Low Tide

Benchmarking Risks in Infrastructure Investments: What the data showed about Thames Water

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Executive Summary

In this paper, we ask what investors in Thames Water, and its holding company Kemble Water, would have learned about the level of risk of their investment and its likely market value had they compared its characteristics to market and peer group data.

A large water and wastewater utility like Thames Water epitomises the "stable and predictable" cash flows that investors are attracted by in the infrastructure asset class. Yet, in December 2022, the value of this investment was impaired by almost 30%, an abrupt and unexpected loss of approximately GBP1.5bn (the company was previously valued at c.GBP5bn by its owners) for investors including UK, Japanese and Canadian pension plans. Only nine months earlier, in March 2022, some investors were still *increasing* the valuations of their stakes.

We show that a straightforward comparative analysis reveals the emergence of a high-risk, low-return profile that should have raised numerous red flags and prompted long-term investors seeking a 'boring' infrastructure to reconsider. For a large water utility to lose so much value so fast, the investment must in fact have been mispriced for several years leading up to the impairment. Our own assessment is that its value had indeed been decreasing for years and will likely decline more from the current reported valuation.

Without this analysis, investors fell pray to a form self-referencing or 'absolute thinking' that is very common in infrastructure investment. This narrow vision can obscure the big picture and the role of the systematic drivers of the fair value of private infrastructure companies. Because infrastructure assets are large and illiquid, once invested, it can be hard not to 'fall in love with your position' since it is difficult to change easily or quickly. Taken in isolation, a single asset is often more of a 'story' than a hard quantitative assessment.

We argue that benchmarking the key characteristics of the asset would have allowed a much better understanding of its risk profile. Taking a relative view requires representative and robust information to build benchmarks and point of reference to which the risks and performance of infrastructure assets can be compared. When this information is available, investors can better understand the kind of investments they have made, because they can compare them to the right benchmark. We use such a database of financial data for similar and comparable investments and in this paper we examine the difference between robust but representative benchmarks and the data available for Thames Water and Kemble Water.

Most infrastructure assets are in some ways unique and will differ from the average in their sector or country. However, when compared with a large and robust sample, any large differences from the benchmark provide indication of not only how unique an infrastructure company is, but also of how confident (or worried) investors should be about its ability to deliver "stable and predictable cash flows". The difference between an investment's characteristics and its benchmark does not necessarily signal problems, but it is something that investors should be able to understand and explain; and, yes, in some cases it can be a red flag.

We discuss three red flags that investors could have considered long before Thames Water had to be brutally impaired. Had these been identified up front, these red flags could have been a cause for remedial action or a revaluation of the asset earlier on.

- Red flag #1: the company should not have been expected to behave 'normally' as its incentives were twisted by an extremely low regulatory weighted average cost of capital (or WACC) that pushed it to take on too much risk. While this is true of the whole sector, Thames Water's market WACC was even lower than all of its peers.

- Reg flag #2: Thames Water had created a structure to extract a lot of cash which also created a huge debt pile, leading to a need to conserve capital. It would have been clear from 2016 onwards that there would be no potential for further payouts for many years.

- Red flag #3: Thames Water's exposure to key risk factors has been high, and rising, for a significant period of time: this leads to a higher risk premium and therefore an increased discount rate.

These findings should have at the least led potential investors to question of the reported value of the company - not to mention the fact that it had apparently increased over time - because they all signal that Thames Water should have instead been losing value for many years. Using our own benchmarks to generate a comparable set of data points for a typical company with the same characteristics as Kemble Water, our measures of risk factor exposure, duration (exposure to interest rate risk) and likelihood of dividend payouts signal that that the firm is likely to have lost between 30% and 50% of its value over the past decade, solely due to the evolution of its risk profile and the market price of risk.

While this does not constitute a formal assessment of the fair value of Thames Water and its holding company, it is a robust point of reference from which investors should have questioned what they knew and the valuation of the asset.

1. Introduction: Seeing Red Flags

In this paper, we ask what investors in Thames Water, and its holding company Kemble Water, would have learned about the level of risk of their investment and its likely market value had they compared its characteristics to market and peer group data.

A large water and wastewater utility like Thames Water epitomises the "stable and predictable" cash flows that investors are attracted by in the infrastructure asset class. Yet, in December 2022, the value of this investment was impaired by almost 30%, an abrupt and unexpected loss of approximately GBP1.5bn (the company was previously valued at c.GBP5bn by its owners). Only nine months earlier, in March 2022, the same investors in the same asset were still *increasing* the valuations of their stakes.

Thames Water and its holding company Kemble Water are complex (and not always transparent) structures and we do not aim to provide a complete analysis of all their dimensions in this short paper. Instead, we ask a simple question: could investors in this business have anticipated this outcome - and therefore, perhaps, managed to avoid it?

We show that a straightforward comparative analysis reveals the emergence of a high-risk, low-return profile that should have raised numerous red flags and prompted long-term investors, hoping to be exposed to typically "stable and predictable" characteristics of the infrastructure asset class, to reconsider.

Indeed, despite being a large and unique asset, a natural monopoly and one of the most visible infrastructure investments in the world, Thames Water is not so unique that it cannot be understood systematically and compared to relevant benchmarks to gauge the level of risk and performance that its owners can expect.

For a large water utility to lose so much value so fast, the investment must have been mispriced for several years by the time it was impaired and declared to have lost one third of its value. Our own assessment is that its value has likely dropped by *more* than a third, leaving investors facing additional losses.

The discrepancy between the value that the current investors in Thames Water must have thought was correct (as reported in their accounts as the 'Fair Value') and what they eventually come to realise was the case is partly due to an absence of 'relative thinking'; investors typically focus on individual assets and their idiosyncratic characteristics and fail to consider the systematic dynamics that make market prices change. Infrastructure assets are special and unique, true, but investors may focus too much on their uniqueness and the story around it, and can miss the bigger picture that is available: the market (and peer groups).

Infrastructure assets and companies possess unique characteristics, making it at first appear very difficult to compare them with one another. Every single airport, road, water and gas utility has been designed and built to fit specific environment, both physical and regulatory, and to operate solely in that distinct environment. Each infrastructure asset is a 'relationship specific' investment i.e., it represents a large immobile, often irreversible, capital asset that can only be used for a single purpose.

This apparent intractability of infrastructure investments may lead some investors to focus solely on the assets they own, and fail to look for benchmarks or points of reference for characteristics that exist across the asset class and could enhance their view on these assets. In other words, they may find themselves looking at infrastructure investments solely from an 'absolute' perspective: each asset is perceived as a special case that warrants little to no comparison.

This form self-referencing or 'absolute thinking' can be very misleading and can lead investors to miss the big picture and the drivers of the fair value in private infrastructure investment. The importance of 'trophy assets' (and frequent fascination with 'real assets') may be clouding the judgment of otherwise seasoned investors.

Beyond the psychology of investing in private infrastructure, it is nonetheless true that a series of adequate comparisons would have revealed years ago that Thames Water was an asset that was in bad shape - and not about to get better.

This idea of the comparability of infrastructure assets is embedded in The Infrastructure Company Classification Standard (TICCS) taxonomy of infrastructure investments: TICCS categorises infrastructure companies by groups of business models, industrial activities (designs and technologies), types of company structures and of geo-economic exposures. While each firm retains unique features, infrastructure assets that are within one TICCS class are more alike than not, especially when compared with assets in other classes. Thus, some a water company like Thames Water is part of the network utilities class (IC80), which exhibits certain economic characteristics such as increasing returns to scale, high barriers to entry, etc., and usually call for some form of economic regulation. However different from each other each water utility may be, they have more in common with one another than with, say, merchant toll roads, which are exposed to short-term economic cycles, can face competition from other transport modes and are less complex assets than utilities spanning entire cities.

Likewise, from an asset pricing and risk standpoint, infrastructure companies share some key characteristics (call them 'risk factors') that explain in part how risky and how valuable their future free cash flow and dividends tend to be e.g., companies that are more profitable are more likely to pay dividends, and companies that are more indebted are less likely to do so, *ceteris paribus*. The risk of future cash flows also depends on the degree of construction risk or on the business model of the investment, etc.

In other words, one can take a comparative, or relative, view on infrastructure investments, however unique and idiosyncratic they may be. In effect, almost any aspects of an infrastructure asset can be benchmarked: say a project company with a 30-year take-or-pay off-take contract is 90% leveraged; is that high? (It isn't.) Say a mature toll road company pays 10% of its revenues as dividends; is that high? (Not really.) Say a solar project in Spain trades at a 6% yield in June 2023; is that cheap? (Probably not.)

Taking a relative view on infrastructure assets can serve at least two purposes for investors: first, benchmarking the characteristics of infrastructure assets allows a much better understanding of what they are like, especially in term of risk profile. Taken in isolation, a single asset is often more a story than a hard quantitative assessment. Because infrastructure assets are large and illiquid, once invested, it can be hard not to 'fall in love with your position' since it is difficult to change easily or quickly. A detailed understanding of what one portfolio is really like compared to the investible universe is, however, a key starting point to better managing the risks of this portfolio.

Second, taking a relative view is the only way for an investor to do what investors do best: arbitraging between assets and asset classes. From the asset allocation stage to each individual investment decision, choosing infrastructure investments only makes sense relative to certain investment objectives at the infrastructure and total portfolio level.

Of course, taking a relative view requires representative and robust information to build benchmarks and points of reference against which the risks and performance of infrastructure assets can be compared. When this information is available, investors can truly understand the kind of investments they have made, because they can compare them to the right benchmark.

In this note, we ask what investors in Thames Water, a large water utility located in the UK, would have learned about their own investment and the level of risk they were exposed to if they had taken such a comparative/relative view of this company. We argue that despite being a large and unique asset, a natural monopoly and one of the most visible infrastructure investments in the world, Thames Water is not so unique that it cannot be understood systematically and compared to relevant benchmarks for the level of risk and performance that its owners can expect.

To answer our question, we use the following approach: we consider a large database of financial data for similar and comparable investments and examine the differences between these *benchmarks* and the data available for Thames Water and Kemble Water. Most infrastructure assets are in some ways unique and will differ from the average in their sector or country. However, when compared with a large and robust sample, any large differences from the benchmark provide indication of not only how unique an infrastructure company is, but also of how confident (or worried) investors should be about its ability to deliver "stable and predictable cash flows".

The difference between an investment's characteristics and its benchmark does not necessarily signal problems, but it is something that investors should be able to understand and explain; and, yes, in some cases it can be a red flag.

In what follows, we consider three such "red flags" that investors wanting to understand their investment in Thames Water, and how much risk they were exposed to, could have considered long before the asset was brutally impaired.

The first red flag is not specific to Thames Water but plagues the entire water sector in England and Wales. It is the large gap between *the company's* regulated cost of capital and its *market* cost of capital. The UK water sector is regulated by creating incentives for firms to be efficient producers (of water and wastewater services) and this is primarily done by setting a revenue cap, which is itself driven by an assumed cost of capital. It is therefore not surprising that firms and the regulator may disagree about their cost of capital. However, in the case of England and Wales, the regulator (OfWat) set the companies' allowed return so far from the reality of the market (by a factor 5 to 6 in the case of Thames Water) that, far from creating positive incentives to be an efficient company, the regulator created incentives for the management to run the company into the ground to maximise short term returns and leave it, bloodless, to the next set of owners.

Indeed, by setting the weighted average cost of capital (WACC) of the firm at 2-3%, very far below the firm's actual costs of capital in the market, the regulator sent the message early on that investments would be hard to recoup and any returns would be low. While it is the mandate of the regulator to incentivise efficiency to minimise tariff increases and private profits, by completely disregarding (in fact, incorrectly modelling) the market cost of capital of the firm by such a very wide margin the regulator instead incentivised owners *not to invest* in the asset, and instead *to extract cash as quickly as possible* including by increasing leverage and other forms of financial engineering. This is exactly what happened.

Thames Water's market cost of capital, when properly measured and compared to its peers, is in fact the highest of the entire UK water sector (11-12% today). Therefore, Thames Water was a likely candidate to choose this path of lower capex and high leverage, thus changing the risk profile of the firm over time. When new investors took over the company, this pattern and its main driver (the wedge between the regulated and the market WACC) were clearly visible. The consequences were not difficult to predict and indeed led to the latest impairment: unhealthy incentives for the firm eventually led to excessive risk taking and the destruction of shareholder value.

Next, we review the investment's financial structure and look at its dividend payout behaviour. While until now we have focused on the regulated water company asset, Thames Water, we now turn to its holding company (Kemble Water) and the additional layer of financial structuring that this entity creates. We consider which elements in the structuring are commonly found in infrastructure investment and which are less common and indeed rare.

The second red flag is that the owners of Thames Water had been extracting large dividends and had followed smaller UK water companies in creating a "whole of business securitisation" structure which was instrumental in increasing leverage and maximising earlier payouts at the risk of exhausting the company's balance sheet. Compared to its peers, this structure was not unusual, but did increase risks related to leverage.

A simple analysis of the difference between the equity payouts and payout growth of Kemble Water reveals an unusual behaviour, namely extremely high payouts as a proportion of the firm's free cash flow which essentially brought forward future dividends to that time. This could have given any new owners of Kemble Water pause for thought as the balance sheet was effectively exhausted by 2017. The change of ownership was followed by a period during which payouts which were significantly below average and dividends disappeared completely.

Moreover, despite paying out a large share of its free cash flow before 2015, Kemble's dividends as a percentage of its revenues were always below the sector benchmark when compared with its peers. In other words, a company that was unperforming its peers in terms of payout ratio (dividend/revenues) was nevertheless choosing to outperform in terms of payout as a share of free cash flow (up to 75%, at a time when the industry average was below 50%).

By the time new owners took over, the ability of the investment (Kemble) to pay dividends at all was frankly questionable. Indeed, it has not paid any since then and is now not expected to before 2030. This amounts to a 13-year dividend famine; so much for 'stable and predictable' dividends.

The last red flag could be have been raised following a simple comparison between the risk factor exposures of Kemble Water and its peers. Some of the key proxies of the risk of future cash flows in infrastructure investment are the firm's size (total assets), profits (return on assets before tax), leverage and capex ratios as a share of total assets. These factors, amongst others, have been shown to persistently explain the market price of risk required by investors in actual transactions in previous research (see Blanc-Brude and Tran, 2019).

Using several peer groups, we see that Thames and Kemble were significant outliers in terms of risk factor exposures and that the combination of large size, low profits and high debt made the investment clearly high-risk compared to both the average UK water utility and to other utilities elsewhere in the world.

The comparison reveals why Kemble Water has a much higher WACC and cost of equity than its peers: it is much larger (by a factor of 6), much more leveraged (by a factor of 3) and much less profitable (by a factor of 6) than both its UK water and European Network Utilities peers. It also invests less than its peers, consistent with "cash cow" behaviour.

In conclusion, investors in Thames Water and Kemble Water were faced with following key facts:

- Red flag #1: the company should not have been expected to behave 'normally' as its incentives were twisted by an extremely low regulatory weighted average cost of capital (or WACC) that pushed it to take on too much risk. While this is true of the whole sector, Thames Water's market WACC was even lower than all of its peers.
- Reg flag #2: Thames Water had created a structure to extract a lot of cash which also created a huge debt pile, leading to a need to conserve capital. It would have been clear from 2016 onwards that there would be no potential for further payouts for many years.
- Red flag #3: Thames Water's exposure to key risk factors has been high, and rising, for a significant period of time: this leads to a higher risk premium and therefore an increased discount rate.

These findings should have at the least led potential investors to question of the reported value of the company - not to mention the fact that it had apparently increased over time - because they all signal that Thames Water should have instead been losing value for many years.

Using a benchmark of what a typical company with the characteristics of Kemble Water is like in terms of risk factor exposure, duration (exposure to interest rate risk) and likelihood of dividend payouts, we find that that the firm is likely to have lost between 30 and 50% of its value over the past decade, solely due to the evolution of its risk profile and the market price of risk.

While this does not constitute a formal or detailed assessment of the value of Thames Water and Kemble Water, it is a robust point of reference from which investors should have questioned what they knew and about the valuation of the asset company.

In conclusion, we return to the valuation of Thames Water/Kemble Water, which has become a high-risk asset over time. Obtaining valuations of existing shareholders, we compare these with the comparables obtained from the infraMetrics database.

We find that our market implied valuations predicted the 30% impairment of 2022 (by several years) and also that existing investors currently hold their valuation at the highest possible valuation bound. infraMetrics comparables suggest significant further writedowns. Had investors made greater use of comparable metrics, they might have had a better assessment of the risks of investing in this asset and of the evolution of its fair value over time.

This is especially relevant for the more 'passive' investors involved in the Kemble structure e.g. Japanese pension plans.

2. Red Flag #1: The Regulated Cost of Capital

In this chapter, we only look at Thames Water, the regulated water utility that is the underlying asset of the larger HoldCo structure to which investors are exposed. We return to the HoldCo (Kemble Water) in the next chapter. Indeed, while the investment in Thames Water is ultimately held in the HoldCo, which holds its own additional risks, the core of the investment remains the water and wastewater business and its ability to generate profits and returns for investors.

We argue that investors in Thames Water should have recognised the discrepancy between the level at which the water regulator set the cost of capital and the actual market cost of capital faced by Thames water (including their own return expectations) as major red flag. Indeed, the large gap in the determination of the expected returns of regulator and investors, once acknowledged, suggests that either private investors would not receive a fair return or that they would need to act recklessly to do so. This is the first red flag that a comparative approach would have revealed.

Thames Water is one of 17 regulated water & sewage companies in the UK. They are to a large extent natural monopolies and need to be regulated to minimise the welfare impact of monopolistic behaviour. For a monopoly such as a water company, it is rational and profit maximising to underinvest in its asset and to overcharge its customers, irrespective of whether it is publicly or privately owned. For these reasons, regulatory oversight is required and aims to have the firm maintain or improve the quality and quantity of service, while limiting the cost to the consumer.

In the England and Wales, this is achieved through incentive regulation by OfWat, the Office of Water Services. The regulator aims to promote productive efficiency by setting tariffs at a level representing that for which an efficient service provider would also earn a fair return. The regulator's view on the firm's cost of capital thus allows setting tariffs while taking into account the need to invest in the asset and the service required of the company, for instance the treatment level of wastewater discharge, but also the level of leakage in the water network, or its expansion.

Of course, the cost of capital is also a key data point for an investor in a private company or project: if the expected return from the investment does not at least equate the cost of capital, then the investor should walk away from the project - or find a way to increase returns.

We argue that the regulator of Thames Water has been setting the WACC inadequately, using a long invalidated asset pricing model as well as the wrong data.

As a result of setting the WACC at a very low level, OfWat was better able to meet its social mandate objectives: to keep water tariffs lower than they otherwise would be if the firms had their way.

However, it also increasingly created toxic incentives for the firm and its investors, who were faced with a higher market cost of capital and therefore had to engage in adaptative tactics to meet their own return targets in a context where the regulator would not recognise the level of return required by the market to invest in a utility company regulated by OfWat.

This process and the level of the WACC imposed by the regulator are public knowledge and of course known to investors. The implications for the firm's behaviour become a matter of simple economic reasoning: faced with a higher cost of capital than the one it is allowed to recoup by the regulator, a firm can make the choice to walk away from the investment (at a very large cost) or to increase the risk profile of the investment to extract a higher return, more aligned with its own cost of capital, but at the expense of bringing itself to the brink of insolvency.

The inability of the regulator to take the market price of risk into account when estimating the fair return of the private sector thus played a role in pushing the water utility to adopt reckless behaviour to reach the level of return required by the market.

Crucially, this behaviour should have been clear to any new investor acquiring shares in the HoldCo as historic investors chose to exit the investment. In other words, a comparative analysis of the market costs of capital of Thames Water with its regulated cost of capital left little ambiguity as to where the firm stood in terms of incentives.

2.1 The WACC matters

The WACC is one of the most fundamental factors driving firm behaviour. If its owners assess that the returns on investment are greater than the cost of capital, then the firm has an incentive to invest in a new project.

OfWat regulates water utilities by employing a Revenue cap: this requires the setting of maximum allowable revenue over a set period of time (the regulatory period). The revenue is made up of operating expenses, capital allowances (essentially the deprecation due to use of assets) and a rate of return on the assets employed to provide the water and wastewater services to consumers, minus any efficiency improvements.

Such a regulatory approach limits demand risk: any revenue not earned during the regulatory period, due to say reductions in demand, can be added to revenue allowances in subsequent periods. It also allows for smooth, predictable pricing, which is socially valuable and helps to manage consumer expectations.

However, this process has to be iterative: first, there could be estimation errors in the setting of prices during the initial period, especially as the firms attempt different types of cost savings and innovations. Environmental requirements and social acceptance may change, requiring the firm to invest in new capacity or improved facilities. The cost of capital itself may change with the credit cycle, as can long-term trends in the level of interest rates, and of course the demand for investments in infrastructure can change, leading to a lower or higher cost of equity for the firm.

For example, the demand for investing in infrastructure companies like regulated water utilities may change and, indeed, has increased over the past two decades, thus potentially lowering the cost of equity. However, the opportunities to invest in other types of infrastructure than regulated utilities have also increased. Such firms used to be the most common and most well-known private infrastructure firms after they were privatised in the 1980s. They have since become merely one type of infrastructure amongst many that investors can arbitrage between. And of course, beyond different types of infrastructure, investors arbitrage between all asset classes. For instance, a decade of low bond yields has increased investor demand for infrastructure, thus compressing the cost of capital for this sector. This trend having reversed, the market demand for such assets may change and so would the cost of equity of a water utility.

Hence, every five years, a reassessment of the variables that impact the revenue cap is needed. With OfWat, these include the investment program, operating costs and the cost of capital.

2.2 What is the cost of capital of Thames Water?

OfWat does not know what the cost of capital of Thames Water is, nor does it try to find out.

The general premise of its approach to the costs of capital is to assume that all water utilities can be compared to a notional firm representing the typical desirable water company. To create this 'yardstick competition', the regulator obtains estimates for leverage, asset betas, market risk premiums, debt market premiums and estimates of tax rates in order to build up the cost of capital for all water and sewage utilities. These estimates all revolve around the assumption of the 'efficient financing' of a water utility, which requires the utilities to retain an investment grade credit rating and a notional level of debt.

Three elements are important for the derivation of the cost of capital: the cost of equity, the cost of the debt and the capital structure. In each case, Ofwat applies an approach which deviates from the objective to measure the *market* cost of capital of the firm and thus sets the stage for distorting the its incentives to invest and develop the asset.

2.2.1 Ofwat and the cost of equity: the wrong model and the wrong data

In equilibrium the expected return of a stock is also the cost of equity of the firm. When setting the cost of equity, OfWat relies on the Capital Asset pricing model or CAPM of Treynor (1961) and Sharpe (1964). The CAPM states that the excess return of an asset can be written as the linear combination of its "market beta" or correlation coefficient with the market excess return or equity risk premium, that is,

$$E(R_i) - Rf = \beta \times (E(R_m) - Rf) \qquad (2.1)$$

where $E(R_i)$ is the expected return of asst i, Rf of the risk free rate of interest and $E(R_m)$ is the return of the market portfolio.

OfWat's approach is flawed for three reasons. First, it is the wrong asset pricing model: CAPM has long been known to be ineffective in explaining returns (see for example Eugene and French, 1992; Fama and French, 1993, 1996). The CAPM's failure to explain returns indicates that there are other factors that explain the returns of companies, including water utilities. Failure to consider these factors means that OfWat is not taking a full account of the risk inherent in the management and operation of water utilities.

Second, OfWat uses the weak data to calibrate it: using CAPM requires estimating equity risk using listed firms to estimate the beta of the asset. Best practice recommends employing a portfolio of stocks to obtain a stable beta estimate but, OfWat is limited by the fact that there are only three listed water utilities in the UK, one of which is not a 'pure-play' water utility. As a result, in PR19, OfWat employs only **two** listed water companies to estimate the equity beta. This beta estimate would not be stable, especially if the firms vary their characteristics significantly.

Third, Ofwat's methodology assumes that asset beta is constant during the regulatory period. There is however, significant research that has shown that beta estimates vary with time (Brooks et al., 1998; Hall et al., 1989, see) Estimating the beta, typically over a historical time-frame, ignores significant market shocks, such as the impact of COVID-19, which had a substantial impact on asset return covariances. Furthermore, the estimation techniques employed by OfWat such as traditional Ordinary Least Squares (OLS) models, do not account for time-varying changes in beta, despite the availability of alternative econometric techniques that allow for time-varying beta estimates, such as filtering methods and other algorithms that are widely used for statistical estimation today.

Finally, in PR24, Ofwat will estimate beta using daily returns data. This is despite Gilbert et al. (2014) showing that higher-frequency data can result in lower beta estimates than using weekly or monthly observations. This would result in even lower equity betas for return on capital calculations.

We see that the approach taken is not representative of water utilities and their risks, nor robust since it relies on a discredited model and little data.

Table 2.2.1 shows the resulting determinations since 1999. Due to the methodology employed, the estimated cost of equity proposed by OfWat for all UK water companies varies little and is in the range of 6.5-7%. We return to what the market cost of equity for such companies is when measured against more adequate data from private markets.

2.2.2 Ofwat and the cost of debt: biases in market data

OfWat's estimation of the cost of debt separates out the existing debt and any new debt required and allows a different rate of return for each.

For existing debt, in PR19, OfWat chose to use the historical yield paid on debt included in the iBoxx non-financials A/BBB index, with more than 15 years to maturity. This resulted in a cost of debt of 4.72%. However, OfWat also considers that debt issued by regulated entities has outperformed the market by 25bp (the market being the iBoxx index). As a result, the cost of debt is reduced by a further 25bp to allow 4.47% (nominal interest rate) for existing debt.

For debt that would be issued during the regulatory period, OfWat employs a similar approach to that of existing debt. Taking spot yield of the iBoxx A/BBB non-financial index, with a maturity greater than 10 years, gives a point estimate of 2.44%. It adds a further adjustment of 25bp based on market implied increases in interest rates, but also subtracts 15bp due to the historical out-performance of water utility debt compared with other debt. As a result of this, OfWat sets the base rate of interest at 2.54% (Nominal). In the PR19, the estimate of outperformance by utilities debt is based on OfWat's observation of greater returns for water company bonds, with more than 10 years to maturity compared with broad-market debt indices (iBoxx A/BBB indices).

Finally, OfWat assumes that 20% of all debt is going to be new, whilst the existing (or embedded debt) remains 80% of the total cost of debt. As a result, the cost of debt employed for the price regulation is 4.18% (nominal).

Here again, we see that the approach is piecemeal at best, mostly *ad hoc* and lacking robustness. While OfWat uses a market index to set the cost of debt, it also imposes employing the historical average yields despite the fact that markets adjust their expectations and demands for returns due to many factors (for instance the 23 September 2022 Budget Statement had a significant impact on yields).

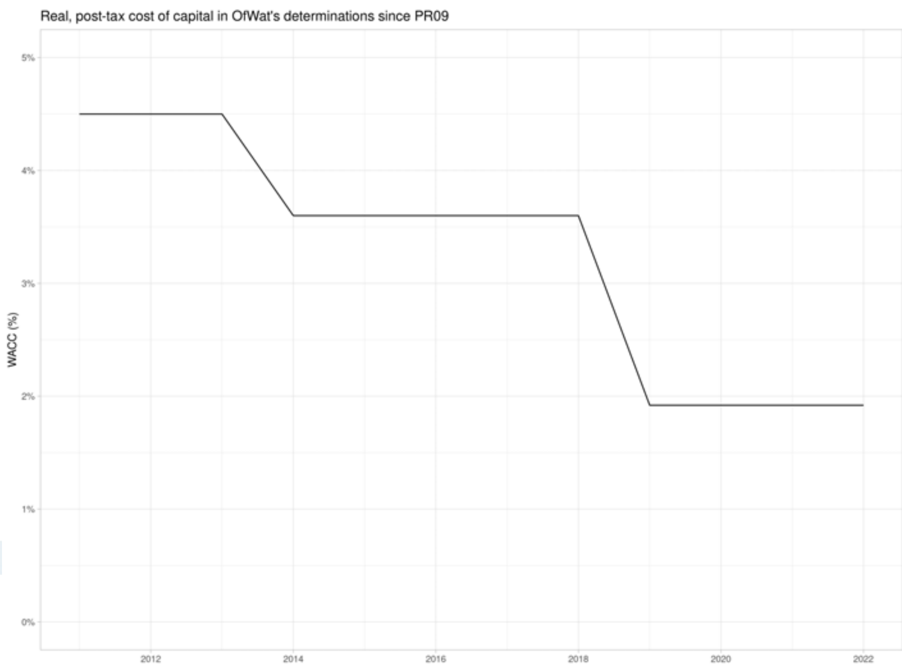
For new debt, we believe the approach is market based, employing market yields, on a forward-looking basis allows for the calculation of a cost of debt based on expectations. Still the use of static adjustments based on historical data for a limited sample of bonds issues by water companies to increase of decrease the yield of water companies is likely to create more distortions going forward.

Table 2.2.1 shows the cost of debt of arrived at by OfWat for a water company for both existing and new debt. We see that the resulting yield is 2.5% for new debt but 4.5% for existing debt. As we show below, only the new debt is correctly priced.

2.2.3 Ofwat and the WACC: an imaginary capital structure

Finally, OfWat estimates the WACC by weighting the cost of equity and debt by the capital structure. It sets a notional gearing with reference to an efficiently financed water utility with an

Figure 1: Real, post-tax cost of capital in OfWat's determinations from 1994 to today.



Source: OfWat

Table 1: Cost of equity and cost of debt for UK water Utilities as determined by OfWat in the price review determinations (source: OfWat)

	Cost of Equity (post-tax)	Embedded|New Debt	Cost New Debt	Cost Embedded Debt	Fees Allowance	Cost of Debt	Gearing
PR99	4.6%-6.2%					2.8%-3.5%	50%
PR05	7.70%					4.30%	55%
PR09	7.10%	75:25		3.40%	0.20%	3.60%	57.50%
PR14	5.65%	75:25	2%	2.65%	0.10%	2.59%	62.50%
PR19	6.27%	80:20	2.54%	4.47%	0.10%	4.18%	60%

investment grade rating. This is similar to the approach it takes to setting the cost of equity and debt to create an 'ideal' financed water utility with its cost of equity and debt and generalise across all water companies.

OfWat assumes a fixed capital structure of 60% total debt and 40% equity, down from 62.5% debt and 37.5% equity in PR14.

This results in the WACC estimates presented in Figure 1 which shows the allowed return on investment (real, post-tax) for each of the different Price Reviews since 1994. Prior to 2009, OfWat provided a range of estimates for the WACC. This was discontinued in PR09 with now only a point estimate provided. We see that over time the allowed WACC has steadily decreased to reach less than 2%.

The reliance on a notional firm only emphasise the lack of representativeness and of robustness of the estimated WACC. This method poses several major problems, including:

- Lack of representativeness of the sector of activity in the choice of beta
- Lack of representativeness of risk premiums
- Lack of representativeness of the financial structure

OfWat is deliberately ignoring market signals, perhaps to try and 'anchor' investor expectations in terms of the long-term returns they can expect from a water utility. But this is self-defeating: large water utilities in age-old cities are risky businesses. They are exposed to numerous uncertainties, and most of their future payouts are so far into the future that they can be considered quite uncertain, especially since the regulator keeps reviewing the allowed return downward.

The most fundamental problem with OfWat's approach is that by misrepresenting the true cost of capital of the firm, it ignores the dynamic of capital markets through which investors may decide to invest in Thames Water, or not (because they have other opportunities to invest in the same level of risk with a better market return).

It follows that those who choose to invest are either willing to take a lot more risk than OfWat expects, or have little understanding of the dynamics between regulated and required return on capital.

2.3 Estimating Thames Water's WACC using private market data

Whilst OfWat's approach has some passing attempt at employing market data to set the cost of capital, the methodologies, as stated previously, have been long viewed as inadequate at capturing the risk factors that investors actually use to price assets. As a result, better and more sophisticated methods should be used.

In this section, we describe how we propose to model the market cost of equity, cost of debt and WACC of any infrastructure company, including regulated water utilities, and specifically Thames Water. We look at the approach used to derive each quantity and provide more details in the appendix.

2.3.1 The Market Cost of Equity of Infrastructure Companies

A better methodology uses market data to estimate the cost of capital required by investors for infrastructure assets over time. This is a familiar problem for investors in private infrastructure who need to determine the fair discount rate of the future cash flows of a given infrastructure asset for the purpose of computing a net present value, that is,

$$\text{NAV}_{i,t} = \sum_{\tau=1}^{T} \frac{\text{Div}_{i,t+\tau}}{(1 + r_{t+\tau})^{t+\tau-1}} \tag{2.2}$$

where $NAV_{(i,T)}$ is the Net Asset Value at time t of asset i, $DIV_{(i,t+\tau)}$ is the cash flow of asset i at time $t+\tau$, $r_{(t+\tau)}$ is the discount rate at time t, and T is the maturity date of the project contract.

While investors and owners and infrastructure companies may have a well-informed view on future cash flows, the discount rate is meant to represent the price that an orderly market transaction would lead to. This is of course, the same concept as the cost of equity that OfWat needs to estimate.

Like OfWat, which has been driven to using just two data points to calibrate a CAPM beta with listed utilities returns, investors in private markets often find that few comparable transactions exist that are both recent enough and exhibit the same or reasonably comparable characteristics.

To circumvent this lack of comparable data, we use a simple approach derived from modern asset pricing theory that has come to replace the CAPM in academic studies of asset pricing: a multi-factor model of expected returns.

Instead of deriving a CAPM beta from too few listed utilities or a private risk premium from too few comparable transactions (which amounts to the same thing), it is possible to estimate the market price (or risk premium) of a collection of risk factors that *empirically* explain the price at which private infrastructure companies actually trade in the market.

Because these risks factors are common to all transactions, they can be priced more readily and more robustly because much more data is available to do so. Once these risk factor prices are estimated in robust manner, they can be used to price any company that does not trade or to derive a market estimate of the cost of capital of a regulated utility.

Say the discount rate (or cost of equity) that needs estimating is written:

$$r_{t+\tau} = \mathrm{Rf}^{C}_{t+\tau} + \gamma_{i,t} \quad (2.3)$$

with $Rf^{C}_{(t+\tau)}$ being the yield curve at time t in country C, at the horizon T of asset I, and $\gamma_{(t,i)}$, being the risk premium of asset i reflecting the market price at time t of the risk of future dividends.

This risk premium can be considered as a function of a limited number of systematic risk factors found in every infrastructure company (including beyond utilities), so that:

$$\gamma_{t,i} = \sum_{k=1}^{K} \beta_{i,k,t} \cdot \lambda_{k,t} \quad (2.4)$$

Common factors determine the risk premium level of a given investment in two ways: 1) the risk that the investment is exposed to (e.g., the amount of leverage), call it beta (β). 2) The price (return) that the market is willing to bear to take this risk or risk premium, call it lambda (λ). If companies are exposed to multiple common risk factors, their cost of equity (discount rate) is a combination of betas and lambdas as stated in equation 2.3.1.

Academic research has shown that the equity risk premium for infrastructure companies can be calibrated from market data using the following data as factors proxies (Blanc-Brude and Tran, 2019):

1. The **size** of the company represented by the book value of its assets.
   This factor represents the relative liquidity, complexity, and cost of transactions i.e. a solar farm representing €100m of investment is a simpler and more liquid operation than the acquisition of a road network representing several billions of assets. This factor has a positive impact on the risk premium: the larger the company, the higher it is.
2. The **debt ratio** represented by the ratio of the so-called 'senior' external debt (bank and bond) to the book value of the assets.
   In line with financial theory since Modigliani and Miller (1958), the firm's debt ratio should increase the risk premium of shareholders whose future dividends are even more at risk. This effect is confirmed here by our empirical studies.
3. The ratio of pre-tax **profits** to book value of assets.
   This factor increases the current and future value of companies and thus reduces the risk premium demanded by investors.
4. The ratio of **capital investment** (property, plant, and equipment) to book value of assets.
   This factor represents the effort taken to invest in new infrastructure and the risk taken by the company to carry out these programmes both in terms of budget and schedule. This ratio therefore has a positive impact on risk premiums since during periods of higher capital investment, owners are more at risk.
5. **Country risk** is represented by the difference between the 30-year sovereign rate and the three-month rate at the time of valuation.
   This term spread approximates the relative risk between countries at a date t. It gives rise to a higher premium if this difference is greater e.g. in 2012, short rates were low throughout Europe, but long rates were much higher in Southern Europe, hence a higher "country premium".
6. **Sectoral control** variables.
   A range of control variables, including whether or not the company is a network utility and has regulated business model, as do the water companies of England and Wales, including Thames Water.

Exposure to all these factors is observable as these quantities are reported in the accounting records. Thus, for each transaction, we also know the factor exposures ($\beta_{i,k,t}$) of the firm i bought or sold for each factor k, at the time the transaction takes place.

Since each transaction involves an IRR, the IRR can then be first decomposed into the effect of (risk-free) interest rates and a risk premium. This overall risk premium observable in each transaction can then be statistically decomposed between the effects of each of these factors.

Finally, once the market risk premiums $\lambda_{k,t}$ have been deducted from the prices observed in secondary transactions, these values are used to determine the risk premium for all unlisted infrastructure companies that request to be valued at that date, based on their own exposures to the same risk factors.

As shown in Table 7 and Figure 16 (appendix), this approach can produce robust estimated of the costs of equity as confirmed by the accuracy of the valuations produced and compared to realised transaction prices. This can be the basis to make a robust estimate of the cost of equity for investors in infrastructure companies including in regulated water utilities in England and Wales and elsewhere.

Indeed, Thames Water and other water companies are exposed to the same risk factors as all other infrastructure companies that investors buy and sell in the market for unlisted infrastructure equity. Therefore the risk premium expressed by market participants also applies to these companies.

2.3.2 Estimating the Cost of Debt and the WACC

The same approach can be applied to estimating the costs of debt of infrastructure companies by estimating the risk premium associated with different risk factor exposures at the debt instrument level.

Using the yield of newly issued debt instruments, it is possible to calibrate a model of the yield of this debt and to use it to re-estimate the market cost of debt of an infrastructure company over time.

The following factors are used to determine the value of the risk premium in each period:

- **Issue size**: Larger debt issues have, other things being equal, lower risk premiums. This is a stylised fact of academic research (see Strahan, 1999) and empirically confirmed for the debt of infrastructure companies (Blanc-Brude and Yim, 2019).
- The **maturity** of the instrument is a measure of its duration (interest rate risk) and has a positive impact on risk premiums.
- **Credit risk** is represented by a measure of 'distance to default' calculated by simulation for each instrument and has a positive impact on the risk premium.
- The level of **three-month bank refinancing rates**: this factor is an important determinant of observed premiums.
- **Country risk**: see above.
- **Sector control**: A number of control variables including the market and currency of the instrument, and whether the emitter is a regulated business and a network utility.

Once, the cost of equity and the cost of debt have been determined, it is possible to estimate the WACC of any infrastructure company including water companies in England and Wales and, specifically, Thames Water.

To compute the WACC, we also collect the financial data of specific companies to produce a forecast of their equity and debt cash flows. Using the cost of equity and cost of debt estimated for a specific company, we computed the market value of its equity and the market value of its debt and calculate a WACC according to the following formula:

$$wacc_t = \frac{\sum_{i=1}^{N} r_{i,t} \times MV_{i,t}}{\sum_{i=1}^{N} MV_{i,t}}$$

i.e. the weighted average of the N sources of capital whose rate of return is $r_{i,t}$ for each type of financial instrument i on the date t $MV_{i,t}$ represents the market value of instrument i at the same date.

This method has several advantages over the standard CAPM-based approach used by OfWat:

- It uses market data specific to private infrastructure companies;
- It allows the determinants of risk premiums to be estimated without smoothing the data over long periods of time since these premiums are revalued each time a new transaction takes place;
- It is parsimonious, since the number of factors whose price must be estimated in each period is much lower than the number of firms for which a WACC must be calculated. This parsimony gives it a real statistical robustness;
- It can be combined with any approach in terms of risk-free rates whose variation it takes into account, including using the forward yield curve matching the horizon of the investment, i.e. most in line with the relevant market values and the IFRS 13 recommendations;
- Finally, this method applies to both equity and debt.

2.4 A Comparative Analysis

The approach described above is calibrated over time using thousands of market transactions of unlisted infrastructure equity and private debt and implemented to estimate the cost of equity, cost of debt and WACC of hundreds of infrastructure companies including Kemble and 14 other UK regulated utilities, as well as European and global peer Groups for the IC80 (Network Utilities) segment of the infrastructure universe.

These results are shows in table 2 and figures 3, 4 and 2. The difference of risk profile between Thames Water and its peers is clear to see:

- Equity Risk Premium: The risk premium for investing in equities has decreased for all utilities over time, an indication of the market demand for such assets, but we see that Thames' currently stand 100bp below its value 20 years ago at 9.7%, while other UK utilities have a lower COE, at 8.7%, which represents a 150bp decrease over 20 years.
- Cost of Equity (COE): The Thames Water COE which had historically been on par with other UK water utilities is now much higher (c.120bp) indicating that its risk profile has diverged over time from that of its peers. Crucially, the COE of these firms is much higher than the value proposed by OfWat at 6.3% as shows in table 2.2.1. the industry's and Thames' COE in particular are at least 50% higher.
- Cost of Debt (COD): Here a market estimate of the COD is close to OfWat's for so-called new debt but not aligned with the regulator's view on the COD for most of the water companies' debt. Here the COD is roughly retained by the regulator twice as high as the market rate.
- Cost of Capital (WACC): Finally, the estimated WACC for Thames using its actual financial structure stands at c.8.5% for the most recent period, which is 160bp above the UK utilities average and three to four times the allowed WACC computed by the regulator.

We can now see that over the past two decades, the WACC of Thames (and UK water companies in general) has always been largely underestimated by the regulator. While they have trended in the same direction due the compression of the risk premium in most markets and of interest rates, they remain separated by a gulf.

This should have made investors very concerned about the likely behaviour of the firm they were investing in. Far from a 'boring' utility, such a company would have to take a lot of risk to be able to meet its own market rate of return, given how much return was permitted by the regulator.

2.5 Red Flag #1: Toxic Incentives

Incentive regulation works by forcing the (monopolistic) firm to be efficient by capping its revenue to match a 'fair' return, as captured by an estimated WACC. While the firm and its regulator are bound to disagree about the WACC, this incentive mechanism only works at the margin. Setting a WACC way below the cost of

Figure 2: Weighted Average Cost of Capital for Thames Water and Several Peer Groups

Source: infraMetrics, pre-tax, nominal

Figure 3: Cost of Equity for Thames Water and Several Peer Groups

Source: infraMetrics, post-tax, nominal

Figure 4: Cost of Debt for Thames Water and Several Peer Groups

Source: infraMetrics, pre-tax, nominal

Table 2: Comparing the market WACC of Thames Water and Water Utilities

Period	WACC	COE	COD	ERP	Obs
Thames Water					
2000-2004	12.9	14.4	5.3	10.7	5
2005-2009	14.2	15.1	5.0	11.7	5
2010-2014	12.1	13.3	2.8	11.8	5
2015-2019	6.9	9.9	2.3	9.0	5
Since 2020	8.5	10.9	2.0	9.7	4
UK Utilities					
2000-2004	11.1	13.9	5.3	10.2	108
2005-2009	10.1	14.7	5.1	11.4	144
2010-2014	8.1	12.6	4.0	10.9	165
2015-2019	5.8	9.2	2.6	8.2	176
Since 2020	6.9	9.7	2.4	8.7	135
Europe Utilities					
2000-2004	10.8	18.4	4.6	16.0	4
2005-2009	9.5	15.8	5.3	12.8	35
2010-2014	6.9	15.2	3.8	12.3	66
2015-2019	5.1	9.3	1.8	8.6	89
Since 2020	6.6	9.8	1.6	9.3	75
Global Utilities					
2000-2004	9.0	17.3	6.0	13.1	15
2005-2009	9.8	16.0	6.6	11.7	52
2010-2014	8.7	12.3	5.6	8.9	81
2015-2019	7.0	10.2	3.7	7.6	96
Since 2020	7.7	11.4	4.7	9.2	77

capital is good for consumers as it cuts water bills, but if it is too low, it fails to provide an incentive to invest in the business.

OfWat's approach to setting the WACC has been to cut the allowed return at every regulatory period since 2009. For the most recent regulatory period, the nominal rate of return for equity investors of 3.08%-4.09% is clearly below the nominal cost of capital for equity investors of 8.35%-8.57% at that time. The continued cutting of the allowed return below the cost of capital, in a capital-intensive business like the provision of water and sewage, is clearly having an impact on the capital structuring and investment policies of the businesses.

OfWat's approach of using the CAPM, a long-discredited asset pricing model that does not capture the returns investors demand, leads to this situation. Instead, a methodology for determining the cost of equity that reflects the actual cost of capital of the firm should be used. Investors, knowing their cost of capital, should have been aware that the rates of return allowed by OfWat were too low. Four water companies did appeal PR19 determination; it is interesting that the others did not. What was the point?

With the WACC set too low, management and shareholders can either live with the cut in allowed returns and make the assets work enough to provide commiserate return to investors, or they can increase returns by gearing up the balance sheet with relatively cheaper debt, pay higher returns on equity and essentially exhaust the balance sheet of the utilities.

In practice, the company can do a bit of both: as we discuss in the next section, a number of water utilities in the UK have recapitalised their balance sheets following many years of increased gearing above OfWat's capital structure assumptions: Apart from Thames Water raising £750mn (see Plimmer, a), Southern Water has received an extra £500Mn (see Will Louch, Will Louch) and Severn Trent has raised £1Bn from shareholders (Wheatley, Wheatley). However, the low rate of return inherent in the investment will make it difficult to convince shareholders to increase equity contributions going forward Wheatley (see Wheatley).

We now see the consequences of many years of setting the WACC incorrectly, with failures to invest and significant pollution issues, amongst others, indicating the lack of capex. Indeed, OfWat as noted in a December 2022 report (see OfWat, 2022) and a House of Lords, Industry and Regulators Committee report (see of Lords, of Lords) that there is a failure of the water companies to complete their investment plans.

The recent failures in meeting environmental targets can be attributed to a failure to invest in the network. Whilst the causes of these failures are many, allowing only half the equity return demanded of investors for the latest regulatory period can be expected be have a significant influence on the decision to invest.

In the end, the investors in this asset, especially the 'silent' shareholders that are remote from the management of the company (the pension funds other than OMERS, which acts like a manager and earns fees for managing Kemble and Thames Water) should have understood that the regulation of the firm's WACC would lead it to increase risk by leveraging up and failing to invest, and therefore gradually failing to meet service standards and facing fines and public pressure. Instead, investors seems to have completely ignored this discrepancy between regulated and market WACC.

3. Red Flag #2: Capital Structure & Dividend Payouts

In this chapter, we examine the capital structure of Kemble Water Holdings (HoldCo), the company that investors hold when they want to invest in Thames Water. We detail the structure of this investment, how unusual it is and how it has impacted dividend and shareholder loan payments for investors. We examine two of the major criticisms of Thames Water as a private investment, namely that is it has a highly financial engineered capital structure with significant debt and that, whilst this leverage was built up, the owners paid themselves significant dividends.

We argue that the HoldCo structure created to invest in Thames Water led to excessive cash extraction, a huge debt pile and the exhaustion of the balance sheet. It should have been clear from 2016 onwards that there would be no more payouts for many years. This is the second red flag that a comparative analysis would have revealed.

3.1 Brief History of the Investment in Thames Water/Kemble Water

We start this chapter with a brief history of Thames Water and its investment holding companies. Following the passage of the Water Act 1989, Thames Water was privatised and listed on the London Stock Exchange in 1989. From 1989 to 2000, Thames Water was an independent company, during which times it pursued a growth strategy by buying or setting up businesses around the world. By the year 2000, Thames Water had companies with operations in Malaysia, Thailand, Singapore, Australia, Chile, Turkey. Whilst most of these companies were related to the provision of water and waste water, Thames Water also entered property development as well as consulting businesses. Leverage (debt to total assets) also increased during this time. From 6.45% in 1991, it had risen to 33.90% by the year 2000.

In 2000, RWE Group, a large German utility successfully took over Thames Water and continued with the practice of expanding the group into areas unrelated to its roots of providing water and sewage services to London. By December 2001, the revenue from the regulated utility accounted for 63% of sales Thames Water's total revenues. The number of countries Thames Water was operating steadily increased, as it added businesses in Chile, further projects in Turkey and the US. During this period of RWE ownership, the business even invested in the London Underground PPPs, buying 20% of the ill-fated Metronet Rail SSL and Metronet BCV SPVs.

In 2004, Thames Water group conducted a strategic review and came to the view that it should focus on the UK and Europe. As a result, large sections of the international business were sold. Of total group revenues in 2004 of £1,945.7 million, the businesses from the Asia Pacific and Americas only contributed £89.3 million and £75.8 million, respectively. It could be concluded that these businesses were more of a distraction rather than contributing significant value. In 2005 RWE conducted its own strategic review, concluding that the group is to focus on electricity and gas supply rather than continue holding onto regulated water assets. The group announced that Thames Water would be sold by 2007 and any proceeds would be returned to shareholders by way of special dividends. Whilst initial estimates for proceeds from the sale would be £7 billion to £12 billion, Thames Water was eventually sold to a Macquarie Bank company, Kemble Water Holdings, for £8 billion (an equity value of £4.3 billion and the assumption of £3.2 billion of debt.)

It is during the subsequent years, from 2007 to 2017, that we can observe a real change in the way Thames Water was managed. Gone were the attempts to expand into other industries and countries; from 2007 there was a focus on the utility, accompanied by significantly increased leverage and distributions to shareholders. In the early years of the Macquarie consortia controlling Thames Water, large dividends and interest on shareholder loans were paid. However, from 2015 the balance sheet capacity for Thames to support such distributions appears to be exhausted. Whilst there were still dividends and interest on shareholder loans paid in 2016 and 2017, since then very little cash has been distributed to shareholders. In 2017 Macquarie ended its association with Thames Water, selling its final stake to Omers and Wren House, with other investors also selling out to the current shareholders.

3.2 How Common is the Thames/Kemble Structure?

3.2.1 Capital Structure

For this and all subsequent sections we will be talking about the Thames Water capital structure post Macquarie takeover. This is because it is the current structure that investors must negotiate for an investment in Thames Water. We first examine the capital structure, then detail the corporate structure before examining the dividend payout behaviour post the Macquarie takeover.

The capital structure that has been put in place for Thames Water is a common complaint regarding the mis-management of the water utilities of the UK (see (Johnson and Handmer, 2002),). The significant debt levels now present in businesses that were privatised essentially debt-free appears on the face of it to be fair. As displayed in Figure 10 (see next chapter) leverage has been steadily increasing for Thames Water since 2007.

Once Macquarie took over management in 2007, there was a marked change in the capital structure. One of the first actions after divesting the non-regulated businesses was the creation of a "Whole of Business Securitisation". This was ostensibly to refinance the acquisition of Thames Water in the first place. A whole of business securitisation is a method of raising finance by pledging the current business' cash flows to lenders.

Unlike other securitisation methods (for instance loans or accounts receivable), the business that has been securitised remains under the control of the owners. This structure allows for credit enhancement, enabling a higher leverage as well as lower cost of funds than if the business were to borrow straight from the financial markets. Thames Water as not the first UK water utility to be structured in this way; however, being the largest water utility, it was one of the most high-profile securitisations.

For Thames Water, the securitisation followed a the similar structure to other securitisations, including the set up of a bankruptcy-remote borrowing vehicle, debt cross guarantees. Finally, as part of the structure, new debt covenants were imposed. These limited leverage to 75% of the Regulated Capital Value (RCV) up until March 2010. From April 2010 this leverage limit was increased to 85% of the RCV, but only through the issue of debt subordinated to the current debt.

These limits related to the regulated utility, with the debt raised from within the corporate structure being separate from Kemble Water Finance. Whilst this isn't as common a corporate structure as other non-infrastructure investments, for assets with predictable cash flows it can provide advantages of a lower cost of debt. It was employed for a range of assets in the UK in the late 1990s, ranging from tourist attractions to train rolling stock(see (??, Whole business securitisation)), as well as other water utilities in the UK.

3.2.2 Corporate Structure

The multiple layers of holding companies for Thames Water add to the difficulty in understanding the level of borrowings and distributions to shareholders. This structure, put in place as part of the acquisition, has changed over the years from the initial investment in 2006 to when Macquarie sold its last shares in 2017. Initially the structure involved multiple holding companies with the capital provided through significant shareholder loans. An example of the structure is provided in Figure 5 below:

The investment was heavily geared during this time. Not only was there the debt held in the utility (the whole of business securitisation), but there was additional debt in the holding company structure. As of 31 March 2007, Kemble Water Finance Limited (a holding company of the investment) reported £616.8m in bank loans. The funds to service this debt relies on cash reserves and dividends from the Thames Water utility. Since this debt takes precedent over cash returns to other equity holders, it makes the equity investment riskier.

The structure presented in Figure 6 was collapsed in 2014, and subsequently the structure in place from 2014 to today is presented below:

As before, there is still leverage in the holding structure. By 31 March 2022 the Kemble Water Finance Limited accounts reported £940.4m in bank loans and bonds. This is in addition to £575m bonds issued by Thames Water (Kemble) Finance Plc, the proceeds of which were lent on to Kemble Water Finance Limited. As mentioned previously, the introduction of leverage increased the risk for equity holders.

This increased risk was highlighted by a regulatory announcement made in March 2003. OfWat stated that it will limit dividends to holding companies if these companies do not link dividends to performance, or if the dividends impact on the financial resilience of the water utilities (see (??, OfWat will block dividends from water utilities)). If there are no funds to service the debt at the holding company level then, unless the owners inject more equity, they could lose control of the company. This announcement has a significant impact on the risk of this investment.

The holding structure is common with other water companies that have completed a Whole of Business Securitisation (see for example ??, Anglian Group Structure,A)). Other water utilities that completed this include:

- Dwr Cymru (Welsh Water)
- Anglian Water
- Affinity Water
- Portsmouth Water
- Southern Water
- South East Water
- Yorkshire Water

Understanding how the money flows to shareholders is complex in such structures, but possible. In the next section we will examine how shareholders receive distributions, both traditional dividends as well as returns on shareholder loans. This process is regularly missed in the analysis of Thames Water's payouts.

3.3 Benchmarking Dividend Payouts

Water utilities are private companies. As such, they need to pay a return to their shareholders. For Thames Water, the payment of dividends has attracted some controversy, with stakeholders unhappy about the size of the previous dividends given the current major pollution problems and investment requirements. To understand this, we

Figure 5: This figure presents the holding structure for Thames Water that was in place as of 31 March 2007.

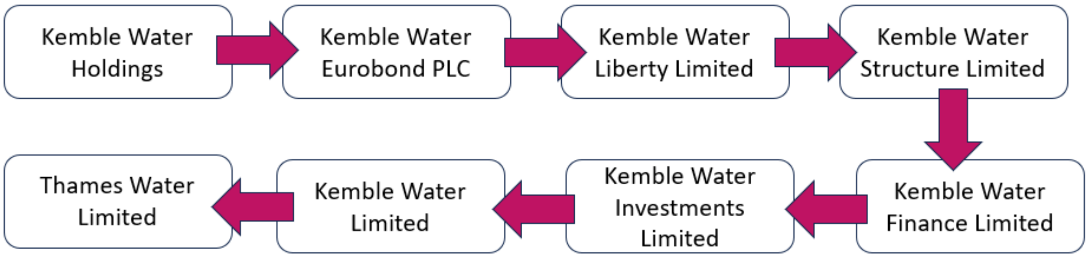
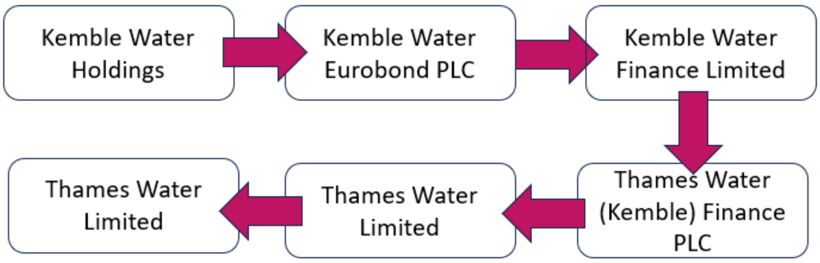


Figure 6: This figure presents the holding structure for Thames Water that was in place as of 31 March 2022



will have a closer look at the dividends Thames Water has paid over the years.

Distributions to shareholders under Macquarie

The shareholder returns for Thames are structured in two ways. The first is the equity dividends paid by the utility into the holding structure. These dividends are used to pay interest and principal on debt at the holding structure. If there is a surplus, these funds are paid to shareholders. The second, from 2007, is in the form of loan notes issued to the ultimate shareholders of Kemble Water Holdings. This is effectively a shareholder loan providing distributions and non-dilutive forms of financing to the group. The full amount of payouts to shareholders by year and type is displayed in Table 3.3.

Dividends Dividends paid to shareholders from 2007 to today have decreased significantly. This can be seen in Table 3.3. Dividends were large in the initial years of Macquarie's ownership but declined sharply thereafter. Since 2017, which corresponds to when Macquarie sold its final shares in Kemble Water Holdings, no dividends at all have been paid to shareholders.

Shareholder Loans Another key source of returns to shareholders of infrastructure investors is shareholder loans. In infrastructure, shareholder loans are a common way to inject money into the business and earn a steady return. These loans are usually junior to other debt and only earn a return after all other debt holders have been satisfied. When examining the accounts, the cash flows to shareholders as a result of the shareholder loans are not clearly disclosed. As a result, we employ the 'indirect method' as described here: $(InterestPayable_t + LoanNoteOutstanding_t + InterestOutstanding_t) - (InterestPayable_t - 1 + LoanNoteOutstanding_t - 1 + InterestOutstanding_t - 1)$ to estimate the cash flows to shareholders from the shareholder loan notes. For this analysis all figures were obtained from Kemble Water Eurobond PLC's financial accounts as this was the entity that had issued the loan notes to the shareholders, not the ultimate entity Kemble Water Holdings.

When Macquarie took over in 2006, investors provided £310.4 million in funding through shareholder loans. The disclosure in the Kemble Water Eurobond PLC 2006/2007 financial accounts states that the interest rate on the shareholder loans was 11% and was due to be repaid in

2021. In 2021, with little prospect of repaying the principal, the loan's outstanding interest was rolled into the outstanding principal, resulting in an increase in the principal of £191 million, the maturity was extended to 2031 and interest rate was cut from 11% to 4.83%. Finally, Kemble Water Holdings - the ultimate group company - was substituted as the borrower for the shareholder loan in March 2023. As a result, the loan was removed from being classified as a borrowing. No cash flows were made to shareholders and the group still owes the outstanding amount.

Figure 7 displays the total shareholder payout as a proportion of revenue per year for Kemble Water Holdings and compares this to other peer groups, specifically UK Water utilities and Global Infrastructure. We can see on a year-by-year basis the payouts do not appear to be excessive compared to these peer groups. On average, 1.23% of revenues in the period 2007 to 2023 were paid though interest on shareholder loans, and 4.55% through dividends. Whilst adding of shareholder loan interest to the payout calculations does not materially increase the cash flows to investors during this time, a still-significant amount of cash was returned to investors through this route.

Interestingly, while Kemble is paying out as much cash as it can as a porportion of free cash flow (see below), at the same time it is actually underperforming its peers in terms of payouts as a proportion of revenues. This is a clear sign that it will not be able to maintain a high dividend payout for long.

Also, the payouts to investors in Kemble Water do not resemble the stereotypical behaviour of infrastructure assets, namely regular, predicable dividends. Figure 8 shows the growth rate for dividends in Kemble Water compared to its peer group. We can see, that despite Kemble Water owning a water utility, it has significant volatility in its payouts. This behaviour could be because it is a private company, so does not have the incentive to smooth dividends as a listed company might, but it is hard to reconcile with the standard infrastructure narrative. Instead, it does indicate that the management were aiming to payout as much cash as it could, hence the volatility in the payouts.

When we further analyse the payout behaviour of Kemble Water, we find further causes for alarm. Figure 7 suggests that the payouts were not particularly unusual compared to its peers as a proportion of revenues. However, if we instead analyse the shareholder payouts as a proportion of the cash flows they could possibly make at the time (otherwise known as free cash flows to equity) and compare this ratio with those of its peers, we find a very different story. Figure 9 indicates that the payouts Kemble made to its shareholders were a significant proportion of the free cash available for equity. Whilst UK water utilities do pay a significant proportion of their equity free cash, they never hit the highs achieved by Kemble Water. This does indicate that there was a conscious decision by management to return as much cash as possible to investors as quickly as possible.

3.4 Red Flag #2: Exhausted Balance Sheet

One can conclude from this section that the large distributions paid to shareholders under Macquarie ownership corresponded with increases in leverage Thames Water's leverage (to be discussed in the next section).

This behaviour is a clear indication that shareholders at that time were taking as much cash and they could from the business. Whilst this is not a sin per se, when it is an asset of critical national importance, such as a water utility for the country's capital, more attention needed to be paid by the Government and the regulator.

Furthermore, existing and new investors would have been able to watch this happening. They then went on to buy this asset in 2017;

Table 3: Dividends and shareholder loan repayments to the shareholders of Kemble Water Holdings from 2007 to 2022. All figures are in £Million.

Year	Dividends	Shareholder Loans	Total Payouts
2007	0	0	0
2008	72.6	29.4	102.0
2009	187.2	34.7	221.9
2010	156.4	34.6	191.0
2011	115.1	34.9	150.0
2012	165.1	34.9	200.0
2013	74.5	17.5	92.0
2014	43.6	54.9	98.5
2015	61.6	36.9	98.5
2016	1.5	0.0	1.5
2017	22.8	77.3	100.1
2018	0	0.0	0.0
2019	0	0.0	0.0
2020	0	0.0	0.0
2021	0	0.0	0.0
2022	0	0.0	0.0

Figure 7: This figure presents the total shareholder payouts (shareholder loans and dividends) as a proportion of revenue for Kemble Water Holdings, UK Water Utilities and Global Infrastructure

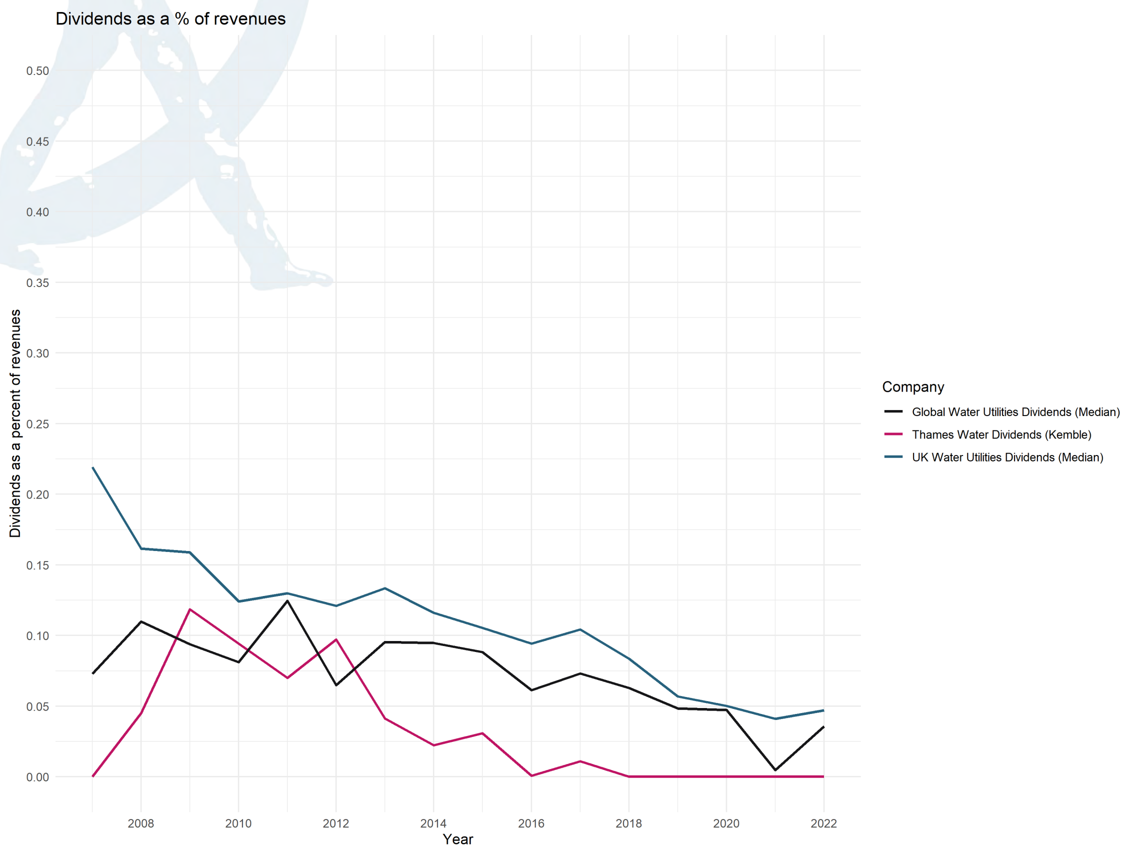


Figure 8: This figure presents the growth in total payments to shareholders for Kemble Water Holdings, UK Water Utilities and Global Infrastructure

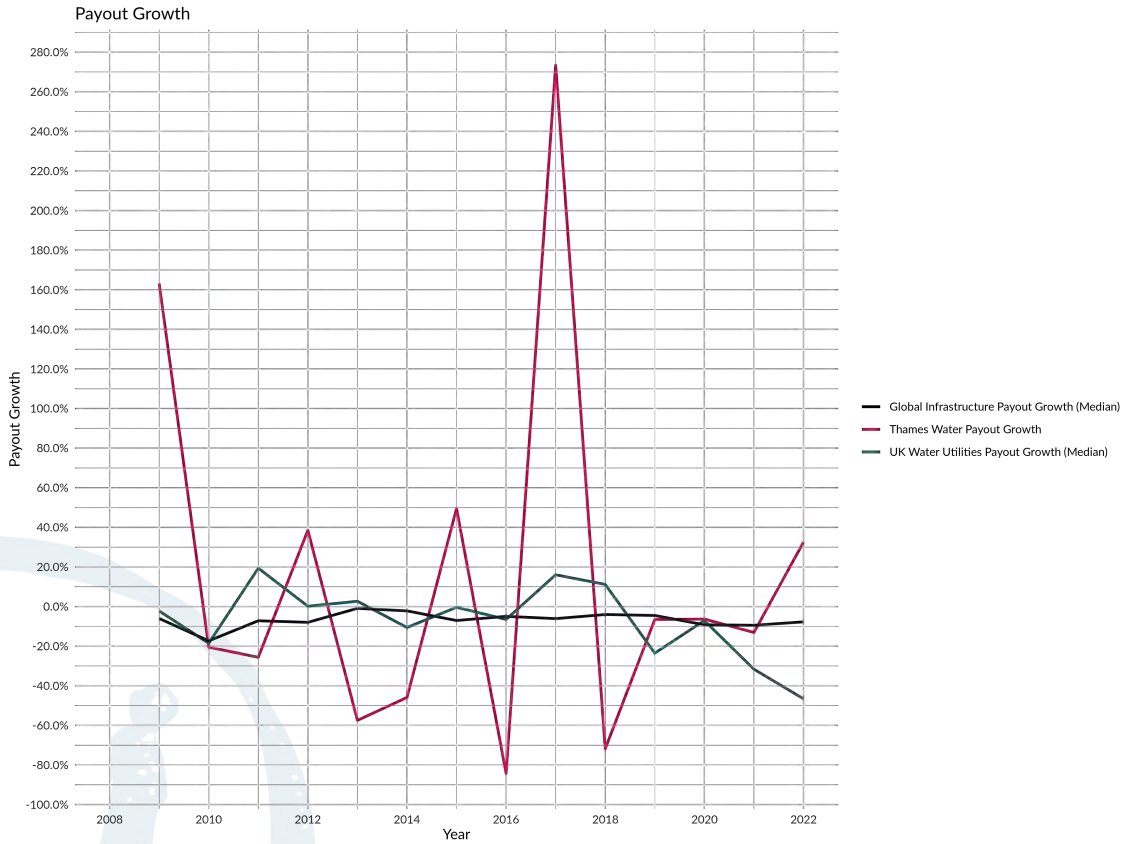


Figure 9: This figure presents the total shareholder payouts (Shareholder loans and dividends) as a proportion of free cash flow to equity for Kemble Water Holdings, UK Water Utilities and Global Infrastructure

clearly, they now need to reconsider how their investment risk assessment was conducted. Since 2017, these shareholders have received no distributions; for a mature, trophy infrastructure asset, this is a significant anomaly.

These leverage and distribution trends were well known before 2017, and call into question why investors bought in to the business at this stage. What was their intended strategy to earn returns from an exhausted balance sheet in a business that required then (and even more so now) significant capital expenditure?

4. Red Flag #3: Risk Factor Exposures

In this chapter, we look at the exposure of the Thames Water HoldCo, Kemble Water, to the various systematic risk factors that drive a large part of the valuation and returns (and therefore the volatility) of infrastructure companies like this one. In chapter 2, we described a series of risk factors that can be used as proxies of the risk of the cash flows of private infrastructure companies and are indeed shown to explain the risk premium in market transactions. We now compare the exposure of the HoldCo to these factors with that of its peer groups, including UK and European network utilities.

We argue that Thames Water is clearly an outlier in terms of risk exposures, or βs, and that a comparative analysis reveals it to have a very different risk profile from the average water utility. We show that investors could have detected this disparity before buying into the HoldCo asset (let alone the 'notional' water company regulated by OfWat); they could have questioned the reasons for this for this substanbtial difference between the risk exposures of asset they were buying and its peers - and the consequences that could arise from it.

4.1 How risky can a utility really be?

There are strong public policy considerations for ensuring that a utility remains functioning and providing a service. As a result, because they provide the necessities of life and despite being complex businesses to operate, utilities should, in theory, be relatively low risk for investors. They are sometimes described as 'boring' because they are stable and predictable.

We examine the four main risk factors found to explain the returns of infrastructure assets, comparing Thames Water's factors to that of its peers in the UK utility segment as well as European and global utilities. The risk factors we examine are leverage, profitability, size and investment. As discussed in the previous chapter, these factors have all been shown to demonstrate a relationship between the risk and return of infrastructure assets (see (Blanc-Brude and Gupta, 2021)). For the analysis here, all figures are calculated from the Kemble Water Holdings Financial accounts, as this is the company that investors now hold.

4.1.1 Leverage

Excessive leverage is a common complaint about the management of Thames Water and other UK water utilities. But how does the leverage compare to other infrastructure assets? Employing the infraMetrics database, we are able to compare Thames Water's leverage with that of other UK water utilities in Figure 10.

Leverage is a key risk factor in examining the returns of infrastructure assets. As shown in Blanc-Brude and Gupta (2021), leverage is positively linked to the risk premium of an asset; the more leverage, the higher the risk of future dividends *ceteris paribus*. This is of course consistent with the Modigliani and Miller theorem.

In the case of Kemble Water, the asset is significantly more leveraged than other similar water assets and compared to infrastructure as a whole. The story of Kemble's leverage starts with a consortium led by Macquarie Bank's investment management taking control of Thames Water from RWE on 1 December 2006. The Thames Water Macquarie inherited was not completely focused on running the utility; other investments included 20% of the failed London Tube PFI (Metronet Rail SSL and Metronet Rail BCV). These investments were either written down to 0

Table 4: Comparing Risk Factor Exposures of Thames Water, Kemble Water and Water Utilities

Period	Size	Leverage	Profit	Investment	Obs
Thames Water					
2000-2004	9157	65.2	11.0	8.7	5
2005-2009	13096	74.3	10.3	10.6	5
2010-2014	22685	86.5	8.7	8.4	5
2015-2019	32624	85.1	6.6	8.5	5
Since 2020	33402	82.7	6.4	8.2	4
Kemble Water					
2005-2009	21827	80.2	8.5	8.2	2
2010-2014	25446	86.7	7.5	7.5	5
2015-2019	32279	92.2	6.6	8.7	5
Since 2020	38866	93.2	5.3	5.7	4
UK Utilities					
2000-2004	2505	66.3	12.8	9.0	108
2005-2009	2832	77.0	11.3	8.1	144
2010-2014	3289	79.7	11.0	7.3	165
2015-2019	5327	77.3	9.8	7.8	176
Since 2020	6327	74.0	8.2	6.2	135
Europe Utilities					
2000-2004	138	100.0	2.7	4.2	4
2005-2009	166	78.8	4.2	6.0	35
2010-2014	388	83.4	8.7	6.2	66
2015-2019	527	80.0	8.6	4.5	89
Since 2020	519	75.5	8.3	4.7	75
Global Utilities					
2000-2004	870	98.8	7.4	3.8	15
2005-2009	1062	77.1	9.2	5.9	52
2010-2014	1194	74.1	9.0	3.9	81
2015-2019	1460	74.1	9.3	5.4	96
Since 2020	1460	72.4	8.3	5.5	77

or divested to allow the business to be considered solely related to the regulated entity. Macquarie then re-financed the debt acquisition debt by conducting a 'whole of business securitisation' as mentioned in the previous chapter.

In the years following the securitisation, total debt and leverage increased significantly as shown in Figure 10. We can see that there was a steady increase in leverage for the Kemble Water structure in the years 2007 to 2013. In 2014, the investment was again restructured, effectively reducing leverage. However, since then leverage has drifted upwards again.

Comparing Kemble's leverage with its peers and infrastructure further afield, we can see that the investment is carrying significantly more debt. As Blanc-Brude and Gupta (2021) demonstrated, higher leverage for infrastructure assets is associated with higher required equity returns, which would be one of the major reasons for investors to reconsider their valuation of Kemble and subsequently Thames Water.

To further illustrate the debt load Kemble Water is carrying, Figure 11 presents the Interest Cover Ratio for Kemble Water versus the UK water and global infrastructure groups. We see that, since 2009, Kemble Water consistently has a lower interest cover ratio than the two peer groups. This indicates that Kemble is paying more of its earnings in interest than the other two groups.

We can put down the increase in leverage to two factors. First, the business was initially able to bear it. The regulator did not raise any concerns until recently about Thames Water's leverage. As a result, the steady increase in leverage can be put down to ambivalence.

Figure 10: This figure presents leverage of Kemble Water Holdings compared to the median leverage for UK water utilities and global infrastructure.

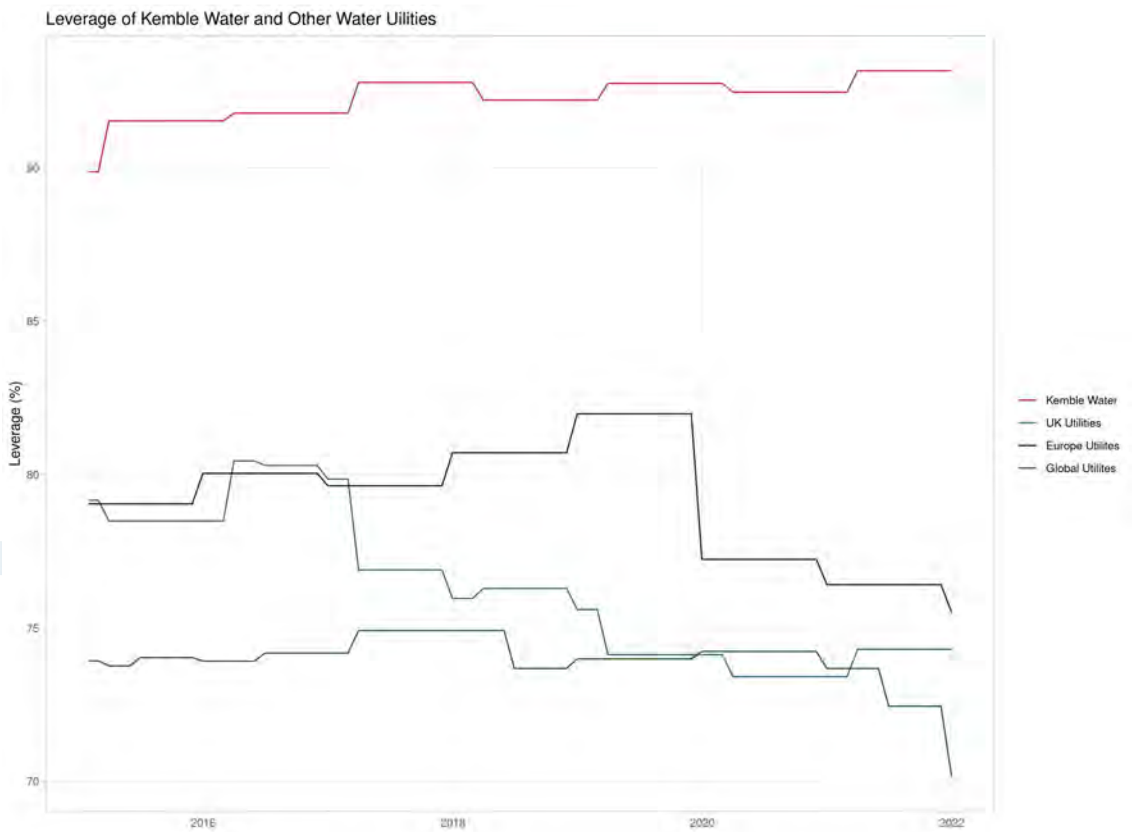


Figure 11: This figure presents interest coverage ratio of Kemble Water Holdings compared to the median leverage for UK water utilities and global infrastructure.

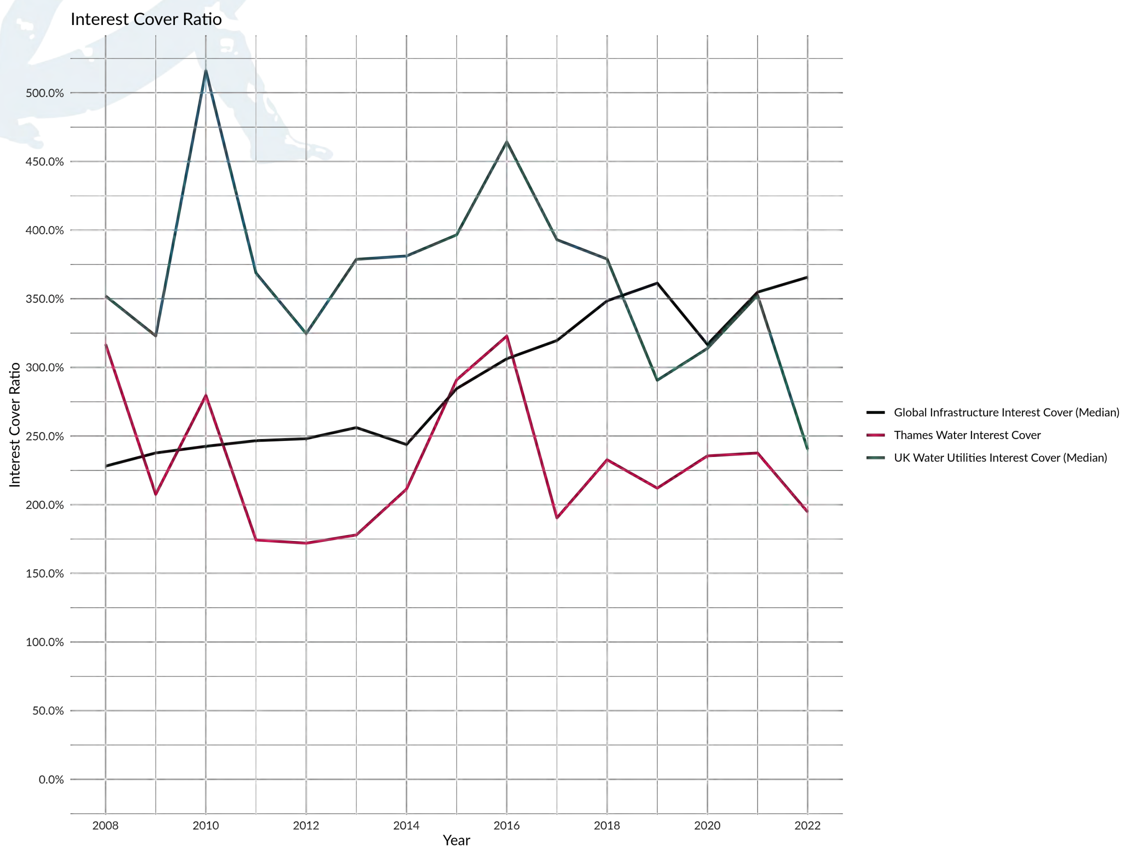


Figure 12: This chart presents the profitability ($\frac{Netprofitaftertax}{TotalAssets}$) factor of Thames Water with that of the UK water utilities peer group and global infrastructure.

Figure 13: This chart presents the size factor of Kemble Water with that of the UK utilities peer group and global infrastructure.

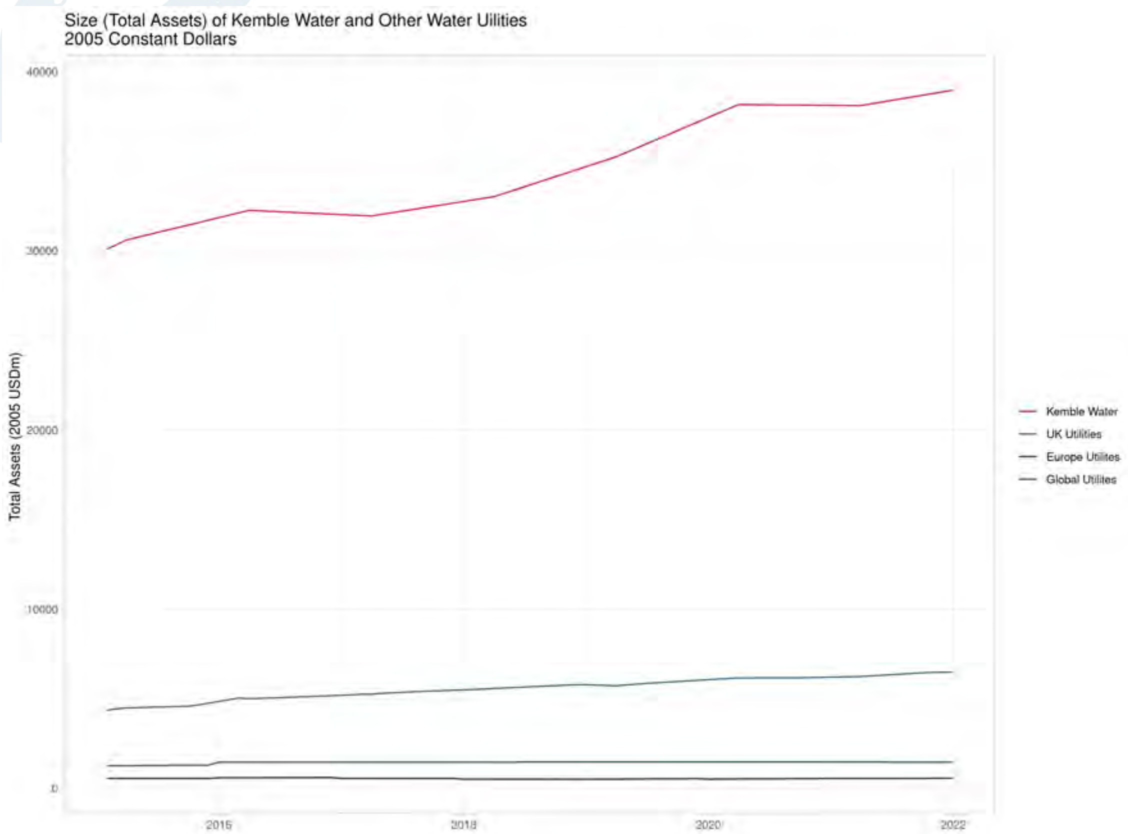
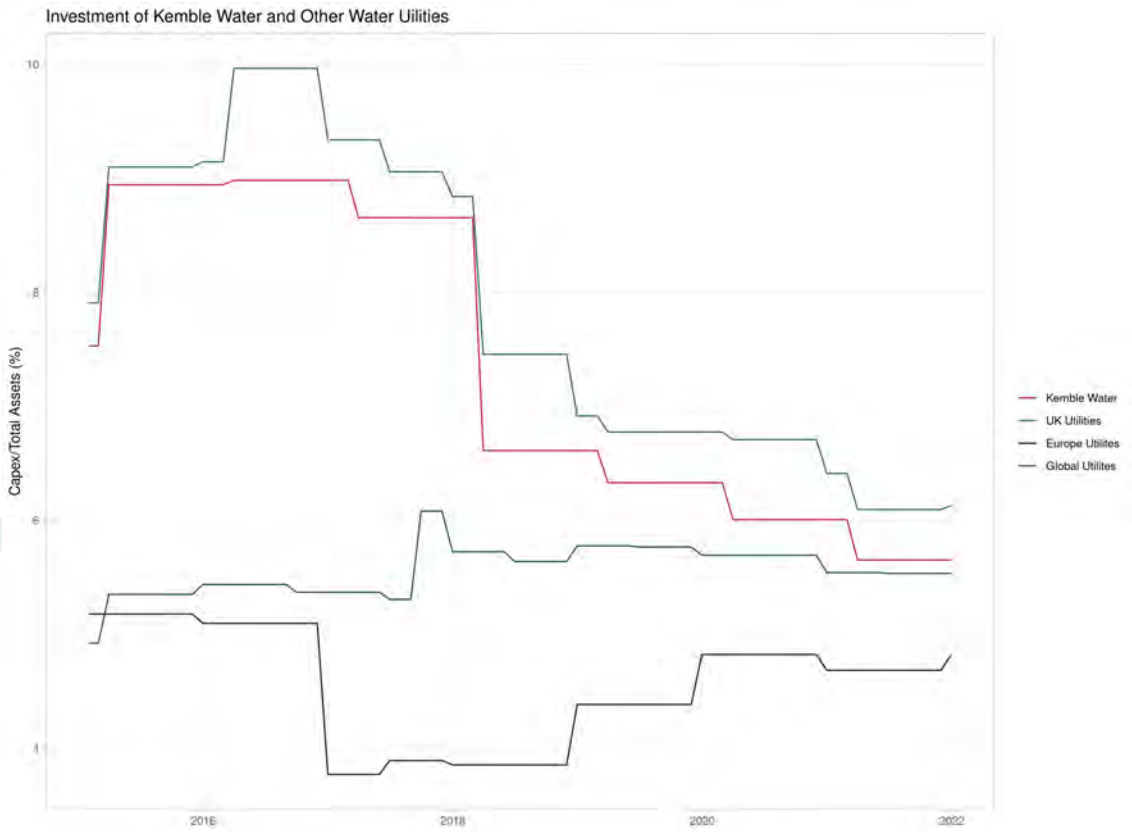


Figure 14: This chart presents the investment factor ($\frac{Capitalinvestment_t}{Totalassets_t}$) factor of Thames Water with that of the UK water utilities peer group and global infrastructure.



Second, is the extensive use of index-linked debt. This debt increases the face value outstanding by an inflation index; in Kemble's case this is RPI. In periods of low inflation, and with revenues also linked to RPI, this is not really an issue. However, in PR19 the direct link between revenues and RPI was broken. That, and the high inflationary environment, resulted in an increase in the face value outstanding of the debt, increasing the leverage.

4.1.2 Profitability

The second factor that helps explain to the risk premium for infrastructure is Profitability ($\frac{Netprofitaftertax}{TotalAssets}$). This factor exhibits a negative relationship with the risk premium of infrastructure assets i.e., higher profits indicate more likely future dividend payouts and a lower discount rate. For regulated water utilities we would not expect high profits. This is something that we do observe in Figure 12, which suggest a decreasing trend in the profitability of utilities everywhere, expect perhaps in some European cases (exc. UK). The UK utilties sector has seen its profitability drop by almost 30% since 2015.

Crucially, Figure 12 shows that Kemble Water's profitability is significantly lower than that of its peers. This would have a negative impact on the risk premium for Kemble, compared with other utility assets, resulting in a higher discount rate. With the trend for profitability negative, we would also witness an ever increasing risk premium over time.

4.1.3 Size

The third factor presented here is size, or the total assets of a firm. Size was found to have a positive relationship with the risk premium for infrastructure assets (see (Blanc-Brude and Gupta, 2021)). The larger the asset, the greater the return because the asset is more illiquid and more complex.

We can see in Figure 13 that Kemble Water is significantly larger than its peers in both the UK water sector as well European and Global utilities. As a result, investors would again expect a higher risk premium for Kemble Water than other infrastructure assets. However, the general trend of growth in the size of the asset stopped in 2020.

4.1.4 Investment

Finally, we consider the Investment factor ($\frac{Capitalinvestment_t}{Totalassets_t}$). Blanc-Brude and Gupta (2021) found that a higher investment factor results in a higher risk premium for assets. Indeed, during periods of higher investment, infrastructure companies face higher risks of delays and cost-overruns, which are well-known problems in large capital projects. All these effects make future cash flows more uncertain and increase the risk premium.

In Figure 14, we can see that Kemble Water and UK itilities have comparable investment factor exposures. This is understandable as they are governed by the same investment/regulatory cycle. We can also see that there are changing investment cycles that would result in changing risk premiums. Specifically, an increase in the factor exposure around 2015 and 2016 for UK water utilities and Kemble Water respectively would increase expected returns, with a subsequent decrease from 2018. This change in the factor, first up then down, would have led to similar movements in the risk premium for Kemble Water and, consequently, the discount rate and valuation.

Still, throughout the period, we also see that Kemble is investing increasingly less, as a function of its size, than its peers in the UK.

We can also observe that, for both Kemble and UK utilities, the investment factor is higher than for European or Global utilities. This would indicate that the risk premium should be higher, hence a higher expected return.

4.2 Volatility as the Ultimate Risk Proxy

Once the valuation and returns of individual assets are computed using a market-implied methodology, it is possible to see the combined effect of these risk factors on the value and the risk of the asset by considering the volatlity of the returns, a standard measure of financial risk. We use monthly returns, provided in infraMetrics, to compute a measure of volatility and also to compare price ratios.

Table 5 presents the return volatility metrics for Thames/Kemble Water, UK Water Companies and Global Regulated Utilities. We see that Thames Water exhibits a higher volatility (as measured by the standard deviation of monthly returns for the previous 10 years).

Hence, the combination of risk factor exposures of the company (its systematic risk βs), the evolution of the market price of risk and its duration (sensitivity to changes in the rate of interest) lead to a much higher level of aggregate risk as measured by the return volatility.

In fact, the risk of Thames Water is more than twice that of the average UK Water utility.

As a risk benchmark, this information reveals that the investments made in Thames and its HoldCo Kemble Water were high risk - 'not boring' at all and also very different from investments in its peers. The difference between the level of risk of this company and the rest of the sector (or the notional regulated firm) was a reason to reconsider it valuation, as we discuss in the next chapter.

4.3 Red Flag #3: High-Risk Profile

From this comparative analysis of the key systematic risk factors to which Kemble Water is exposed, investors should have been able to conclude that the investment:

- was highly levered;

Table 5: Comparing the return volatility of Thames/Kemble Water and Other Water Utilities

Name	Volatility
Thames Water	28.0%
Kemble Water	22.0%
UK Utilities	12.4%
European Utilities	16.2%
Global Utilities	13.4%

- produced low profits compared to its peers;
- was very large;
- had low capex compared to other utilities; and
- was much more more volatile than its peers.

These had obvious consequences for the valuation of the asset.

The cash flows to equity investors would become riskier as the company increased its debt and under-invested in the asset and was therefore likely to underperform operationally sooner or later, thus facing future high costs and fines. Moreover, the lower profitability also indicated that future dividends were less likely, a situation that was bound to get worse with the ripple effect of under-investment.

From a systematic risk perspective, the discount rate should have been high and increasing markedly: large size, high leverage and low profitability positively impact the equity risk premium of unlisted infrastructure assets (and increase their discount rate) whilst low capex negatively impacts the risk premium (and decreases the discount rate).

Finally, the volatility of returns, once they are computed at a higher enough frequency, should have told investors that Thames Water was riskier. This information should have made them pause and consider what value they should ascribe to an investment in the asset.

Once again, the focus on the asset itself in all its idiosyncratic glory, and a lack of comparison and benchmarking, seems to have left investors in Thames and Kemble oblivious to the risks they were taking.

5. Conclusion: A Company that Had Been Losing Value for Years

In the previous chapters, we have established three red flags for the investors in Thames Water and Kemble Water:

- Red flag #1: the company should not have been expected to behave 'normally' as its incentives were twisted by an extremely low regulatory weighted average cost of capital (or WACC) that pushed it to take on too much risk. While this is true of the whole sector, Thames Water's market WACC was even lower than all of its peers.

- Reg flag #2: Thames Water had created a structure to extract a lot of cash which also created a huge debt pile, leading to a need to conserve capital. It would have been clear from 2016 onwards that there would be no potential for further payouts for many years.

- Red flag #3: Thames Water's exposure to key risk factors has been high, and rising, for a significant period of time: this leads to a higher risk premium and therefore an increased discount rate.

These red flags indicate that the firm's dividend cash flows are becoming both declining (in expected value) and becoming riskier and that they should command a higher discount rate. Hence, the same investors should have considered the value of the firm to be decreasing for several years. Indeed, while the business of the water utility Thames Water could not be expected to grow very fast, the future cash flows of Kemble to its shareholder were becoming more and more uncertain and would have needed to be discounted with an increasingly high discount rate, as reflected by the firm's rising market WACC and COE as reported in chapter 2.

Table 6: Discount Rates Employed by USS to Value Kemble Water Holdings

Year	Low Bound	High Bound
2020	8.00%	9.00%
2019	8.75%	9.75%
2018	7.75%	8.75%

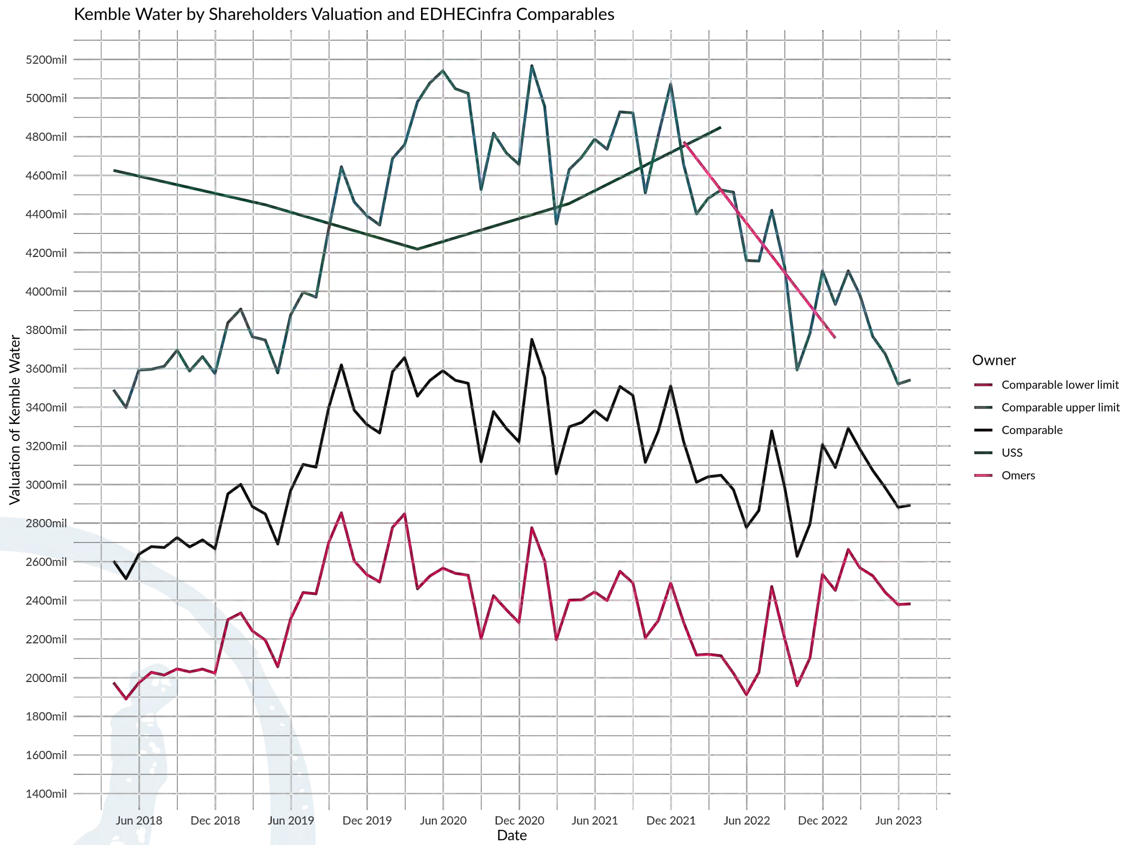
5.1 A Delay in the Revision of the Valuation

Instead, the valuation of the Kemble Water HoldCo by its shareholder followed a different pattern: it was held quite steady or increased until the March 2022, before dramatically deceasing by 30% in December 2022.

For the valuation of Kemble Water Holdings, most of the investments are held in holding companies with low disclosure requirements, or the valuation has not been revised in the accounts since the initial investment. To understand this better this, we obtained the valuations of the investment in Thames Water's parent company Kemble Water Holdings from public sources. The investors, USS and Omers, hold their investment in Kemble Water Holdings through various holding companies that have to file accounts. The valuations used here are taken from these accounts, which have been audited.

This includes Church Water Holdings, a UK registered company that holds USS's 19.71% holding of Kemble Water Holdings. USS is a UK pension plan for academics. Multiple holding companies hold the 31.77% stake of Omers, the Canadian investor and pension plan, including Omers Farmoor Singapore PTE LTD, a Singapore entity that holds 21.88% of Kemble Water Holdings; and Omers Farmoor 3 Holdings B.V., a Nether-

Figure 15: This figure presents the shareholder valuations for 100% of Kemble Water obtained from shareholders and the comparables obtained from infraMetrics using private market-calibrated data.



Sources: Omers Farmoor Singapore PTE LTD, Omers Farmoor 3 Holdings B.V.,Church Water Holdings, infraMetrics®

lands registered entity that holds 4.36% of Kemble Water Holdings. Whilst the two holdings companies identified do not account for the total of Omers' holdings, the valuations of Kemble are relatively consistent between the two; as a result, it is possible to assume that for the remainder of Omers' holdings companies, the valuation will be consistent.

A time-series of valuations is drawn from the three firms above, with the longest time series of the valuation coming from USS's Church Water Holdings. Figure 15 presents these 'fair value' marks for Kemble Water Holdings. We can see that the valuation decreased a little until 2018, before subsequently increasing until March 2022 following a purchase of an additional 8.77% share from Wren House. As this purchase was between two willing partners, and at arms length, it allowed all investors to re-value their investment in Kemble Water.

The Omers valuation, which occurs at different points in time than that of USS (year-end in December) generally concurs with the USS valuation, with no material difference until December 2022. At this point a large mark down can be seen in the carrying value, which corresponded to a 29.19% decrease in the value of Kemble Water Holdings. To date we have not observed any other large write down in Kemble Water by other shareholders but, given recent reporting, it is reasonable to anticipate this.

Note that the methodology employed by the investors to value the investment in Kemble Water is consistent for both Omers and USS; fair value is estimated using the so-called 'income method' i.e., discounted cash flows. However, there is a significant lack of disclosure around the inputs used in these discounted cash flow models. In the USS financial accounts from 2018 to 2020, a discount rate range was disclosed (see table 5.1). In the three years for which the information is available, the discount rate did increase, albeit in the end by not much. We note that the level of discount rate used by USS is in fact close to the market-implied cost of equity presented in chapter 2 for UK utilities but still on the low side for a company like Thames or Kembles Water.

In the years since, no such information has been revealed. Hence we do not know what discount rate the investors currently use and whether the increase in their marks in March 2022 was driven by a lower discount rate or an optimistic view on the cash flows. Neither do we know why the Omers vehicles reduced their mark so drastically and if this was driven by a change of discount rate, cash flow forecast or both. At the time of writing (December 2023), the Church Water Account are still unpublished and exactly what loss USS will recognised is also unknown even though it can be expected to match OMER's mark.

What we do know is that the red flags had long been captured by a market-calibrated approach such as the one described earlier.

5.2 Did the Market Know?

Figure 15 also presents the range of valuations produced using our the methodology consisting of estimating the market price of risk of key systematic risk factors like size, leverage, capex, profits, etc. and to calibrate this model with the most recent transaction values (entry IRR) in the market in order to capture the market price of (unlisted infrastructure equity cash flow) risk at each point in time.

This data allows us to built a comparable valuation range for Kemble using the same risk factor exposures or β_t as those of the firm, as described in chapter 4 and the market price of risk or $\lambda_{k,t}$ for each factor k.

We obtain an average equity risk premium for a company with the same systematic risk exposures as Kemble (and in the same TICCS segment in the UK) of 9.31% in December 2022 (9.5% in October 2023) and a discount rate or cost of equity of 12.25% in December 2022 and 13.17% today.

These estimates are given reasonable bounds following the standard methodology used in asset pricing [1]

Finally, infraMetrics includes a free cashflow and dividend forecast for Kemble Water that includes several assumptions including a revenue growth of 2.9% until 2030, and 1.5% after that on average until 2050, and no dividend payouts until 2030 followed by a free cash flow to equity retention rate (the inverse of the payout rate) declining from 90% to 80% until 2033 and rising towards a long term value of 60% after that.

This gives us a range of net asset values for Kemble Water as shown on Figure 15.

We observe that the current valuations by USS and Omers are at the high end of the infraMetrics comparables. In 2020, when the comparable valuation peaked, we still see Kemble Water held at a much higher mark. Investors took a view on the valuation that was 'stale' i.e., it did not incorporate the change in market price and increased exposure to risk factors of the asset.

Since 2020, our comparable valuation has been steadily declining. We observe that the owners recognised a similar loss but very late and in one shot at the end of 2022 when Omers cut its valuation.

Given the events of 2023, with OfWat changing licence agreements to block dividend payments, the risk of Kemble will continue to increase and and its valuation to decrease further.

1 - The Cochrane and Saa-Requejo (2000) methodology allows identifying a confidence interval around the valuation. The idea behind the methodology is that some deals are too good to be passed over by investors. Therefore this sets an upper and lower limit on the valuations. The infraMetrics implementation of the Cochrane and Saa-Requejo (2000) methodology employs a Sharpe Ratio based on the expected returns of global infra market and historical volatility. See Appendix for details.

Recently, Kemble Water said that its investors expect no distributions before 2030 ((Plimmer, b)). This highlights the perilous nature of Kemble's balance sheet. So too does the reported need to refinance £190m debt in Kemble Water's holding structure (((Plimmer and Pickhard, Plimmer and Pickhard)) and a requirement for an additional £250m in financing. ?? (Moody's cuts Thames Water unit credit rating, slaps on new warning) reports that shareholders only provided £750M in financing when £1Bn was requested.

5.3 Lessons Learned?

In this note we have highlighted that employing a relative/comparative view on the valuation and risk of an asset is powerful as it allows for relative benchmarking of the risk/valuation of the asset. For most investors, owning the water utility of the capital of a G7, nuclear-armed country, with a strong history of rule of law would be the ideal boring investment. This utility should have paid regular predictable dividends to shareholders and its valuation should not be too volatile.

Obviously this was not the case with Thames Water.

When compared with its peers, Thames/Kemble Water showed some significant risks that were not accounted for when viewing the utility in isolation - as its investors apparently did when assessing the asset.

Since 2015 we have seen:

- Its allowed revenues were too low.
- Its payouts would soon cease.
- Its exposure to key negative risk factors was high and increasing.

We showed that Thames/Kemble Water has the highest cost of capital of all UK utilities, and one that is significantly above the returns OfWat allowed in the PR19 price review. This disparity has meant that investors are wary of providing more capital, because OfWat does not consider the firms' cost of capital when setting allowed returns. Instead, as noted in Chapter 2, OfWat employs a long-discredited methodology to set returns. If market returns were employed, then investors would more likely to be willing to provide the funds needed to both invest in the network and reduce debt.

We next showed that if the investors of Thames/Kemble had the opportunity to compare the key factors that explain infrastructure returns (leverage, profitability, size and investment), they would have realised that the asset rated poorly against its peers in two of these. The trend in these factors should have also provided investors with enough information to ask questions around the valuation and risk of their investment. That we have not observed this in the last five years does indicate that investors were taking the time to benchmark their investment. This, as we showed in this chapter, has resulted in some nasty surprises for the investors, with one writing down their investment by roughly 30% in a single year.

All in all, this note has provided a good case study showing that, instead of concentrating their attention on just the one asset in isolation, investors would have done better to take a comparative view of Thames/Kemble Water with other assets in the UK and around the world. This would have helped to identify the red flags sooner and allowed for a better assessment of the risks involved in investing.

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A. Appendix

A.1 Market-Implied Valuation Methodology Robustness

To test the results of this valuation approach, we conduct robustness tests of more than 250 reported transactions from a diverse set of sectors and countries.

- We compare the mean and median of the valuation ratios of the observed market transactions against the infraMetrics estimates. We find that on an aggregated basis, the estimates are fairly close.
- We also present a distribution of the estimated errors of the individual reported deals. The median and mean errors are less than 1%. However, the extreme percentile values can reflect up to 5% estimation error.
- We also show a linear regression chart of the estimated and reported EV/EBITDA ratios. It shows a very high R-squared value, and the dots are well-aligned with the diagonal line (a perfect match between model and predicted prices would line up all dots on these plots on the 45° line).

A.2 Valuation Bounds

The Cochrain & Saa-Requejo (2000) methodology allows identifying a confidence interval around the valuation. The idea behind the methodology is that some deals are too good to be passed over by investors. Therefore, this sets an upper and lower limit on the valuations. The infraMetrics implementation of the Cochrain & Saa-Requejo (2000) methodology employs a Sharpe Ratio based on the expected returns of global infra market and historical volatility. The methodology allows for the identification of the distribution of discount rates, and, given the current valuation of the asset (and other holding period assumptions) the terminal value can be estimated for the asset. From this terminal value and distribution of the discount rates its possible to identify a confidence interval for the asset values. The estimation process is explained below.

Step 1: estimate the volatility of the discount factor

$$DR\_vol_t = \frac{2 * SR_t}{1 + R_f} * \sqrt{T}$$

Where, DR_vol_t is the volatility of the discount factor at time t

SR_t is the market Sharpe Ratio at time t calculated using the average expected return of global infrastructure market and the ten-year historical volatility

R_f is the risk-free rate in the US central bank policy rate

T is the holding period of the asset, assumed to be 5 years

Step 2: Estimate the terminal value

$$TV_t = P_t * (1 + E(R_{m,t}))^T$$

Where, TV_t is the terminal value at time t

P_t is the estimated valuation of ABP at time t

$E(R_{m,t})$ is the average expected return of the infrastructure market at time t

T is the holding period of the asset, assumed to be 5 years

Step 3: Calculating the bounds

Figure 16: Reported vs estimated EV to EBITDA ratios"

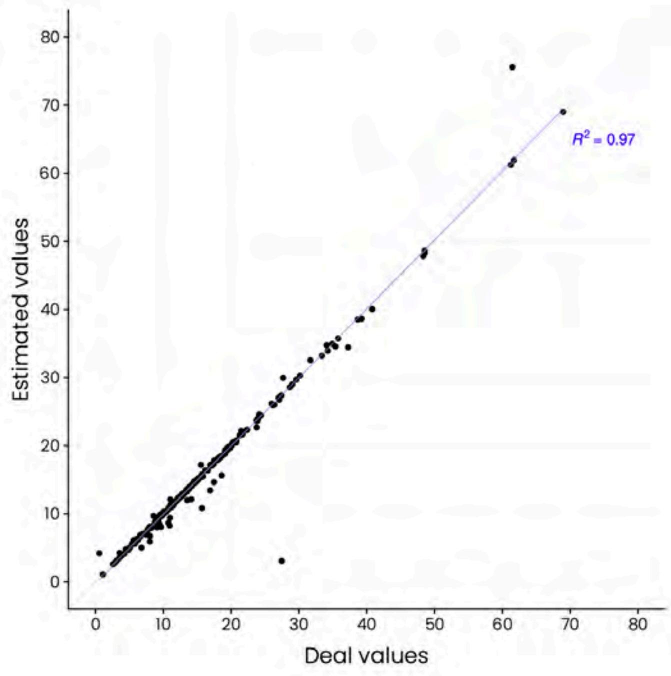

Table 7: Estimated vs. reported valuation ratios and model's goodness-of-fit.

Ratio	Reported Mean	Est. Mean	Reported Median	Est. Median	R^2	RMSE
EV/EBITDA	15.54	15.34	12.98	12.61	0.97	2.27
P/Book	2.37	2.28	1.65	1.59	0.87	0.90
P/Sales	3.35	3.21	2.52	2.32	0.85	1.43

$$P\_lower_t = \frac{TV_t}{(1 + E(R_{m,t}) + 1.96 * DR\_vol_t)^T}$$

$$P\_upper_t = \frac{TV_t}{(1 + E(R_{m,t}) - 1.96 * DR\_vol_t)^T}$$

Where, P_lower_t is the lower bound of the valuation

P_upper_t is the upper bound of the valuation

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