relatively large pool of investors for whom regulated utilities are an attractive asset class, notably pension funds, infrastructure funds and sovereign wealth funds, and as parties have demonstrated successful investment returns from the sector, others have also been attracted.

On the other side, the characteristics of regulated utilities mean that the majority of investors have a medium- to long-term investment horizon, sometimes due to the nature of the corresponding liabilities they manage (e.g., pension funds and insurance companies), which results in an infrequent availability of these assets.

This combination of a limited set of potential buyers and sellers for these transactions suggests that they could be subject to many behavioural biases and specific circumstances which are less likely to result in an efficient price. Given that a seller has a choice about selling, the inefficiency is likely to be reflected in a selling price implying a MAR premium.

Timing or selection bias

Linked to the previous point is the fact that existing owners choose when to put their assets on the market, and that they will do so when the price expectation is at its highest so the observed transactions are subject to a material selection bias. A transaction will only conclude when the seller is satisfied with the price offered, and sale processes are paused or terminated when bids do not meet the seller's requirements.

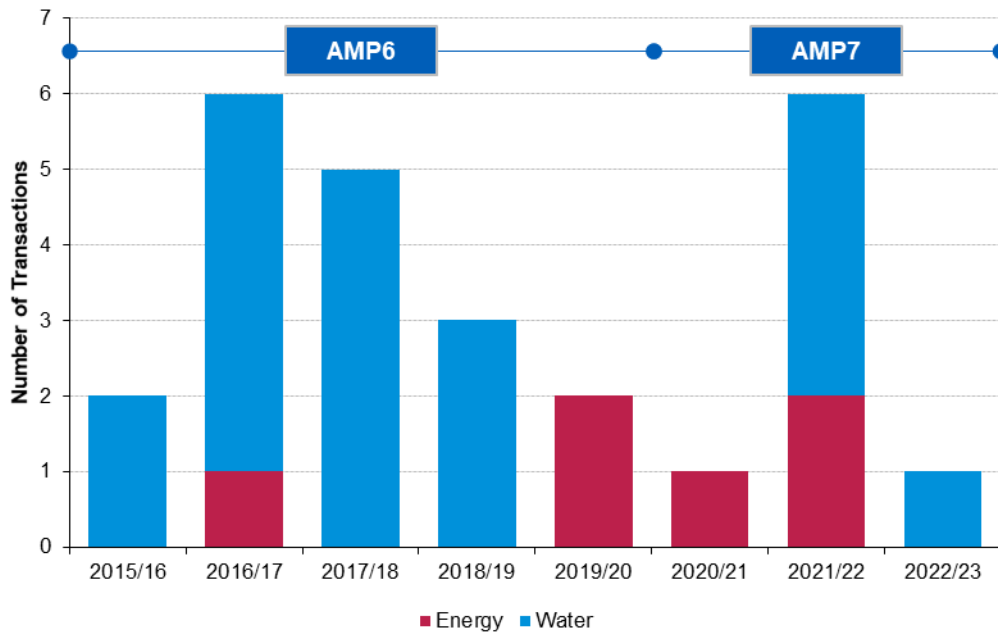
This implies that completed transactions will normally take place at the point of greater certainty and the highest valuation and it would be expected that only sales with a MAR in excess of 1 will be observed. Public information is only available on the concluded

⁷⁰ [Acquisition of the Bristol Water Group and proposed Special Dividend and Share Consolidation | Pennon Group PLC \(pennon-group.co.uk\)](https://www.pennon-group.co.uk/acquisition-of-the-bristol-water-group-and-proposed-special-dividend-and-share-consolidation)

transactions which, owing to the choices available to the sellers, means that a biased sample of cases only where the MAR is greater than 1 is available.

Transactions in regulated utilities will typically coincide with the conclusion of price reviews when there is an element of certainty about the short-term returns which can help facilitate a clearer mutually acceptable valuation. This is illustrated by Figure 2 below which shows the number of transactions in regulated energy and water companies annually since the start of AMP6 (the sixth Asset Management Plan period) in April 2015:

Figure 2: Transactions in UK regulated utilities since April 2015



Source: KPMG analysis.

There were numerous water company transactions in the first four years of the previous price control period when the regulatory regime was known and performance reliable. However, as the PR19 consultation began in early 2019 and the price review process progressed including an appeal to the CMA in February 2020, transaction activity ceased during 2019/20 and 2020/21 while there was uncertainty over what the companies' returns would look like going forward. Only once the CMA concluded its enquiry and published its final determinations in March 2021 did acquisitions resume, with both potential buyers and sellers having the confidence to be able to reliably value assets.

These transactions therefore can be thought of as showing the “peaks of the mountains” of the full spectrum of valuations over a limited time period rather than the entire continuous range of company valuations that would be characteristic of an efficient market.

Capacity to reflect broad sector fundamentals

The transactions also cover a small subset of the assets of the sector as a whole. Whether the subset is representative will depend on the characteristics of the transactions that take place. Considering the proportion of assets that are represented by the sales will help to inform the representativeness of the price information derived from these transactions and consequently its reliability.

The five water company transactions comprise a traded RCV of approximately £7bn (estimated since the exact stake involved in the Southern Water transaction is not in the public domain), of the total 17 companies in the sector. As shown in Table 7, the transactions

in 2021/22 related to only c.7.7% of the total sector RCV. while the one transaction so far in 2022/23 covers only 1.4% of the total RCV.

Table 7: Water sector transactions since 2020

	2021/22				2022/23			
	No of deals	RCV traded, £m	Total RCV (March 2021), £m	Share of 2021 RCV	No of deals	RCV traded, £m	Total RCV (March 2022), £m	Share of 2022 RCV
Water and Sewerage Companies (WaSCs)	3 (of 11)	c.5,400	73,133	c7.3%	1	1,137	79,555	1.4%
Water only Companies (WoCs)	1 (of 6)	556	4,077	13.6%	-	-	4,493	-
Total sector	4 (of 17)	c.5,900	77,210	c7.7%	1	1,137	84,048	1.4%

Note: The total RCV transacted in 2021/22 is an estimate as the exact ownership stake in Southern Water involved has not been publicly disclosed, stated only as "majority".

Source: Ofwat 'Regulatory Capital Values 2022'⁷¹; KPMG analysis.

This is a very limited sample from which to draw conclusions about the valuation assumptions for the sector as a whole. Especially as the prices paid in each of these transactions will have been driven by unique characteristics specific to the individual companies and winning bidders' demand, which are not necessarily representative of the underlying valuation basis of the sector as a whole.

Successful transactions inherently represent a statistically biased sample of the sector's valuation. The fact that sales are willingly transacted by buyer and seller means that an expected MAR in excess of 1 must exist otherwise the seller can wait for a better opportunity (unless forced to sell by external circumstances).

Summary

In summary, the information which can be obtained from observed transaction MARs is limited by:

- involving a small number of participants and low frequency of trades;
- a selection bias on the part of sellers, and cyclical timing of opportunities; and
- not being representative of the sector as a whole, and inherently comprising a statistically biased sample.

These various limitations indicate that the suitability of MARs observed from private transactions to explain the fundamentals of a particular asset, including individual regulatory price control parameters determining its cash flows, is significantly compromised. There is no continuous, efficient market for these assets, and the observed transactions are point-in-time valuations that are prone to biases rather than efficient pricing signals that could inform the level of return at which the market would commit capital to the sector in general.

4.3 Equity analysts' reports on traded water companies

This section examines the extent to which equity analysts' valuations of public companies allow for a decomposition of observed traded MARs in a transparent manner that would

⁷¹ Ofwat 'Regulatory Capital Values 2022' available [here](#).

support the conclusion that a clear relationship can be assumed between the MARs and rate of return.

A review of equity analysts' sum-of-the-parts valuations on the traded water companies, SVT and UU, since March 2021 shows a wide range of assumptions about the contribution to each company's total enterprise value from different sources, including an estimated/assumed premium to RCV, the non-regulated and retail businesses, and any pension surplus or deficit.

Reports by Credit Suisse, Exane BNP Paribas, HSBC, Investec, Jefferies, JP Morgan, and Morgan Stanley published between March 2021 and August 2022 were reviewed for this assessment, 18 covering Severn Trent and 19 on United Utilities, with the results from each summarised in Table 8 and Table 9 below.

Differing approaches are taken to estimating a company's value: some use a discounted cash flow (DCF) analysis of forecast cash flows with a terminal value, others assume a premium over the current/forward RCV as a starting point, while a few explicitly estimate company outperformance (totex, ODIs, and financial). The value of non-regulated and retail businesses is typically added on through assumed EV/EBITDA or EV/EBIT multiples or as the book value, with pension valuations further impacting overall EV.

Table 8: Equity analysts' estimates of Severn Trent value components

Analyst report	Date	Non-regulated	Retail	Pension surplus / (deficit)	Premium to regulated RCV
JP Morgan	28 Jun 22	1.2%		-2.1%	15.0%
Investec	16 Jun 22	3.7%	0.3%	-0.6%	25.0%
Credit Suisse	20 May 22	6.9%		-1.4%	17.7%
Jefferies	22 Feb 22	2.1%		-3.8%	16.4%
Morgan Stanley	17 Feb 22	4.1%		-1.4%	28.6%
JP Morgan	24 Nov 21	1.3%		-3.3%	30.0%
Credit Suisse	25 Oct 21	6.2%		-1.4%	16.9%
JP Morgan	15 Oct 21	1.5%		-3.5%	30.0%
Investec	08 Oct 21	3.6%	0.4%	-2.5%	31.0%
Jefferies	08 Oct 21	1.5%		-3.6%	33.7%
JP Morgan	24 Sep 21	1.7%		-3.7%	30.0%
HSBC	21 Sep 21	5.8%			9.0%
Exane BNP Paribas	25 Jun 21	10.8%		-3.4%	10.8%
Credit Suisse	24 Jun 21	7.1%		-1.7%	17.9%
Investec	04 Jun 21	3.7%	0.4%	-2.5%	32.0%
HSBC	27 May 21	5.8%			9.0%
JP Morgan	29 Apr 21	1.7%		-3.7%	30.0%
Exane BNP Paribas	20 Apr 21	11.4%		-2.4%	5.5%
Range of estimates		1.2% – 11.4%	0.3% – 0.4%	-3.8% – -0.6%	5.5% – 33.7%

Source: KPMG calculations based on analysts' reports on dates indicated.

Table 9: Equity analysts' estimates of United Utilities value components

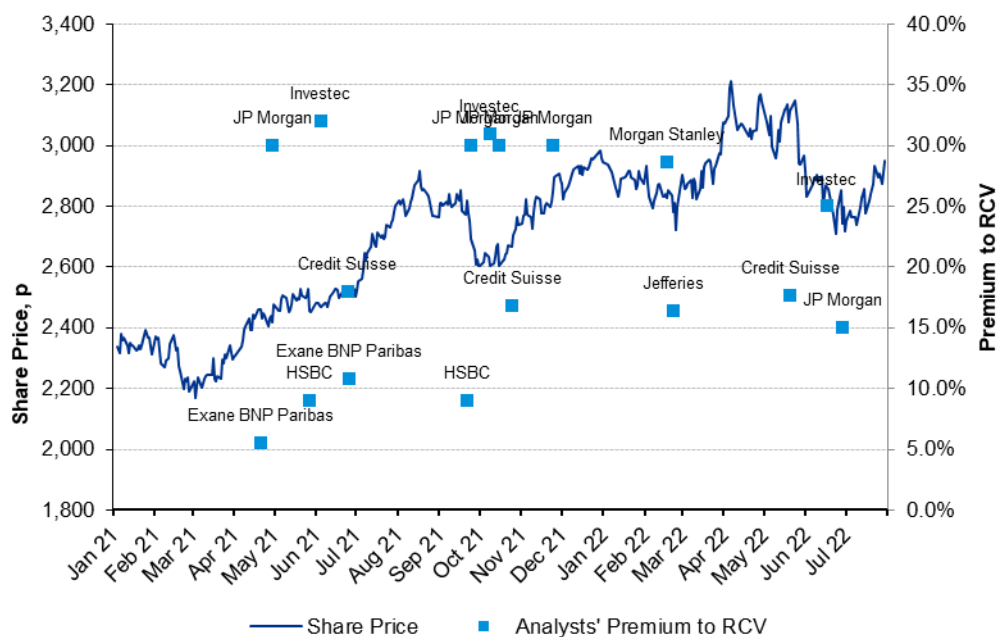
Analyst report	Date	Non-regulated	Retail	Pension surplus / (deficit)	Premium to regulated RCV
Credit Suisse	2 Aug 22	0.7%		2.4%	15.4%

Analyst report	Date	Non-regulated	Retail	Pension surplus / (deficit)	Premium to regulated RCV
JP Morgan	28 Jun 22	0.5%		0.0%	10.0%
Investec	16 Jun 22	0.1%	0.3%	5.2%	20.0%
Credit Suisse	13 Apr 22	1.6%		3.8%	13.7%
Investec	28 Mar 22	0.0%	0.3%	4.4%	26.0%
Jefferies	22 Feb 22	0.5%		5.0%	8.6%
Morgan Stanley	17 Feb 22	0.1%		0.0%	14.8%
JP Morgan	24 Nov 21	0.5%		0.0%	19.0%
HSBC	29 Oct 21	2.3%			4.4%
Credit Suisse	22 Oct 21	1.6%		3.8%	15.5%
Investec	08 Oct 21	0.0%	0.4%	4.5%	31.0%
Jefferies	08 Oct 21	0.5%		4.7%	21.7%
JP Morgan	28 Sep 21	0.5%		0.0%	19.0%
Exane BNP Paribas	25 Jun 21	8.5%		0.0%	7.4%
Credit Suisse	18 Jun 21	1.7%		3.9%	13.9%
Investec	04 Jun 21	0.0%	0.4%	4.5%	32.0%
JP Morgan	29 Apr 21	1.1%		0.0%	19.0%
Exane BNP Paribas	20 Apr 21	10.5%		0.0%	4.4%
Investec	26 Mar 21	0.0%	0.4%	4.5%	20.0%
Range of estimates		0.0% – 10.5%	0.3% – 0.4%	0.0% – 5.0%	4.4% – 32.0%

Source: KPMG calculations based on analysts' reports on dates indicated.

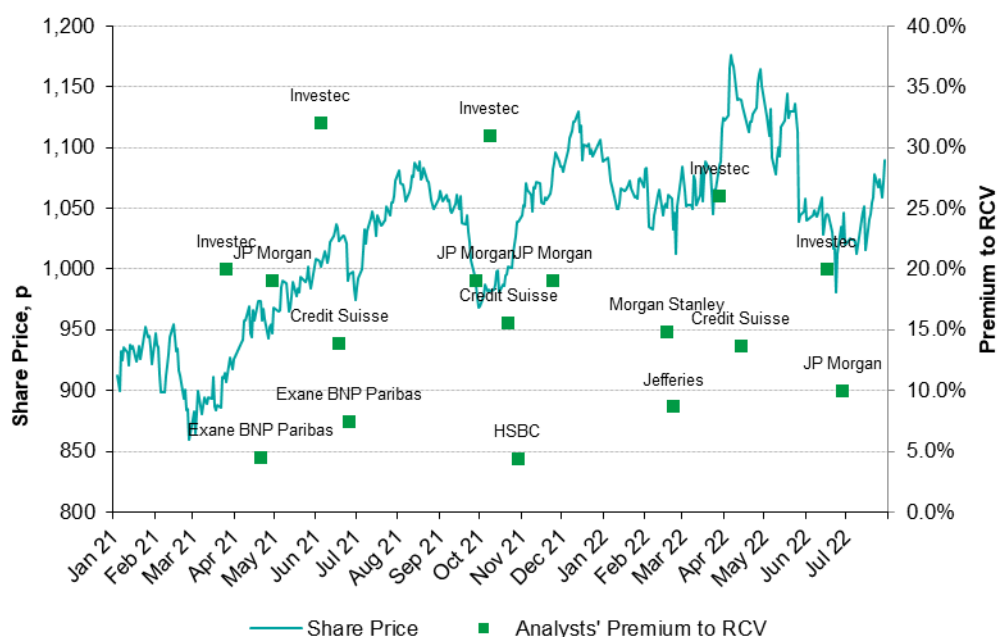
It also appears that there is no obvious relationship between estimated premium to RCV and the actual share price performance of the company with a wide variance between analysts' estimates even at similar times, as seen in Figure 3 and Figure 4 below:

Figure 3: Severn Trent share price against analysts' estimated premia to RCV



Source: Refinitiv; KPMG analysis.

Figure 4: United Utilities share price against analysts' estimated premia to RCV



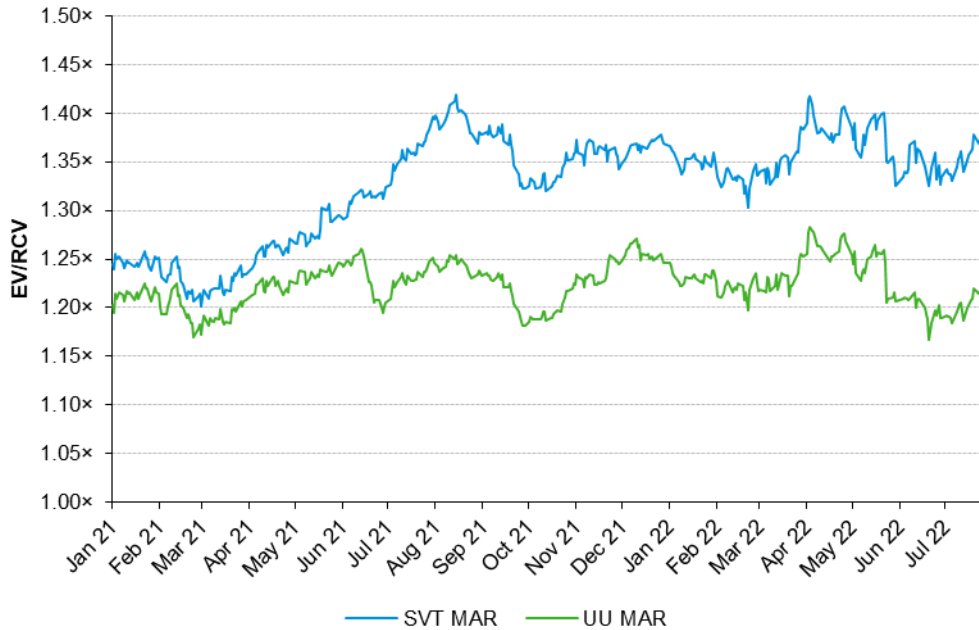
Source: Refinitiv; KPMG analysis.

The variation in published reasonings and views highlights the range of unknown assumptions and expectations behind investors' valuations:

- For example, in April 2021 Exane BNP Paribas estimated the lowest premium to RCV among the reports reviewed for both companies: £561m on an RCV of £10,178m (5.5%) for Severn Trent on the basis that the company's impressive track record on outperformance was already *"fully priced-in"*, while they also *"struggle[d] to find catalysts for a further re-rating"* following United Utilities' *"very decent share price performance year-to-date"* with a £514m outperformance estimate on a forecast £11,592m RCV (4.4%).
- JP Morgan though at the same time assumed a 30% premium to forecast RCV for Severn Trent and 19% for United Utilities, with the latter deemed to be trading at a level that underappreciated *"the company's potential for RoRE outperformance beyond AMP7, especially with a strong track record of financing outperformance."*
- In June 2021 Investec estimated a 32% premium to RCV for both companies, the highest level for United Utilities and close to the highest for Severn Trent in the review, based on expected improved outperformance and the outcome of the CMA appeals being *"a longer-term positive for the broader water industry."*

Implied MARs from the share price movements of the two companies over this same period are shown in Figure 5 below:

Figure 5: Water companies' implied traded MARs since January 2021

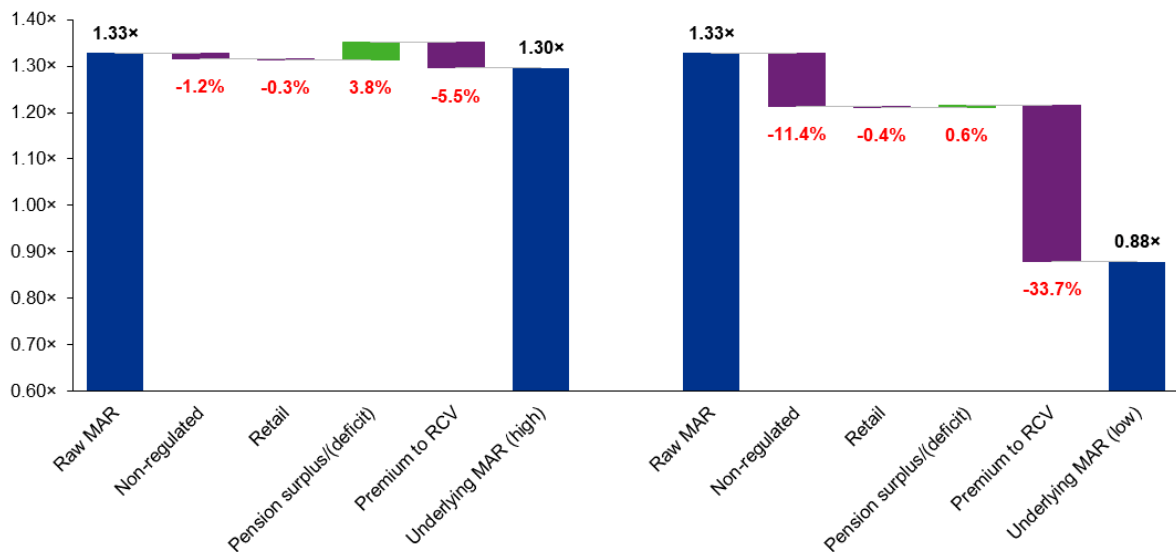


Source: KPMG calculation based on Eikon (enterprise value) and Ofwat (RCV) data.
 Note: Daily traded MARs have been calculated assuming RCV and net debt change linearly through the year.

Over this period, the implied traded MAR for Severn Trent has ranged between 1.20 and 1.42 with an average of 1.33, while that for United Utilities has varied between 1.17 and 1.28 with an average of 1.22. These are generally lower than the raw MARs observed from the private transactions.

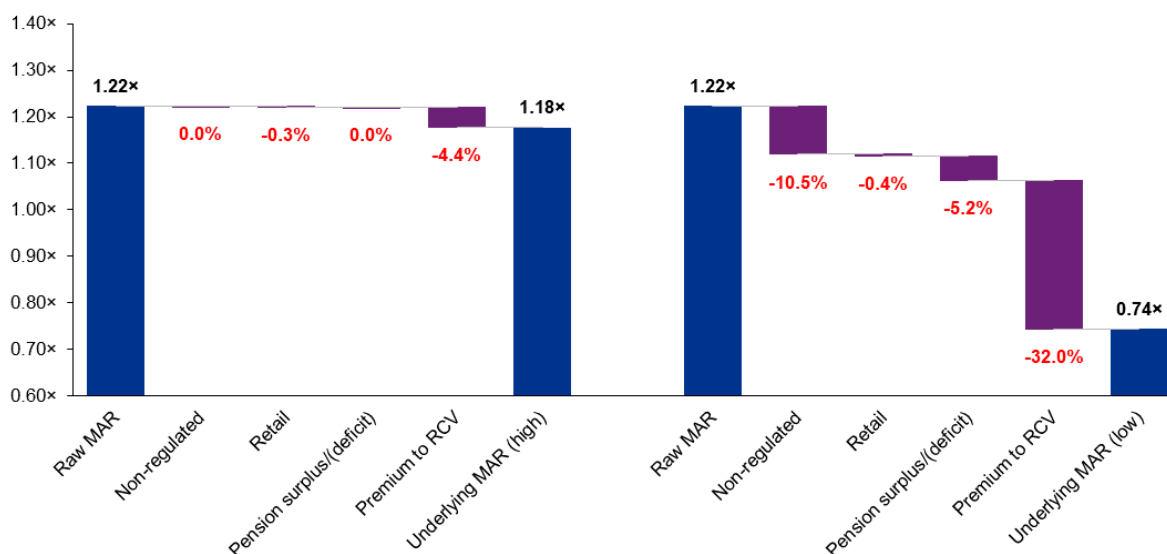
By applying the ranges of equity analysts' estimates for the various value components to these observed implied average traded MARs, it is possible to decompose an underlying value for the pure MAR of the regulated business. This is shown for each of SVT and UU in Figure 6 and Figure 7 respectively below, with each component – non-regulated business activities, retail, pension surplus/deficit, and the estimated premium to RCV – removed from the observed MAR:

Figure 6: Decomposition of MAR for Severn Trent



Source: KPMG analysis.

Figure 7: Decomposition of MAR for United Utilities



Source: KPMG analysis.

As seen, decomposing the average observed MAR with the range of these components indicates that the underlying regulatory MAR could vary between **0.88 and 1.30** for SVT and from **0.74 to 1.18** for UU. This range of MARs mirrors that derived from the previous sensitivity analysis.

This broad range of the potential valuation of the underlying regulated business compared to the RCV, indicates that it is very difficult to draw any meaningful conclusions about specific investor assumptions on individual aspects of the regulatory settlement from implied MARs of the traded water companies.

In addition, it should be noted that Severn Trent and United Utilities are among the best performing companies in the sector, as evidenced by their most recent RoRE performance as previously shown in Figure 1 above.

Therefore, it is even less reliable to attempt to draw conclusions for the sector as a whole from the share price performance of these two companies.

5 Conclusions

Based on all the research and analysis in the report, this section assesses MAR against the cross-check criteria that are set out in Section 2 of this report. This section also provides a high-level evaluation of other cross-checks against the criteria, for comparative analysis purposes and to test whether there are better alternatives to MAR. Finally, this section sets out some key conclusions on the use of MAR in price control determinations.

5.1 Evaluation of the use of MAR against criteria

The use of MAR is assessed against the cross-check criteria to explore how it fares against the principle of being transparent, targeted, objective, incentive compatible, and consistent with precedent and academic literature.

5.1.1 Transparent: whether the approach uses widely observed information which gives replicable results

The information to calculate traded MARs—equity market value and net debt, which makes up the EV, and the RCV—often appear available. However, such figures do not necessarily reflect the MAR for the regulated business alone as listed companies undertake other activities beyond the regulated ones. In practice, it appears that the value decomposition cannot be effectively carried out. This is highlighted by the review of equity analysts' reports for the traded water companies, which shows that there is a wide range of estimates of the relative value of the regulated and unregulated businesses. This means that it is very difficult to reliably and consistently separate out the cost of capital as a driver of the underlying regulated MAR.

Transaction MARs are in fact not as readily available, especially those involving private companies. Often specific details of the transaction are not publicly disclosed (including sale price, ownership stake, transaction boundary, etc.), and even when they are it can be unclear exactly what the transaction value refers to.

Overall, therefore, MARs appear to only partially fulfil the criterion of transparency.

5.1.2 Targeted: whether the indicator can accurately isolate the desired effect from other factors

The target of the cross-check in this instance is to assess and provide a measure of whether the allowed return on equity is sufficient, but not excessive. However, as highlighted in Section 3, in order to be able to conclude that the 'true' rate of return assumed by an investor is different from the allowed return based on MAR, many long-term assumptions on the future cash flows, operational performance and others would need to be made with a high degree of certainty.

Additionally, it is important to consider the market and the point in the global economic cycle, which could contribute to some asset classes being over or under valued due to supply and demand imbalances that aren't reflective of the underlying valuation fundamentals.

There are many unknowns in the determination of a company's value, and the calculated MAR cannot be solely attributed to a difference in investors' assumed return of equity from the allowed return.

This untargeted nature of MAR, particularly as it is difficult to isolate the cause of the premium from the 'noise', is inconsistent with the principles of better regulation introduced by the Better Regulation Taskforce. These principles, and the building block approach, are

designed to avoid a situation where untargeted regulatory mechanisms produce unintended consequences.

Overall, therefore, inferences from MARs **do not meet the criterion for targeted regulation** as they cannot reliably isolate the required information from other factors.

5.1.3 **Objective: whether the cross-check can be relied upon as an unbiased indicator**

Transaction MARs are by their nature biased towards the winning bidder's aims, assumptions, and strategic advantages. The issues highlighted regarding transactions in Section 3.2 and hence inefficiency, investors' expectations and biases, winner's curse, unique individual circumstances, etc, mean that by their very nature these are not unbiased indicators of a company's value.

Conversely, traded MARs (when taken in aggregate rather than one individual assessment) do reflect a much broader set of market expectations and assumptions for the company and companies in the sector and could thus be considered to having a wider, more informed view of the various valuation assumptions. Traded MARs also suffer from certain problems and limitations as efficient market signals but less so than private transactions.

In this regard, it would suggest that MARs do **partially meet the objective criterion** but they also vary significantly over time and face the same limitations in linking observed or derived value to the allowed rate of return as a driver so they **cannot be considered an unbiased indicator of the required return**.

5.1.4 **Incentive compatible: whether the indicator could distort regulatory incentives**

Incentive based regulation is based on a series of carefully calibrated incentive mechanisms applying to costs and service levels. Each of these incentives is designed to provide an economic motivation for companies to apply additional effort where the cost of that effort is less than the benefit to consumers. This aligns incentives between consumers and network companies to promote overall welfare gains for both. For example, the incentive rate applied to an ODI might be related to consumers' willingness to pay for a unit of service improvement. This would ensure that the company is incentivised to apply effort up to the value of that willingness to pay if it can deliver the associated improvement.

The application of MARs by Ofwat to revise the allowed cost of equity (whether up or down) could cause regulated companies to behave in ways which were not intended and not in the best interests of consumers. Specifically, if it was feared that any outperformance – whether in totex, ODIs, or financing – which pushed the company's MAR above 1 (as explored in the stylised sensitivity analysis above) would subsequently result in a further reduction in the allowed cost of equity and the introduction of the 'ratchet effect'. This would further dampen incentives for improved performance as companies may fear that any rewards gained during a price control will be clawed back at the next price control through a reduced cost of equity.

A disincentive to outperform on totex allowances and/or ODIs, if not adequately controlled for when relying on MAR, will thus also have adverse consequences for consumers, through the potential disincentive that it may create, such as higher costs and/or worse customer service.

This potential ratchet effect would tend to suggest that MARs **are not incentive compatible as a cross-check**.

5.1.5 Consistent: whether the indicator is consistent with economic theory, established regulatory precedent and academic research

MARs have been adopted and accepted as a cross-check on a varying basis over time by regulatory authorities, as detailed in Section 1.3. The CMA accepted that Ofgem did not err in using MARs as one of a set of cross-checks. However, its use on its own was deemed not to be reliable.

Academic literature and research has been generally clear that MAR cannot be used to observe cost of equity without controlling for other factors which influence companies' values. There is significant 'noise' in both traded markets and private transactions that cannot be directly controlled (behavioural biases, winners' curse, empire building mindsets, etc.) which directly influence the MAR. It is notable that the academic studies on this subject do not look at the effect of the cost of equity as there are so many more important drivers of a company's valuation (such as quality of management, economic outlook) that the cost of equity has a relatively small effect – when a company's stock price goes up or down, it's due to a news announcement (e.g. a management change), changes in the company's expected future profits, etc., not changes in the company's beta and hence cost of equity.

On this basis, while MARs have been occasionally used by regulators as a cross-check, such usage was only deemed reliable when part of a wider set of indicators, and the academic dismissal of them as a basis for the cost of equity would suggest that they **partially** meet the consistency standard.

5.2 High-level comparison against other cross-checks

A comparison of MARs against other potential cross-checks for the cost of equity, specifically multi-factor models (MFMs), financeability tests, hedge ratios and quantification of risk exposure has also been undertaken based on the same criteria.

It is important to acknowledge that any cross-check is subject to limitations, and it is unlikely that a single cross-check would fully satisfy all five elements of the criteria. The criteria are intended to guide the assessment and ensure that a given cross-check is as robust and effective as possible.

A wholesale detailed analysis of the suitability of the other cross-checks, with reference to theory and in practice, was out of scope for this report, therefore, this section explores only at a high level how other cross-checks perform against the cross-check criteria. All of the chosen cross-checks have the same apparent benefit as MARs, namely relying on independent publicly available market data.

Table 10 below presents an overall summary of how each of the five cross-checks performs against the criteria. Further discussion and the individual assessments for other cross-checks are shown in Table 11 to Table 14. It is relevant to note that the design of the financeability test, which is discussed below, is assumed to be based on the CMA's approach for the PR19 determination.

Table 10: A high level assessment of potential cross-checks against criteria

Criterion	MARs	Multi Factor Models	Financeability (per the CMA)	Hedge ratios	Analysis of risk exposure
Transparent	Amber	Amber	Green	Green	Amber
Targeted	Red	Green	Amber	Green	Amber
Objective	Amber	Green	Amber	Amber	Amber
Incentive	Red	Green	Green	Green	Green
Consistent	Amber	Amber	Green	Amber	Green

Note: Green indicates that the cross-check meets the criterion well; Amber that it partially does so; and Red that it does not do so.

Table 11: Assessment of multi-factor models (MFMs) against cross-check criteria

Criterion	Assessment of MFMs	Suitability
Transparent	MFMs use publicly available observed data and prescriptive methodologies set out in seminal academic papers. They require limited judgment and are not dependent on assumptions regarding the future (as they rely on past data only). The only judgement required is on how to tailor the factor construction approaches to the UK market (e.g., the frequency of accounting reporting) but this can, to an extent, be informed by existing academic papers which apply MFM to the UK market and only affects limited number of parameters.	Partial
Targeted	MFMs are fully targeted as they assess the required returns directly based on the risks faced. MFMs are based on the same core underlying principle as CAPM and describe the return on an asset in terms of the risk of the asset with respect to a set of factors. MFMs ultimately represent extensions of CAPM i.e., they augment CAPM (which is based on the market factor only) with additional explanatory factors.	Good
Objective	MFMs have been proven to be statistically robust based on extensive empirical analysis, with better empirical performance than the CAPM across several statistical tests. In fact, the genesis of MFMs was the consistent finding from academic research of a series of empirical shortcomings in CAPM to explain observed returns. By design, MFMs are a more unbiased estimator of required returns than CAPM.	Good
Incentive compatible	MFMs imply at least the same degree of compatibility with incentives and regulatory objectives as CAPM and additionally provide statistically more robust evidence of the required returns for a given level of risk of the asset with respect to a set of factors.	Good
Consistent	MFMs are well established and are the standard asset pricing model used in academia and by practitioners to explain and estimate excess returns (over and above the risk-free rate). MFMs have been used as the preferred asset pricing model for over thirty years. Standard corporate finance textbooks position MFMs as the mainstream model for measuring risk for both academics and practitioners. Large assets managers, including those who have historically invested in regulated utilities, use MFMs to explain returns and manage risk across their portfolios. In the regulatory context, UKRN and CMA have recognised the stronger explanatory power of MFMs compared to CAPM, however some regulators have previously dismissed them as too complex to apply and interpret.	Partial

Table 12: Assessment of financeability tests (as per CMA’s approach) against cross-check criteria

Criterion	Assessment of Financeability tests	Suitability
Transparent	Financeability tests are undertaken based on the price control models published by the regulators and are directly based on the proposed parameters for the price control. Debt financeability tests should be applied following the prescriptive guidance provided by rating agencies. There may be greater judgement in designing equity financeability tests, but these can be grounded in Corporate Finance theory.	Good
Targeted	The financeability cross-check diagnoses the calibration of the whole price control across WACC, cost allowance and other regulatory mechanisms such as incentives. However, as noted by the CMA at PR19, WACC is the primary driver of financeability suggesting that the impact of other factors is relatively limited.	Partial
Objective	Financeability test performed by the CMA at PR19 acted as an unbiased indicator of whether the allowed WACC is sufficient. However, it should be noted that the results of the financeability test can be distorted where their logical sequencing is reversed, and they become contingent on assumptions being made by a regulator (e.g., on notional gearing). However, this does not need to be the case.	Partial
Incentive compatible	Financeability tests are a unique cross-check as they are explicitly linked to the regulator’s financing duty and so by design are incentive compatible and underpinned by core principles of UK regulation and years of precedent.	Good
Consistent	These tests tend to be applied in a regular, prescribed fashion.	Good

Table 13: Assessment of hedge ratios against cross-check criteria

Criterion	Assessment of Hedge ratios	Suitability
Transparent	Hedge ratios focus on checking if the gap between the cost of equity and the cost of debt is sufficiently high to compensate for the additional risk inherent in equity financing (i.e. the lower priority of equity relative to debt in terms of claims on cash flows) in order to promote equity investment. Hedge ratios use publicly available observed data and regulatory decisions in previous periods and are based on corporate finance principles. They require limited judgment and are not dependent on assumptions regarding the future (as they rely on past data only).	Good
Targeted	Hedge ratios are based on the delta between the risk premium on the assets of a company and the risk premium on the debt of the same company. The delta is expected to be positive since equity is more risky than debt. The Hedge ratio cross check considers how large the delta should be based on (1) an implied risk premium on debt derived using market data and (2) an estimated risk premium on assets derived from a mixture of market data and regulatory precedent. This can then be compared with the delta based on the regulator’s determination of the allowed cost of debt and cost of equity. As a result, Hedge ratios are specifically targeted at assessing the return on equity relative to the cost of debt.	Good
Objective	Hedge ratios are calculated based on data calibrated from market information, and hence may be influenced by various inefficiencies in markets. External drivers beyond fundamentals may have an influence on observed values. Hedge ratios also effectively assume that regulatory decisions from previous periods appropriately priced the parameters used in the calculation. To the extent that this is not the case (e.g. total market return was understated), the results of the cross-check could be distorted.	Partial
Incentive compatible	The premise underpinning Hedge ratios as a cross-check is that the allowed return is commensurate with the return that investors can earn on investments of comparable risk and so is sufficient to ensure adequate equity investment in a company. This should therefore ensure that the regulator’s objectives of securing capital required for investment which is in customers’ interests.	Good

Criterion	Assessment of Hedge ratios	Suitability
Consistent	<p>While Hedge ratios have been suggested for use as a cross-check on the cost of equity, there is not a widely established regulatory precedent for use of hedge ratios as a cross check.</p> <p>Hedge ratio analysis is also relevant to the assessment of financeability as it is comparable to coverage ratios such as AICR and PMICR applied by rating agencies. Both hedge ratios and coverage metrics consider returns on assets relative to the return on debt.</p>	Partial

Table 14: Quantification of risk exposure against cross-check criteria

Criterion	Quantification of risk exposure	Suitability
Transparent	The quantification of risk as a cross check compares financial risk exposure based on historical business evidence and macroeconomic data to the financial buffer available for management of risk. While the returns achieved can be readily measured from publicly available information, the quantification of different types of risk on a forward-looking basis may not always be observable but instead based on simulations and scenario analysis.	Partial
Targeted	<p>Risk analysis captures the full spectrum of risk (i.e. systematic and asymmetric) and hence can cross check holistically whether the allowed returns are commensurate with the risk exposure faced by the regulated companies.</p> <p>Risk analysis is fully targeted as it assesses the required returns directly based on the risks faced based on the calibration of the price control and risks allocated to companies.</p> <p>Risk analysis reflects water company obligations and incentives— some of the most important risks that water companies face include non-compliance with regulatory standards, health & safety risks, response costs, inability to identify significant events quickly.</p> <p>Risk analysis also checks whether equity returns provide sufficient buffer for companies to manage significant events and risks.</p>	Partial
Objective	Quantification of different categories of risk can sometimes be somewhat subjective and requires judgment, particularly where risks are new or changing.	Partial
Incentive compatible	Quantification of risk is linked directly to calibration of regulatory mechanisms and incentives and hence can sense check that design of regulatory mechanisms does not introduce perverse incentives (for example setting allowed returns below required returns on a mean expected basis) or undermine the ability of the sector to attract capital.	Good
Consistent	Risk analysis has long formed part of standard price control processes – most notably in stress testing projected credit metrics and RORE analysis as part of financeability and financial resilience assessments.	Good

The assessment presented in the tables above suggests that there are better options than MARs for use as cross-checks on the allowed cost of equity in regulatory price control determinations. There is a risk that if MARs are used to inform the allowed cost of equity, mainly based on the most recent private transactions or from listed utilities in GB, this may be incentive incompatible and may result in biased estimates.

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