WORKING PAPER

Reform, not revolution, is what is needed now for yardstick competition

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Abstract[1]

Yardstick competition as an approach to set the prices of regional natural monopolies is now an established tool. After 30 years of application to the water industry in England and Wales, this article takes a critical look at how yardstick competition has been implemented in the latest Price Review 2019 (PR19). It proposes reforms to ensure that in the next Price Review 2024 (PR24) and/or beyond the efficiency challenges are appropriately set and the degree of information at the regulator's disposal is maximised.

Keywords

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1 Both authors worked at Ofwat during the period of PR19. The views and opinions expressed in this paper are the sole responsibility of the authors and do not necessarily reflect those of their past, current or future employers.

1. Introduction

This article reconsiders the practical use of the key regulatory tool of yardstick competition. Also known as cost or comparative benchmarking, yardstick competition has been relied upon by regulators over the last couple of decades to set price or revenue caps for services supplied by regional natural monopolies, such as those for water and energy distribution services. In some early applications, it was also used to benchmark national telecom network monopolists against international peers (in part facilitated by the break-up of AT&T into seven *baby bells* local monopolies in the US).

At its basic, with yardstick competition the regulator can reduce its very large information asymmetry vis-à-vis the firms it regulates by comparing the available cost information across these geographically distinct monopolists. Over the last thirty years this has proved to be a very useful tool to, at least partially, overcome the intrinsic information asymmetry gap faced by regulators. The original idea of comparative benchmarking was to compare the cost efficiency of each firm on a like-for-like basis – i.e. controlling for differences that are not under management control - and set a target efficiency level based on the cost of other more efficient firm(s). Critically it differed from cost-plus regulation because it severed the link between the regulated firm's own costs and the efficiency target. It thus reduced, but not eliminated, the unilateral incentive for a firm to over-declare or inflate its costs.

As regulators learned by experience, yardstick competition has been refined and become more complex and extensive over time (CMA, 2021, para 2.11). However, the scope of its sectoral application is significantly more limited today (i.e. fixed telecom no longer relies on benchmarking, electricity distribution in the UK experienced consolidation making benchmarking significantly less useful). This only leaves the water and sewerage services in England and Wales as the main remaining example of application, which is the focus of this article.

This article examines the application of yardstick competition to water regulation in England and Wales under the latest Price Review 2019 (PR19), assesses some of its potential pitfalls and suggests several ways to improve its application. We conclude that in its current application yardstick competition has not yet fully taken into account the fact that even the most efficient supplier, which could be used as the most demanding among alternative efficiency targets, is still likely to be significantly inefficient. Therefore, any concerns about the firms' financeability that have led to apparently reasonable, but in practice we believe too cautious, efficiency targets have been overblown. Furthermore, yardstick competition has also not yet, at least explicitly, adjusted the efficiency targets since privatisation to take into account evidence that firms in other liberalised markets substantially increased their efficiency in the few years after they were first exposed to competition. Instead, the regulator's approach has been only limited to ensuring that firms keep up with the most efficient among their peers and that the sector, as a whole, does not lose ground in terms of productivity relative to markets exposed to competition. We consider that the current approach is insufficient for the water sector to achieve its full efficiency potential. Furthermore, the introduction of cost sharing for underspent further reduces the firms' incentives to increase their efficiency, as doing so would lead to more limited rewards. While the above criticisms apply to most types of costs, there is still a sizeable proportion of costs, which is yet to be touched by yardstick competition. For the latter the regulator has not yet designed any alternative convincing tools to address the very large information asymmetry it faces. The regulator still acts under very limited information, often in the dark, or at least in a foggy environment, as to what the efficient costs are, resulting in higher allowances and prices for consumers.

Therefore, we call for the regulator to set tougher efficiency targets and/or introduce a one-off adjustment to the efficiency target that takes into account the fact that the sector's efficiency was never brought up to the level that could be achieved if, theoretically, the sector could be exposed to competition. We also consider that cost sharing for underspent should be reconsidered in the light of the above criticism. Lastly, we consider appropriate, if not urgent, to adopt as many measures as possible to reduce the yet untouched asymmetry of information for the not insignificant proportion of costs that are not yet exposed to yardstick competition. The most important measure is a proposal for firms to run a mandatory competitive procurement exercise for all service elements that are not easily benchmarkable, because there is either no historical information or are specific to one or at best few firms. While the use of competitive procurement is already envisaged in the current framework through Direct Procurement for Customers (DCP), our proposal would significantly expand the scope to which competitive procurement would apply and, hence, its impact in setting cost allowances.   If appropriately designed, competitive procurement could reveal the real cost of such services at limited additional costs to the industry. This appears particularly relevant and urgent in the light of the water firms' PR24 request to increase their total enhancement costs, a significant share of which is not benchmarked, for PR24 by £36bn or 60% above the level in PR19.

2. How to deal with the local natural monopolies' regulatory problem

Since its privatisation in 1989, water and sewerage services in England and Wales have been provided by privately-owned regional monopolies. Water and Sewerage Companies (WaSCs) have been supplying both water and waste-water services, while Water-only Companies (WoCs) have only been focusing on water services, generally in less extended areas than those served by WaSCs.[1] This setting – with private local monopolies supplying a relatively homogeneous products – provides the best conditions for applying yardstick competition. Left unregulated, these largely privately owned companies will not set the prices, quality and other terms that maximise consumer welfare. This would lead to static inefficiencies, as local monopolies would set their prices at monopoly level and would not face strong incentives to reduce their costs. It would also generate dynamic inefficiencies, as these companies would have limited incentives to innovate. Solutions to this concern could be grouped under two main categories. First, the state could attempt to reproduce a central planning solution – i.e. state ownership with the aim of planning to achieve the social optimum. In the England and Wales prior to privatisation, and in most countries still today, local monopolies such as those supplying water services, have operated under state ownership. This may ensure that prices for the services are not set at the monopoly level. However, it suffers from considerable drawbacks – i.e. limited incentives to become efficient and innovate or to satisfy on consumers' needs and, therefore, significant risks of deviating away from the pursuit of social optimum. Second, the state may put in place a framework that mimics, though imperfectly, the outcome of competition by providing the private (and sometime state) owners with incentives to behave as if the firms were facing competition. In the US, instead, the main approach has been cost-plus (or rate of return) regulation, whereby privately-owned firms are allowed to set their prices at a level that allows the recovery of the incurred costs plus an adequate rate of return. While cost-plus regulation addresses the key static allocative efficiency concern by forcing prices close to the declared costs, it provides a very incomplete set of incentives. In particular, it provides all regulated firms with a strong incentive to inflate rather than reduce their costs, it distorts investment decisions in favour of capital rather than operating costs and fails to incentivise cost reduction innovations. Irrespective of the approach chosen to address the above market failures, the state, as the shareholder or central planner, or the regulator needs to minimise or address the large asymmetric information advantage enjoyed by the regulated firm.

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1 Unless otherwise noted, by 'water companies' or companies we refer to WOCs and WASCs.

The criticisms of both state ownership and cost-plus regulation have led to privatisation together with the emergence of yardstick competition, a term that Shleifer's (1985) seminal paper borrowed from a methodology to compare privately and state-owned firms. He used it, instead, to provide a regulatory solution to the problem of mimicking competition among privately owned local monopolists. Shleifer's starting point was his criticism of the cost-plus approach in the US, an approach that, according to him, offered no incentives to minimise costs. Shleifer recognised the importance of the lagged price adjustment approach suggested by Baumol (1970) and Bailey (1974) allowing firms to reap the benefits of their efficiency savings. However, Shleifer argued that this is only a partial solution, as it creates at least a temporary divergence between prices and costs and, critically, provides limited incentives to reduce costs, as firms know that lower regulated prices follow cost reductions. At its basic Shleifer's yardstick competition idea was to rely on the costs of comparable firms to set the price of the regulated firms. In other words, each firm is forced to compete with its shadow firm. The key intuition was to delink a firm's allowed price from its own costs, but instead link it to those of the other firms. In Shleifer's own words: "*… the regulator can force firms serving different markets effectively to compete. If a firm reduces costs when its twin firms do not, it profits; if it fails to reduce costs when other firms do, it incurs a loss*".

Shleifer first looked at a set of identical firms that operate locally and do not compete with each other. He showed that under yardstick competition, in the form of the average cost of all firms or other forms (but excluding the costs of the regulated firm), each firm sets its price equal to the average cost and that the solution is a symmetric Nash equilibrium. According to Shleifer, "*yardstick competition works because it does not let an inefficient cost choice by a firm influence the price and transfer payment that that firm receives*", as long as the regulator can commit itself not to pay attention to the firms' complaints and to be prepared to let the firms go bankrupt, if they chose inefficient cost levels. In these circumstances, according to Shleifer, yardstick competition delivers the (static) first best, intended to be the yardstick competition level. When firms are heterogeneous, Shleifer suggested to rely on regression analysis to control for exogenous factors - i.e. factors affecting cost efficiency, which are outside management control. Even if this approach imperfectly controlled for differences across heterogeneous firms, as long as the firms uncontrolled differences are small, yardstick competition is likely to outperform cost of service regulation.

Shleifer seminal paper was since extended in a number of ways to test the validity of its general conclusions. However, the overall conclusion remains valid. First, Lefouili (2015) extended Shleifer's model to examine how the intensity of yardstick competition (i.e. the level of the price constraint) affects the regulated firms' incentive to invest in cost-reducing innovation. The intuition is that a firm reacts to a less intense constraint by anticipating it and setting a higher price and lowering demand. This reduces the incentives to reduce its costs. Lefouili cautions about the possible welfare risks of setting a yardstick competition, which is the most intense, for two reasons. First, the firm may decide to exit. Second, if the inducement to invest in cost cutting is too strong, it may crowd out other types of investment (i.e. quality improving innovations). Second, Meran and Hirschhausen (2009) proposed a modified mechanism that has similar properties as Shleifer's, but differs in the following main aspects. Their mechanism relies just on total costs, with no need to distinguish between fixed and variable costs, thus reducing the scope for arbitrary allocations. Furthermore, it introduces a tariff basket regulation allowing for the possibility to engage price discrimination among consumers. Third, Le Lannier (2011a) examined the effect of relaxing the assumption in Shleifer's that the regulator perfectly commits not to renegotiate the decision taken ex ante. He observes that, in practice, in applying yardstick competition regulators have not ruled out the possibility of renegotiation. Le Lannier shows that relaxing the commitment assumption does not prevent the implementation of yardstick competition, but requires adapting the contract design and the institutional framework. While his paper focuses on exogenous shocks that reduce the firm's profits and create incentives to renegotiate, Le Lannier also commented on the fact that the regulator may want to claw back profits, if the shock increased the firm's returns. This is very close to the so-called cost sharing mechanism discussed below. Fourth, Bisceglia, Cellini and Grilli (2022) generalise Shleifer's model

by considering a dynamic framework, whereby firms can adjust their reaction to their rivals' actions and other changes over time. They find that under the assumption that firms are symmetric the result is the social optimum, as in Shleifer. However, if firms are asymmetric the social optimum can only be reached asymptotically. This is because at any point in time firms can react based on a number of variables - i.e. prices, cost reducing investment etc. – while the regulator has only one policy tool – i.e. yardstick competition. Lastly, Chong and Huet (2009) consider the firms' incentives to collude under yardstick competition – i.e. to behave in a way that results in a laxer cap. Using a repeated game setting, they look at one setting which is particularly favourable to collusion – i.e. firms with symmetric production costs. They find that even with these conditions, collusion to tamper with yardstick competition may be difficult to sustain.

Abstracting from the debate as to whether private or state ownership of local monopolies is preferrable, there seems to be a general consensus that yardstick competition is superior to cost-plus, especially when such monopolies are privately owned (Rommel and Schwarze, 2007). The scope of yardstick competition's application has been limited, though. While some (Burns, Jenkins and Riechmann, 2005) report that it was applied to the electricity distribution and water industries in the England and Wales, the Netherlands, Austria and Germany or even more widely in the extended benchmarking meaning (Dassler, Parker, and Saal, 2006), its main application remains limited to the England and Wales water industry, where it has been the most important regulatory tool for over thirty years. Application in telecoms across national boundaries was mired with difficulties and abandoned early on, while in electricity distribution its use was undermined by the increasing paucity of comparators. While we agree that yardstick competition has been a very useful tool to regulate water companies, after thirty or so years of application it may be the right time to revisit its detailed application.[2]

3. PR19 approach to cost benchmarking in water

This section briefly covers the key features of water economic regulation in England and Wales and provides a detailed account of the Water Services Regulation Authority's (Ofwat) current approach to cost benchmarking.

3.1. Water sector regulation in England and Wales

In England and Wales, there are currently 16 regional monopoly water companies: 11 WaSCs and 5 WoCs.[3] Currently, there is no effective competition in the supply chain except in the segment for non-household retail in England,[4] where several retailers compete since 2017. While there are plans to promote competition in upstream water (i.e. water resources) and waste water services (i.e. bio-resources), these efforts are so far at their infancy and the market structure is still dominated by incumbent monopolies and third-party suppliers play a marginal role, in particular, in upstream water services.

Ofwat's key tool to regulate water companies is the five-year Price Review (PR), like PR19. A PR sets price, or more precisely, revenue allowances for each WaSC and WoC in England and Wales for the following five years. The price controls set the water companies' revenue allowance and the service package they have to offer. In PR19, Ofwat set four wholesale revenue controls covering network plus water, network plus waste water, water resource and bioresources. It also set retail controls for all companies in England and Wales and a business retail control for companies in Wales (Figure 1).

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2 This article does not discuss the pros and cons of different methods used to implement yardstick competition – i.e. regression analysis and Stochastic Frontier Analysis (SFA). See for example Le Lannier (2011b) or Burns, Jenkins and Riechmann, 2005).

3 See https://www.ofwat.gov.uk/households/your-water-company/contact-companies/.

4 In England, any business customer is eligible to switch in the business retail market. However, in Wales, only customers using a mini-mum of 50 mega litres of water a year are eligible to switch. In practice this meant that the Welsh market has not yet been fully opened to competition.

Figure 1: The water value chain
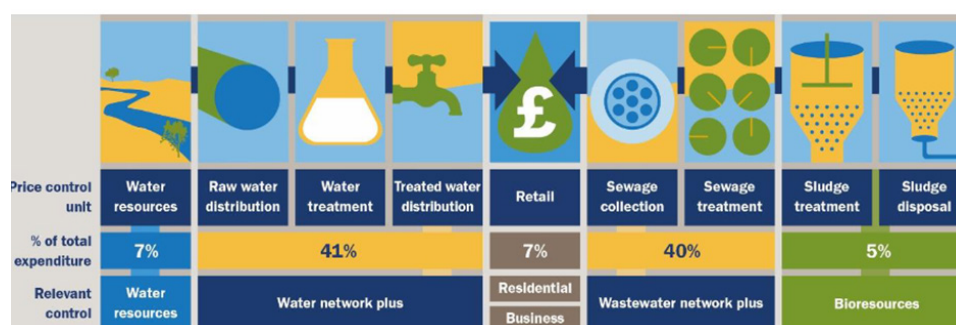
Source: Ofwat (2019a).

The PR process works as follows (Ofwat, 2020). All water companies submit their business plans with their views of their efficient costs and proposed service levels, known as outcomes. Ofwat then assesses these plans, makes interventions when necessary, and sets the revenue controls and service and incentives package for each WaSC and WoC for the next five years. Ofwat may adjust these revenues within the PR through a number of mechanisms that aim to incentivise performance and share risks with customers, though this is very rarely used.

Ofwat's approach relies on three key building blocks (Ofwat, 2020). First, through cost assessment Ofwat sets each WaSC's and WoC's revenue allowances. Second, through the outcomes regime Ofwat sets the service levels, which water companies should deliver, as well as a set of incentives for them to do so. Third, through risk and return Ofwat sets an allowed return on capital to provide investors with a return on their assets and ensure water companies' financeability. The remainder of this section only focuses on the role of cost benchmarking as part of Ofwat's cost assessment.

3.2. Cost benchmarking

Cost benchmarking has been a feature of water sector regulation in England and Wales since the water industry was privatized in 1989. In fact, the initial revenue controls that were set at privatization, before the creation of Ofwat, also relied on some form of comparative efficiency assessment across water companies (Ofwat, 2006). Since then, cost benchmarking has evolved, increasingly relying on econometric models and becoming more complex and granular in scope.

As part of PR19, Ofwat set a total revenue allowance (totex) for each company for the PR period (Ofwat 2019b). The totex approach was first introduced in Price Review 2014 (PR14) to remove a potential bias in favour of capital expenditure. Before the introduction of totex, Ofwat separately set allowed capital expenditure (capex) and operating expenditure (opex), a framework that incentivised water companies to prefer investing in capital assets over operational expenditure.

Ofwat also set separate allowances for wholesale and retail activities (Ofwat 2019b). Within these two broad categories, Ofwat distinguished among three key building blocks – i.e. modelled base costs, unmodelled based costs and enhancement costs. For retail residential and business activities there are no enhancement costs and the remaining costs are all modelled.

Base costs and enhancement costs were the two key components of Ofwat's totex allowance and accounted for 92% of allowed totex, which also includes retail costs, in PR19 (Ofwat 2019b). Hence, the next sections focus on Ofwat's PR19 approach to set allowances in base and enhancement and the role that benchmarking plays in each case.

3.2.1. Ofwat's approach to base costs

Base costs are standard and routine, year-on-year costs, which water companies incur in the normal running of their business to provide a base level of service to their customers. Ofwat distinguished further between modelled and unmodelled based costs.[5] In PR19 the former accounted for 74% of allowed wholesale totex and were estimated using econometric methods. Instead, unmodelled base costs accounted for 8% of allowed totex and econometric benchmarking played no role in their estimation. Enhancement costs (section 3.2.2) accounted for the remaining 18%.

There are three key stages in setting the modelled base cost allowance: 1) econometric modelling, 2) catch-up challenge and 3) frontier shift. Below we explain these concepts in more detail.

Econometric modelling

Ofwat relied on econometric models to estimate the relationship between water companies' costs and a few explanatory factors (cost drivers). This relationship is known as the average (best fit) cost curve (Ofwat 2020). It helped Ofwat to disentangle the proportion of cost variation across companies that corresponded to differences on efficiency, which can therefore be controlled by management (rather than be driven by exogenous factors). Econometric models allow Ofwat to rank water companies on the basis of their relative efficiency and rely on the most efficient ones as a benchmark for the remaining ones.

Ofwat modelled base costs covered opex and capex together. Opex included enhancement opex as water companies did not distinguish between base and enhancement opex in their annual reports (Ofwat 2019b). Capex included some capex enhancement activities that share similarities with base costs as they are driven by population growth.[6] Ofwat estimated its econometric models in water and waste water using the industry's actual expenditure from 2011/12 to 2018/19 and relied on different models to benchmark different costs at different levels of aggregation. As a last step, it combined all this information triangulating across different models to form its view of efficient base costs.

Catch-up challenge

The catch-up challenge incentivised the average and low performing water companies to catch-up with their most efficient peers – i.e. those at or below the efficiency frontier. In more technical terms, Ofwat shifted the average cost curve to estimate an efficient cost curve. This shifting was based on a relatively efficient company. In PR19 and in each PR, Ofwat set incentives for the least efficient water companies to catch up with the frontier. As an additional incentive to increase efficiency, Ofwat may allow the most efficient water companies to recover more than what they asked for in their business plan (Ofwat 2019b).[7]

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5 Unmodelled base costs consist of a small number of items whose particular characteristics make them more suitable for a separate assessment not based on benchmarking: abstraction and discharge service charges (for water services only); business rates; costs associated with the Traffic Management Act (TMA); waste water Industrial Emissions Directive costs (for waste water service only); third party costs (incurred by companies in providing services outside of their principal services); and non-section 18514 diversions costs (Costs of diverting mains where the request is not made under section 185 of the Water Industry Act 1991).

6 The enhancement wholesale water activities added to modelled base costs included expenditure for local distribution assets to provide a water service to new customers; expenditure on local network assets associated with new developments in water services and, expenditure to reduce the number of properties with low pressure. The enhancement wholesale wastewater activities added to modelled base costs included expenditure for the provision of new development and growth in sewerage services; expenditure to meet or offset changes in demand from new and existing customers at sewage treatment works; expenditure for enhancing the sewerage system to reduce the risk to properties and external areas of flooding from sewers and, expenditure on assets falling within the scope of the statutory transfer of private sewers and lateral drains.

7 This would be the case if the costs predicted by Ofwat's model for the most efficient companies are higher than the forecast costs in these companies' business plans.

In PR19, Ofwat set the catch-up challenge at the fourth placed company (out of seventeen) for wholesale water base costs and at the third placed company (out of ten) for wholesale wastewater (Ofwat, 2020). Despite this catch-up challenge, Ofwat's total allowance for base costs in PR19 was practically the same as the total allowance for base costs requested by water companies (Ofwat 2020).

Frontier shift

The frontier shift challenge was the second component of Ofwat's overall efficiency challenge for modelled base costs. This challenge applied to all water companies, including those at or below the frontier, which instead are exempt from the catch-up challenge. This aims to mimic the impact of rivalry in competitive sectors on efficiency - i.e. the efficiency frontier improving over time mimics the cost reducing innovation that occurs under competition. To set the frontier shift in PR19, Ofwat considered the productivity improvements in the wider competitive economy that the water sector should be able to emulate. It also considered a one-off efficiency improvement from water companies making greater use of the totex and outcomes framework at PR19 (Ofwat 2019b). Overall, it applied a frontier shift of 1.1% per year based on these two factors.[8]

In PR19 Ofwat continued to allow for real price effects on some input costs (Ofwat 2019b and 2020). Real price effects measure how much Ofwat expects water companies' costs to change due to input price inflation, relative to the Consumer Prices Index adjusted for Housing Costs (CPIH), which is the inflation index used for wholesale allowances. In PR19 Ofwat adjusted for real price increases for wages where the water companies input costs were more affected than what the CPIH would suggest. Instead, Ofwat did not adjust for any real price decreases (e.g. where the water companies were found to be less affected than the CPIH). An allowance for real price effects increases softens the frontier shift challenge.[9]

3.2.2. Approach to enhancement costs

Enhancement costs relate to activities that water companies undertake to enhance the capacity or quality of their services beyond the base level. They may include expenditure related to meeting new statutory or environmental obligations, ensure resilience or address water scarcity, amongst others. These are expenditures that are inherently difficult to benchmark because there is generally no historic track record or the expenditure is specific to one or a limited subset of water companies.

Ofwat set enhancement cost allowances on a totex basis. In most instances, Ofwat examined enhancement costs separately for each category (e.g. metering or supply/demand balance). In some instances, the assessment combined different items together where there was some synergy between programmes.

Ofwat relied on several methods to assess enhancement costs. For around 70% of enhancement proposals Ofwat used some form of benchmarking (Ofwat, 2019a and Ofwat, 2022a), either through simple econometric models (less sophisticated than those used for base costs) or simple comparisons of average unit costs across water companies. In either case, the assessment relied on submitted forecast, and not historical, costs (Ofwat 2019b). In other cost categories, where even simple benchmarking was not possible, Ofwat undertook either "shallow dives" or "deep dives" - i.e. *ad hoc* common-sense assessments - to assess the proposals of water companies.

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8 In its 2021 re-determination, the CMA set a 1% frontier shift, "slightly lower" than Ofwat's (CMA, 2021, para 4.650).

9 In PR24, Ofwat will consider whether a labour real price effect remain appropriate in PR24. It will also reconsider whether a real price effect is needed for other inputs (e.g. energy and materials) (Ofwat, 2022c).

"Shallow dives" are light touch and Ofwat applied a company specific efficiency factor to the company's proposed costs.[10] "Shallow dives" were chosen for enhancement cost elements whose expenditure forecast was less than 0.5% of the WaSC's or WoC's water or waste water wholesale totex. "Deep dives", instead, were more in-depth assessments that were performed when expenditure was above 0.5% of the WaSC's or WoC's water or waste water wholesale totex. Ofwat assessed whether the level of expenditure was justified on the basis of a set of criteria - i.e. whether there was a need for the investment, whether alternative options were available, the robustness and efficiency of costs and customer protection measures, where appropriate. Ofwat allowed this expenditure in full, if it found convincing evidence that the costs were efficient. If not, it applied a company specific efficiency factor ranging between 5% and 10%.

There are two additional key differences between how Ofwat assessed enhancement costs compared to base costs (Ofwat, 2019b). First, for base costs, the most efficient water companies might be allowed to recover more costs than they requested. According to Ofwat, this incentivises water companies to submit efficient business plans. However, for enhancement costs the assessment was more reliant on forecast information, so, as a general rule, no WaSCs or WoCs was allowed to recover more cost than they requested. Second, as opposed to base costs, Ofwat did not apply a frontier shift to the majority of enhancement cost elements, with the exception of WINEP.[11]

3.3. Cost adjustment claims

Ofwat's approach to cost assessment acknowledged that its econometric models could not take into account all relevant factors that explain cost variation and that there might be instances where an adjustment was required to correct for these (Ofwat, 2020). For this reason, the regulatory framework allows water companies to submit cost adjustment claims when submitting their business plans. Water companies often argue that they face unique circumstances that explains why their efficient costs are higher than what Ofwat's models suggests.

In PR19 Ofwat required water companies to submit evidence in support of their cost adjustment claims, which Ofwat assessed against a set of criteria.[12] These criteria were similar to those used by Ofwat to assess "deep dive" enhancement claims. Ofwat claimed it set a "high evidential bar" (Ofwat, 2020), when deciding whether to accept a cost claim to prevent companies obtaining a one-sided adjustment that would be detrimental for customers.[13] In its PR19 methodology, following what the CMA had argued for in its 2015 determination on Bristol Water's appeal, Ofwat stated its intention to have a process of symmetrical adjustments.[14] These would apply to cost adjustment claims whose costs are already reflected in the baseline. The idea was to offset any accepted cost claim with a reduction in modelled allowances, so that the acceptance of the claim would not lead to an increase in overall allowed costs across all water companies. While in PR19, Ofwat rejected 43 cost adjustment claims and accepted or partially accepted 19, it did not adopt any symmetrical adjustment[15], contrary to its declared intention in the PR19 Methodology. In PR24, Ofwat stated

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10 This efficiency factor is based on Ofwat's assessment of cost efficiency (Ofwat, 2019b). Ofwat considers that evidence on cost efficiency is good evidence of the company's overall efficiency. A company efficiency factor is defined is the ratio of our view of efficient modelled base costs to the company view of modelled base costs over 2020-25. In shallow dives, the efficiency factor is capped at 5%. Hence it takes values from 0% to 5%, depending on the company's efficiency score.

11 Environmental obligations under the Water Industry Environmental Programme (WINEP) in England, or National Environment programme (NEP) in Wales. In the CMA's decision on the appeal of Anglian, Bristol, Northumbrian and Yorkshire in 2021, the frontier shift was also applied to all enhancement costs (see CMA, 2021 para 4.652).

12 In particular, Ofwat assesses whether there is evidence on whether the cost adjustment is needed, whether it is outside management control, whether the investment is needed, whether it represents the best option for customers, whether the company's cost estimates are robust and efficient, or whether the impact on affordability has been considered.

13 The process is one sided as companies do not submit cost claims arguing that their efficient costs are materially lower than Ofwat estimates.

14 The CMA (2015) noted (para 3.24, c) that "*where special cost factor adjustments were made, these mostly acted to increase companies' wholesale expenditure allowances, where Ofwat accepted claims from companies that the estimates from its benchmarking analysis were too low. Only limited downward adjustments to companies' allowances appear to have been made to address the risk that, for some companies at least, the estimates from Ofwat's benchmarking analysis were too high*".

15 See PR19 Feeder model: Cost Adjustment Claims aggregator.

again that it intends to implement symmetrical adjustments when possible (Ofwat, 2022c).
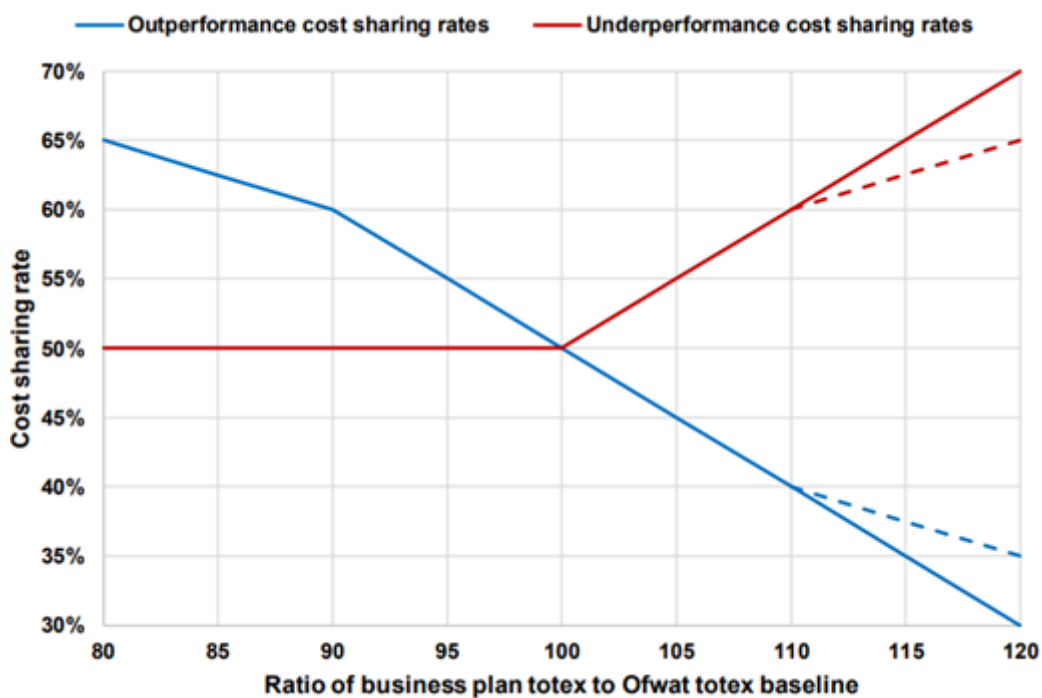
3.4. Cost sharing rates

Setting cost allowances in advance for a period of five years is always subject to some degree of uncertainty, some of which is outside management control. As revenue allowances may turn out to be too high or too low, Ofwat's framework incorporates a cost sharing mechanism that aims to share this risk between water companies on one side and their customers on the other (Ofwat, 2019b). Cost sharing works as follows: when a WaSC or WoC over - or under-spends its allowance in a PR, it will share the overspent or underspent with its customers. An initial form of cost sharing was introduced in Price Review 2009 (PR09) in relation to capex. Before PR09, there was no cost sharing mechanism, and water companies did not have to share with their customers a proportion of their over - or under-spend. In PR14, cost sharing was extended to totex, through Ofwat's menu approach and cost sharing incentives.

In practical terms, Ofwat implemented this mechanism relying on ex ante cost sharing rates. The latter indicate the proportion of cost savings that investors keep, or the proportion of any cost overrun that investors bear. In PR19 Ofwat took the water companies' cost performance against their allowed costs into account in the PR19 reconciliation for the next PR period. Ofwat also relied on cost sharing to incentivise the submission of efficient business plans, since water companies, that did so, got more favourable cost sharing rates.

Ofwat calculated cost sharing rates for each water companies using the ratio of a company's view of totex (business plan totex) to Ofwat's view of efficient totex. Therefore, each water company had a cost sharing rate for outperformance and one for underperformance. Figure 2 illustrates how Ofwat set the cost sharing rates for water and waste water services in PR19. These rates differed across water companies.

Figure 2: Calculation of cost sharing rates in PR19

Source: Ofwat (2019b). Note: dotted lines show the part of the line where the sharing rates schedule was different at draft determinations.

4. The limitations of the current application of yardstick competition to the water industry in England and Wales

Overall, we consider that the application of yardstick competition worked well in the water industry relative to other possible alternatives. Since privatisation, the sector experienced significant investment, limiting real price increases and saw high compliance with environmental standards (Ofwat, 2015, p. 3), although some of these achievements are now contested and it is difficult to compare these with a suitably credible counterfactual. The approach also evolved considerably since its first application to meet some important challenges. For example, as mentioned in Section 3.2.1, at first opex and capex were separately estimated, initially there was no cost sharing for underspent (Section 3.4) and no systems of outcomes to incentivise better service quality. This, however, does not mean that the current application of yardstick competition could not be further improved, while coexisting with private and public ownership and a system of regulatory incentives.

We take, as our main example, the application of yardstick competition to the water industry in England and Wales by Ofwat in PR19, which we refer to it as the "current framework". Where useful we also refer to the CMA's Final Report on the appeal of Anglian, Bristol, Northumbrian and Yorkshire against Ofwat PR19 final determination (CMA, 2021).

Understanding first the limitations of the approach described in Section 3 is the most appropriate way to consider possible improvements to the application of yardstick competition to the water industry in England and Wales. We consider it useful to rely on the same key issues first mentioned in Section 2 and use a simple numerical example for illustration. This assumes that there are 30 local water monopolists (as it was the case at the time of privatisation) that in terms of their cost efficiency, after controlling exogenous (i.e. outside management control) factors affecting cost efficiency, are ranked as in Table 1. The latter also shows the distance (in percentage terms) from several alternative efficiency frontiers. It first shows the differences under an industry average frontier, as originally contemplated by Shleifer (1985)[16] and the more stringent upper quartile approach adopted by Ofwat. The latter further distinguishes between whether it is approximated to the higher (i.e. the firm ranked 7th) or lower (i.e. the firm ranked 8th) integer.[17]

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16 The CMA in its Bristol PR14 determination also relied on an average efficiency frontier (CMA, 2015).
17 The upper quartile (25%) is defined as the firm ranked 7.5, hence, in this illustrative example it could be the firm ranked either 7th or 8th

Table 1: Illustrative example of efficiency ranking and frontier setting

Firm	Costs	Average	Upper quartile		Upper decile		
			Rounding down	*Rounding up*	*Average*		*Average*
1	101	22%	8%	7%	3%	3%	2%
2	102	21%	7%	6%	2%	2%	0.7%
3	104	18%	5%	4%	0%	0%	-1%
4	104	18%	5%	4%	0.4%	0.0%	-1%
5	106	16%	3%	2%	-1%	-2%	-3%
6	106	16%	3%	2%	-1%	-2%	-3%
7	108	14%	1%	0.0%	-3%	-4%	-5%
8	109	13%	0.0%	-1%	-4%	-5%	-6%
9	109	13%	0%	-1%	-4%	-5%	-6%
10	109	13%	0%	-1%	-4%	-5%	-6%
11	111	11%	-2%	-3%	-6%	-6%	-7%
12	111	11%	-2%	-3%	-6%	-6%	-7%
13	113	9%	-4%	-4%	-8%	-8%	-9%
14	120	3%	-9%	-10%	-13%	-13%	-14%
15	123	0.2%	-11%	-12%	-15%	-15%	-16%
16	125	-1%	-13%	-14%	-16%	-17%	-18%
17	129	-4%	-16%	-16%	-19%	-19%	-20%
18	129	-4%	-16%	-16%	-19%	-19%	-20%
19	131	-6%	-17%	-18%	-20%	-21%	-22%
20	136	-9%	-20%	-21%	-23%	-24%	-24%
21	137	-10%	-20%	-21%	-24%	-24%	-25%
22	137	-10%	-20%	-21%	-24%	-24%	-25%
23	138	-11%	-21%	-22%	-24%	-25%	-26%
24	139	-11%	-22%	-22%	-25%	-25%	-26%
25	141	-13%	-23%	-23%	-26%	-26%	-27%
26	141	-13%	-23%	-23%	-26%	-26%	-27%
27	142	-13%	-23%	-24%	-26%	-27%	-28%
28	144	-14%	-24%	-25%	-27%	-28%	-29%
29	145	-15%	-25%	-26%	-28%	-28%	-29%
30	146	-16%	-25%	-26%	-28%	-29%	-30%
Frontier		123.2	109.0	108.0	104.4	104.0	102.8
Rank		15th	8th	7th	4th	4th	2nd

4.1. Allocative efficiency

The first issue relates to whether the current framework can achieve allocative efficiency – i.e. ensuring that prices[18] are close to costs, in this case the long run average costs of providing water and wastewater services, respectively. Under yardstick competition, prices are pushed close to the cost of the frontier firm for those firms that are less efficient than the frontier. In our illustrative example, these are firms ranked between 16 and 30 under an average frontier or between 8 or 9 and 30 under Ofwat's upper quartile frontier. However, firms that are more efficient than the frontier can set their prices above their costs. Take the most efficient Firm 1 in the illustrative example. Under Ofwat's highest quartile approach it makes margins above costs (and return on capital) of 7-8%, which it is allowed to keep. The prospect of obtaining these supra-normal profits, it is argued, provide an incentive for the less efficient firms to catch up. In other words, firms are incentivised to compete to be more efficient than the frontier and obtain the prize of supra-normal profits. This is a

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18 In this article for simplicity of exposition we refer to prices, while in most instances Ofwat sets revenue caps.

productive efficiency argument, which we discuss next. Furthermore, as discussed in Section 3.3, Ofwat's cost claims mechanism allows water companies to put forward claims when they believe that the econometric models do not fully or partly take into account some exogenous factors that are particularly important for them. However, this system *de facto* only incentivises claims that lead to higher allowed revenues. No WaSCs or WoCs has incentives to put forward claims for adjustments leading to lower revenues. As a result, if such claims were accepted, the allowed revenues, and the overall prices charged, are likely to be set higher than the underlying costs.
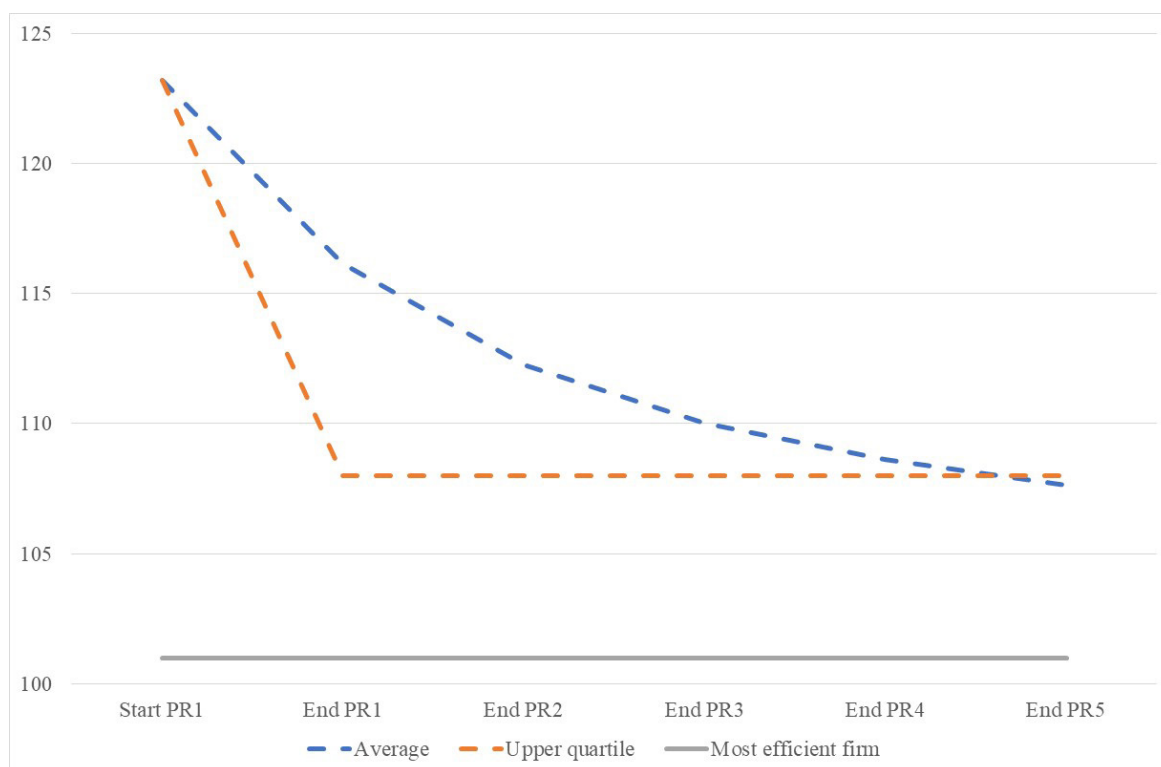
4.2. Productive efficiency

Perhaps the most important limitation of the current approach is that the impact of yardstick competition towards achieving productive efficiency has been often overemphasised. This is especially the case when the frontier is not very challenging. In itself, yardstick competition cannot and does not provide additional incentives for these local water monopolies that have been placed on the efficiency frontier to become more efficient and reduce their costs further than under no regulation. Take the most efficient Firm 1 in the illustrative example. Under Ofwat's highest quartile approach it made a 7-8% supra-normal profit. It could make this larger by reducing its costs, but, as John Hicks once famously observed *"the best of all monopoly profits is a quiet life"* (Hicks, 1935) Ofwat itself recognises this concern by stating that *"its efficiency challenge was set using data from long standing monopolies in one industry. Even the relatively efficient companies within this sector were unlikely to be as efficient as companies in other industries facing competitive pressure. This was related to the concept of X-inefficiency, where in non-competitive sectors there was inefficiency due to a lack of competitive pressure"* (CMA, 2021, para 4.481). The CMA agreed that *"while Ofwat is correct that monopolies may be less efficient than companies operating in competitive sectors, the regulatory regime is designed to mimic aspects of competitive pressure and reduce any X-inefficiency. Furthermore, we have no way of quantifying this theoretical effect"*. As a result, the CMA placed "*little or no weight*" on this and opted for an upper quartile efficiency frontier (CMA, 2021, para 4.492-3). However, this reasoning is inconsistent with the current approach to frontier shifting (Section 3.2.1), where a significant effort is made to assess the productivity gap between the water and other sectors that are exposed to competition. Critically, the presence of yardstick competition does not change the incentives of the firms at or below the efficiency frontier. However, firms that are less efficient than that setting the frontier have incentives to reduce their costs and converge towards the cost of the frontier firm. For example, under Ofwat's approach the least efficient firm in our illustrative example would need to reduce its costs by 25-26% just to make a normal profit.

Critically, yardstick competition can drive a convergence to the frontier, but at best all firms may converge to the most efficient firm, which though is unlikely to be efficient.[19] Our observations are threefold. First, the speed of the convergence depends on how the frontier is set and how challenging it is. As illustrated in Figure 3, under an average cost efficiency frontier it will take several PRs for all firms ranked above the frontier to asymptotically converge to the most efficient firm. Convergence is initially quicker under Ofwat's upper quartile than under an average approach. However, in this case, once the less efficient firm have converged to the firm setting the upper quartile, there is no mechanism to drive the frontier closer to the most efficient firm - i.e. Firm 1 rather than Firm 7/8 in our illustrative example. Second, unless the frontier is set as the most efficient firm, other firms will not be forced by yardstick competition to achieve that level of efficiency. An average set frontier will asymptotically get closer to the most efficient firm, while under upper quartile approach this cannot happen unless the firms in the upper quartile also become more efficient (Figure 3).[20]

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19 Some commentators (Stern, 2005) argued that there is no theoretically robust argument to determine the speed of convergence. Other argued that in an earlier phase there was evidence of cost convergence in electricity distribution (Pollitt, 2005), while for the water industry early convergence may have even reversed since 1999 (Cubbin, 2005). We consider that the way the efficiency frontier is set can shape the incentives faced by the firms as to the speed of convergence to the efficiency frontier.

20 This assumes that firms less efficient than the frontier will converge to the frontier at the end of each PR, while more efficient firms will not change their costs.

Figure 3: Convergence under average and upper quartile frontier in four PRs21

Third and critically, there is no theoretical basis to believe that convergence would be towards the efficient cost of production – i.e. that productive efficiency would be maximised. Convergence is not towards an efficient benchmark, but a perhaps only moderately less inefficient one, again depending on how strict is the frontier set. Even setting the efficiency frontier at the most efficient firm would not address this concern. Yardstick competition selects the most efficient firm, or firms, if an average is taken, among a set of local monopolists, and makes this as the frontier for all less efficient firms. However, even the most efficient firm among them is very likely to be very inefficient. In our illustrative example, while the most efficient Firm 1 has costs that are 22% lower than the sector's average, it is very unlikely to be efficient. An argument against setting the efficiency frontier at the most efficient firm is that would make it possible for only one firm to obtain the right to supra-normal profits. This, the argument runs, would provide an insufficient incentive for the rest of the pack to engage in cost efficiency savings. The odds would be discouraging. However, there are two important counterarguments.

First, even an unregulated monopolist has an incentive to become more efficient to increase its profits, yet, there are not many monopolists that earnestly engage in cost savings. Simply put, under monopoly this incentive is unlikely to be as strong as under competition. Yardstick competition, even if very well designed, cannot provide the same incentives for firms to reduce their cost as under competition. Under yardstick competition, water companies have some incentives to outperform the frontier as they would gain extra margins. However, such gains would be time limited, as they would be eroded in the following PR, partial, as under the current framework they would be shared with consumers and, perhaps critically, limited in scope, as the most efficient firm cannot attract new customers from other regions. Therefore, under yardstick competition a WaSC or WoC setting the frontier would have a similar incentive to reduce its costs as a monopolist, irrespective of whether

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21 This is based on data shown in Table 1. It assumes that once the frontier is set at the start of a PR firms less efficient than the frontier will fully catch up, while those at or more efficient than the frontier will remain as cost efficient as they were at the start of the PR. The average frontier refers to the simple average of the 30 firms at the end or a PR. The upper quartile frontier is defined as the seventh most efficient firm out of 30.

the latter is price regulated. Instead, under competition the most efficient firm would attract some of the rivals' customers. Hypothetically and at the limit, under perfect (Bertrand) competition with homogeneous products and no capacity constraints, the most efficient firm will corner the entire market. This provides a much stronger incentive to increase its efficiency relative to its rivals.

Second, if such incentive worked, one would expect to observe significant convergence towards the efficiency frontier. In PR19, thirty years since privatisation, there are still very large differences in cost efficiencies. Figure 4 shows that on a like-for-like basis the least efficient firm's costs were 49% and 44% higher than those of the most efficient firm, for water and waste water, respectively. Even considering that the most efficient firm may be an outlier, the least efficient firm's costs were 23% and 25% higher than those of the firm of setting the efficiency frontier, for water (the 4th firm) and waste water (the 3rd firm), respectively.

Figure 4: Efficiency ranking in water and waste water in PR19
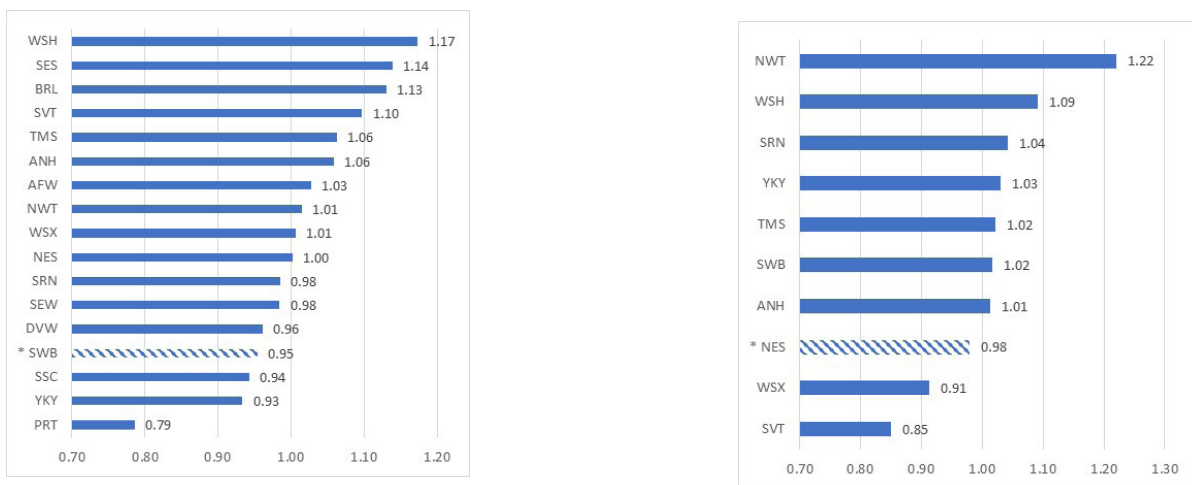
The efficiency ranking is based on modelled base cost (triangulated).
* This indicates the firm setting the efficiency frontier.

Furthermore, the incentive for the most efficient firms to become more efficient was stronger in prior PRs, where firms could keep all the cost savings they could generate during the period till the next PR. This incentive was substantially softened by introducing the cost sharing mechanism, whereby water companies can only keep a share of their efficiency savings. Symmetric[22] cost sharing as in PR 19 provides significant disincentives to increase costs (no full pass through as a proportion of the additional costs is borne by the firms), but critically also to reduce costs (as the regulated firm cannot keep the full profits from its improvement in efficiency).

The absence of a stringent competitive benchmark is intrinsic in the water industry structure and cannot be easily overcome. However, the limitations of yardstick competition in achieving productive efficiency call for setting the efficiency frontier as stringently as possible.

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22 With the term symmetric here we refer to the feature that any over- or under-spent is shared between consumers and the firms – i.e. firms have to pass on some under-spent to consumers in the form for lower prices while they can only pass-through a proportion of their overspent in the form of higher prices. In PR19 the level of cost sharing varied depending on whether there was an over- or under-spent, its level, the type of firm (e.g. fast or slow track) and cost. The CMA applied the same rates (i.e. for underspent 55% went to consumer and for overspent the firms could only pass 45% to consumers) to all firm in the dispute (CMA, 2021, para 6.107).

4.3 Dynamic efficiency

Undoubtedly, the most difficult incentive for a regulator to foster is dynamic efficiency. This is especially so in a sector, which is subject to price regulation and where competition, even prospectively is not possible. Simplifying one can think of two main types of innovations: either innovation in the products offered – i.e. the introduction of new products, which are valued more by consumers – and/or process innovation – i.e. better and cheaper ways to provide the same products. Process innovation seems more likely than product innovation in water services, as the nature of the core services is hardly modifiable.[23] This means investing in cheaper ways to deliver the same services. The main[24] incentive for the sector to become more dynamically efficient is given by the efficiency frontier shifting factor that links the costs of the frontier's firm to the productivity improvements of competitive sectors in the economy chosen as the benchmark.[25] This ensures that the efficiency, or better productivity, of the water sector does not fall behind that of sectors, where competition can spur innovation. Reverting to our illustrative example, assume that after five years the regulator expected an overall 5% productivity improvement in the competitive sectors. Under an upper quartile (rounded up) approach the frontier would shift from the firm ranked seventh with costs of 108 to the second firm in the ranking with costs of 102.6. The frontier is shifted ex ante based on past evidence and expected future performance. The risk of error is not insignificant, as productivity is particularly difficult to predict and it has remained relatively stagnant in the last few decades in the UK. This uncertainty, though, is not costless, as it may increase the cost of capital for water companies and as a result also increase their overall allowances. While frontier shifting is an important tool, it only ensures that the degree of productivity of water companies does not fall behind that of the competitive sector. However, as discussed under productive static efficiency in Section 4.2, if the water sector accumulated a productivity or efficiency gap before privatisation, yardstick competition could have not filled that gap.

4.4 Asymmetric information

Critically, given the regulator's high asymmetry of information in this regulatory setting, perhaps the most important question is whether the current framework could at least improve the large information asymmetry faced by Ofwat. Ideally the regulatory regime should incentivise water companies to fully reveal their costs together with revealing the level of a truly efficient firm. As discussed above, the latter is not achievable, while as far as the former is concerned collectively firms have strong incentives to over-declare their costs. Yardstick competition partially addresses this, unless firms colluded, which seems not easy to achieve (Chong and Huet, 2009). Other regulatory tools, such as the business plans mechanism put in place by Ofwat, could provide incentives to supply more accurate information and may also play some role in reducing the asymmetry of information. However, water companies with the best business plans are rewarded by having a higher cost of capital and more advantageous cost sharing rates, both of which offset, at least in part, the benefits from more reliable cost information. In particular, Ofwat, or more precisely consumers, are likely to benefit only if the rewarded firm sets or, at least can influence the frontier. Critically, in PR19 (Figure 5) yardstick competition has only been applied to base modelled base costs (73.8% of total costs, excluding the return on assets), while 8.2% of total costs are unmodelled base costs. Enhancement costs make up to 18.1% of total costs, of which about a third are not subjected to yardstick competition and the remaining two thirds have a less stringent frontier set as the median rather that at the upper quartile.

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23 Some product innovation could take place with ancillary products or services being added to the core products.

24 Ofwat put in place other initiatives to increase water companies' incentives to innovate. For example, it set aside £200 millions to finance innovative proposals via competitions (Ofwat, 2023).

25 Frontier shifting could be also thought as providing incentives for regulated firms to increase their productive efficiency in line with that of the competitive sectors. However, given that frontier shifting is linked to productivity improvements, which are necessarily triggered by innovation, we consider that it is more appropriate to consider frontier shifting as a tool to incentivise dynamic efficiency.

Figure 5: Total and proportion of allowed costs (over total wholesale totex) in PR19
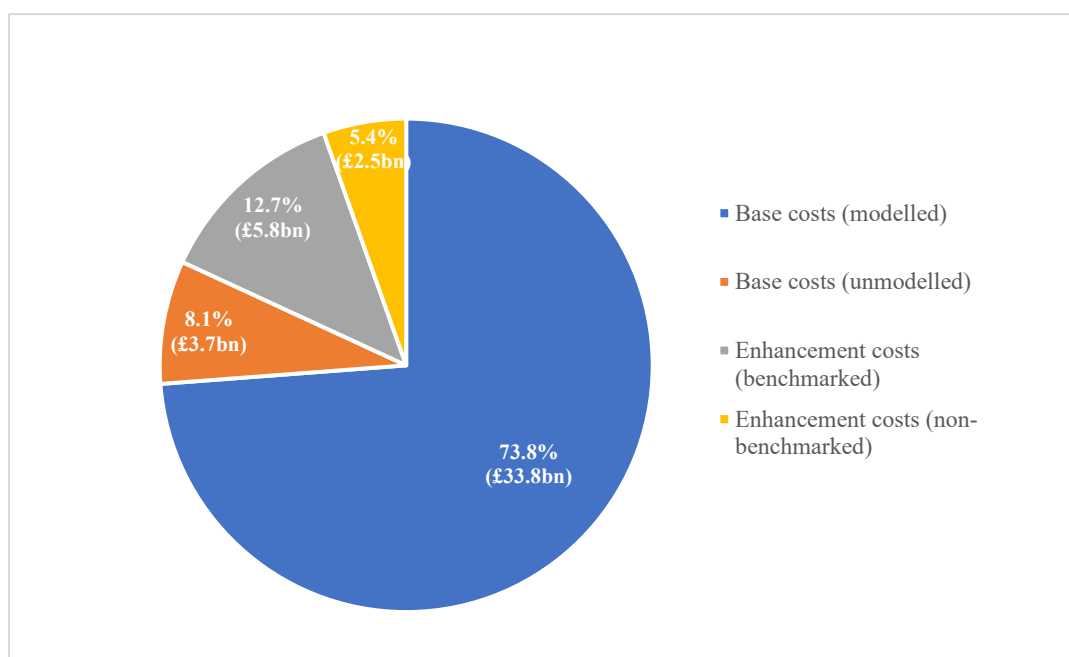
Source: authors' calculation based on data contained in Ofwat (2019a), Ofwat (2019b) and Ofwat (2022).

5. Can we do it better in applying yardstick competition?

Section 4 highlighted some concerns about the current and historical implementations of yardstick competition in the water sector in England and Wales. This section considers how yardstick competition in its current form could be redesigned to improve its impact on consumer welfare. The focus is on productive and dynamic efficiency and on reducing the asymmetry of information.

5.1. Improving productive and dynamic efficiency

While allocative efficiency is an important factor in justifying regulatory control of prices, it plays a minor role once either yardstick or cost-plus regulation is already in place. Under cost-plus regulation, the price of each firm is set at its (declared) costs, hence, automatically achieving allocative efficiency, unless the costs are over-declared. Under yardstick competition allocative efficiency improves the more stringent is the efficiency frontier. Each firm more efficient than the frontier can set prices above its costs. Hence, there will be more of such firms if the frontier is set at the average costs than at the costs of the upper quartile firm. To show the effect of setting a more stringent efficiency frontier, let's revert to the original illustrative example where firms' costs range from most efficient of 101 to the least efficient of 146 (Table 1). If all firms were incentivised to become as efficient as the most efficient firm consumers will gain mostly from increased efficiency in producing the same set of services (for the most inefficient firm this is shown by the area A in Figure 6). They will also gain from expanding consumption, although this is likely to be small given that overall the demand for water and waste water services is relatively inelastic.[26] The area C in Figure 6 represent the deadweight loss from regulation that it is set too leniently. This analysis has some analogies with the seminal work of Williamson (1968) on mergers, which both increased market power in the form of enabling the merging firms to set higher prices and lowered the marginal cost of the merged firm. Williamson showed that, especially when the demand elasticity is low, a price increase, triggering a deadweight

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26   Dalhuisen et al. (2003) undertake a meta-analysis of the literature on water demand estimation and find that residential water demand is relatively inelastic. Their article reviews 314 price elasticity estimates from the literature, mostly referring to the United States. Their distribution of price elasticities has a sample mean of -0.41 and a sample median of -0.35.

loss,[27] needs to be particularly large in order to offset a given small efficiency gain. Translating this into the economic regulation context, it means that the gains from efficiency (the area A in Figure 6) are more important than the deadweight gains (the area C in Figure 6), but differently from the merger example, they move in the same direction – i.e. there is no trade off from a tighter efficiency frontier and both benefit consumers, at least in a static efficiency.

Figure 6: Efficiency gains and deadweight gains
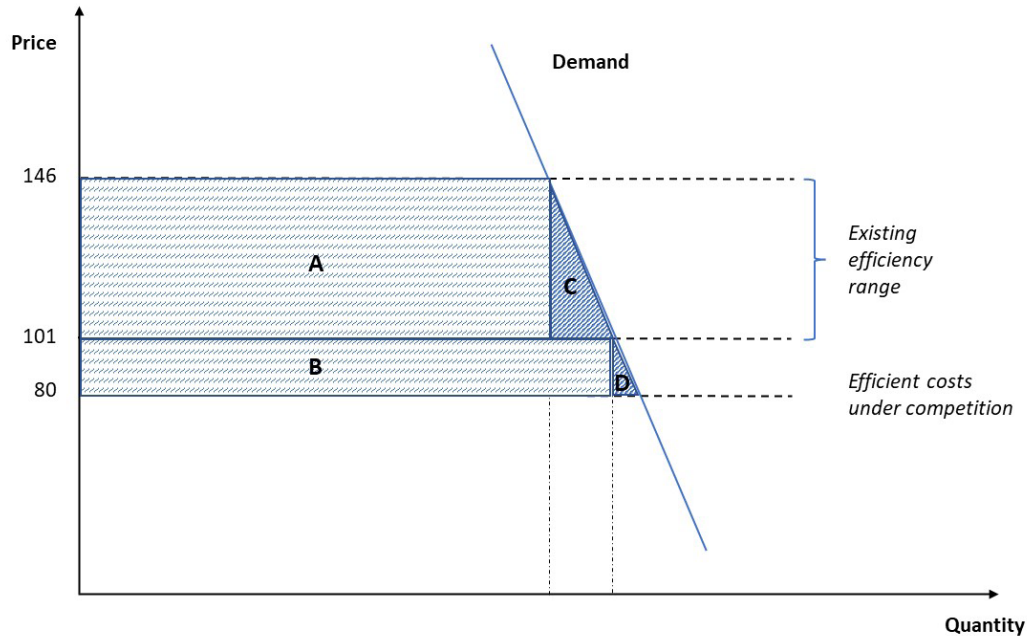
We consider that there may be scope for setting the frontier more stringently than the upper quartile set by Ofwat in PR19 (and also Ofgem for electricity distribution providers in RIIO-1). Figure 6 builds on the illustrative example to show the impact of using a competitively efficient benchmark of 80, which could bring to additional welfare gains of the areas B and D.

The main reason for arguing in favour of a more stringent frontier is that even the most efficient of the firms is very likely to be run with significant inefficiencies. Because of this, absent any evidence of significant measurement errors, the risk is that setting a more stringent frontier (i.e. at 101) based on observed costs would still be too lenient. Hence, it would be appropriate to set the efficiency frontier more stringently (i.e. at 80). Once the risk of measurement errors in ranking the firms according to their efficiency is taken into account, the risk of setting the frontier too stringently (i.e. at 80) may become relevant. Measurement errors mean that the ranking will not just reflect true differences in efficiency, but also some amount of random or systematic error. If the latter was substantial the risk of error in setting the efficiency frontier would be correspondingly substantial. Cubbin (2005) argued that Ofwat econometric modelling, at least initially, was imprecise with only around 40% of the estimated cost variation that might be due to differences in efficiency. Cubbin undertook these estimates on behalf of Water UK, the industry body. This contrasts with Ofwat's claim at the time that 90% of water regression equation residuals and 80% of those for sewerage can be attributed to differences in efficiency (Stern, 2005). However, while the presence of measurement errors is used to explain a rejection of a frontier based on the most efficient firm (CMA, 2021, para 4.442), the probability of a measurement error is likely to be symmetric – i.e. measurement errors could either over- or under-estimate the efficiency of the most efficient firm with equal probability.[28]

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27 This applies if the focus is on total rather than consumer welfare. An increase in prices will also transfer welfare from consumers to producers.

28 However, the cost of errors may be asymmetric. As a result, if the efficiency frontier was set too tightly, the risk is that firms may go bankrupt. Instead, if the efficiency frontier was set too laxly, the risk would be limited to a consumer welfare loss in the form of higher prices. It is worth noting that Ofwat's system of cost claims would in part counteract the risk of bankruptcy, as it is likely to inflate al-

There are two non-mutually exclusive ways of addressing the concern about setting the frontier too leniently.

First, we consider that the upper quartile frontier may be too generous. There are number of ways to make it more stringent. Setting it at the most efficient firm may raise some risks, only if such a firm is a clear outlier – i.e. significantly more efficient than all the other firms because of exogenous factors that other firms could not replicate[29] – or there are substantial concerns about measurement errors. Other alternatives (shown in Table 1) are the firm in the upper decile or the average of the firms in the upper quartile or decile. Importantly, relying on averages substantially reduce the risk that the frontier may be set based on an outlier or if the risk of measurement errors mentioned above was substantial. The potential gains for consumers, however, could be significant. In our illustrative example, assuming that all the firms have the same size, shifting the frontier from the upper quartile rounded-up to the average upper quartile, a frontier just a bit tighter than the one adopted in PR19, would lead to an overall industry price reduction of almost 3%.[30] Second, as far as we were able to ascertain no PR since privatisation explicitly argued that the productive efficiency of the sector had historically lagged behind that of sectors subject to competition and adjusted the efficiency frontier accordingly.[31] In Section 4.2 we argued that even setting the most stringent frontier would only force convergence to the most efficient firm, but not to those of an efficient firm hypothetically exposed to competition. Therefore, an additional or alternative measure is to apply a one-off adjustment to align the efficiency of the water sector to that of sectors exposed to competition. The adjustment should be calibrated as the difference between the current frontier and the expected frontier, if there was a competitive benchmark. The difficulty is to find an appropriate benchmark. However, in Section 2, we claimed that such adjustment would not be conceptually different from or more complex than the exercise of setting frontier shifting targets based on the expected productivity gains of competitive sector. The empirical literature shows that opening markets to competition has a considerable impact on productivity growth and cost reductions. This effect has been observed in utilities, such as electricity or telecoms, but also in other industries, such as airlines, railways, retail, or iron ore, among others. For instance, during the 1980s, regulatory reform in the US telecoms industry increased total factor productivity growth on a per year basis by at least 2.4% each year (Gort and Sung, 1999). The exogenous increase competition in iron ore international markets during the early 1980s triggered an increase in labour productivity growth of 50-100% over the decade in countries affected by the shock (Galdón-Sánchez and Schmitz, 2002). In the early 1990s, restrictive regulation in European airline markets resulted in their costs being up to 35% higher compared to a by then fully liberalised (US) airline industry (Ng and Seabright, 2001). During the mid-1990s, competition and privatisation reduced costs in the US electricity generation industry by 12% (Fabrizio et. al., 2007). Further, this literature also shows that regulation may have a limited effect when trying to mimic the outcomes of competitive markets on productivity. In other words, the effect of competition adds to the effect of regulation. One such example is the regulation of the US telecoms industry in the 1980s (Gort and Sung, 1999). The liberalised and competitive long distance telephone market exhibited much higher productivity growth than local telephone monopolies, which were still subject to regulation. Research on the effects of market-based reforms in the US electricity generation industry shows

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lowances, as explicitly argued by Ofwat (CMA, 2021, para 4.445).

29 For example, in PR19 Portsmouth Water was the most efficient firms for water services (modelled base costs). In particular, its efficiency was particularly marked in water resources based on the size and location of its only reservoir, a factor that it is not easily replicable by other firms. Similar considerations also apply to Hafren Dyfrdwy. Both are small WoCs.

30 All, but the first three most efficient firms, will see the prices they can charge decline from 108 (i.e. upper quartile rounded up) to 104.4 (i.e. average upper quartile).

31 We note that there were substantial reductions in Price Review 1999 (PR99) - i.e. an average 12% reduction in real bills in 2000/01 and an overall annual average reduction in real bills over 2000-2005 of 2% (Ofwat, 1999). This was justified because past performance by water companies indicated significant potential for further improvements on efficiency. However, there was no mention of a one-off competition adjustment to align the cost efficiency of the water sector to sectors exposed to competition. Furthermore, as noted in Section 4.2, Ofwat itself recognises stating that *"its efficiency challenge was set using data from long standing monopolies in one industry. Even the relatively efficient companies within this sector were unlikely to be as efficient as companies in other industries facing competitive pressure. This was related to the concept of X-inefficiency, where in non-competitive sectors there was inefficiency due to a lack of competitive pressure"* (CMA, 2021, para 4.481).

that privatization and regulation contributed to cost reductions, but that these were much higher in markets where competition in electricity generation was introduced (Fabrizio et. al., 2007).

Third, once the efficiency of the water sector is aligned with that of competitive sectors, an adjustment that can be introduced gradually, it is important it remains competitive and does not lag behind over time. One tool to ensure that firms have incentives to increase the dynamic efficiency is frontier shifting to reflect the productivity advances in sectors exposed to competition. Currently this is set ex ante based on past and expected performance with a not insignificant risk of error. Setting it ex ante means that each firm would have an incentive to try to match the improvement set by regulation. However, if the frontier was set ex post to reflect the, yet unknown, actual productivity gains of competitive sectors, knowing this would force water companies to try their best, explore the innovations introduced in other relevant sectors and behave ex ante as if they were exposed to competition, without the need to set an ex-ante target under significant uncertainty and risk of errors. This would better mimic the competitive process where firms have to innovate and become more efficient without knowing in advance how much gains they need to achieve. We also consider that the frontier shift should apply to all types of wholesale expenditure, including enhancement costs. In PR19, Ofwat did not apply a frontier shift to most of its enhancement costs, with the exception of WINEP.

Lastly, we consider that the efficiency frontier could also be set more stringently by reforming two other aspects of Ofwat's current regulatory approach.

The first is cost sharing. We agree that a cost sharing element may be useful, under some conditions, if actual costs proved higher than expected ex ante. Making the firms bear some of these additional incremental costs maintains the incentive to keep them under control and ensures that these costs are not opportunistically inflated ex post. Clearly, if cost increases were entirely beyond the control of management, these could be passed on to consumers in full. Hence, a targeted and fine-tuned approach calibrating cost sharing to the ability of management to control price increases may be justified.[32] However, if costs proved lower than expected ex ante, we consider that there should be no cost sharing mechanism and the firms should benefit in full from these, unless these were very likely to be mostly outside management control.[33] The incentives to further reduce costs are currently undermined by the fact that a proportion of any such cost savings must be shared with consumers. While this may be appropriate under static efficiency considerations its dynamic incentive properties play against investing towards cost reductions. This is based on the importance of fostering the firms' incentives to reduce costs and the fact that such a windfall only benefits the firms over one PR. Over a longer timeframe consumers will benefit. In other words, there is already a cost sharing mechanism across PRs even in the absence of a cost sharing mechanism for underspent within a PR. We consider a generous underspent sharing for water companies, at the limit allowing the latter to retain all benefits from underspent within a PR, as providing a useful strong incentive for firms to increase their efficiency.[34] This is particularly important if a tighter efficiency frontier reduced the prize to become more efficient than the frontier.

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32 Ofwat already did in part adopt this approach in PR19, as for example, for unmodelled costs, where management control is limited, it had adopted a 75% cost sharing rate (CMA, 2021, para. 4.973). The CMA agreed with Ofwat's approach (CMA, 2021, para. 4.981). Unsurprisingly the firms involved in the CMA PR19 redetermination for modelled base cost asked to replace Ofwat's sharing rates with a symmetrical 50/50 sharing rate (CMA, 2021, para. 6.78). This signals that these firms were happy not to be strongly incentivised to lower their costs, but at the same time they wanted to be protected, if their costs increased.

33 A mechanism for pass thorough for overspent outside the management control was already present from the start as water companies could and still can ask for an interim redetermination (Cowan, 1995, p. 336).

34 Indeed, we do not have to go that far to find a similar approach within water regulation framework in the UK. In PR99, Ofwat strengthened incentives to improve efficiency by introducing the rolling incentive allowance for both operating and capital expenditure, whereby efficiency savings in excess of the regulatory assumptions (outperformance) would be retained by companies for five years before being passed to customers (PR99).

The second aspect relates to the mechanism of cost claims. The current small number of 11 WaSCs and 5 WoCs means that the econometric models may not be sufficiently sophisticate to pick up all factors that explain the cost variation across firms. This provides a justification for a cost claims mechanism to rectify this outside the modelling exercise. However, as discussed in Sections 3.3 and 4.1 the current approach to cost claims leads to biased outcomes and higher prices for consumers overall. There is no reason to believe that, because of the omitted variable bias, regression modelling would systematically underestimate the firms' costs. The effect and risk from this bias is more likely to be symmetric. The current approach leaves it to water companies to bring possible claims of biases from omitted explanatory variable to Ofwat's attention, thus creating an incentives for firms to only put forward cost claims that, if accepted, would increase their efficiently estimated costs and, hence, allowances. No firm would have incentive to bring forward claims that reduced their revenue allowance. Hence, only omitted variable claims that could lead to higher costs for the claimant are examined by Ofwat. This is likely to increase the allowance of the claimants and of industry overall. Two simple changes could address this concern. First, Ofwat could ensure that any gains for a WaSCs or WoCs that results from accepting a cost claim do not increase the overall allowance of the industry – i.e. increases in the allowance for one firm must result in equal overall decline for all the other firms. As mentioned in Section 3.3., Ofwat stated its intention to have a process of symmetrical adjustments, thought in the end it did not adopt any symmetrical adjustment. Second and closely related, Ofwat should allow companies, whose allowances would decrease by accepting a claim, the opportunity to provide evidence to counter the cost claim by another company. This would reduce the asymmetry of information faced by Ofwat in assessing these claims. We consider this approach superior to having a biased mechanism or to reject most claims in practice.[35] We do not consider such mechanism would be more resource intensive than the current, but instead it would increase the regulator's information and increase the reliability of estimations.

A possible concern about making the overall efficiency targets more demanding is that it may increase the incentive to shirk and reduce investment and/or the quality of the services. The recent events showing that, despite what we consider a relative lax efficiency target, several WaSCs failed to abide by the environmental regulation and obligations (Hodgson, 2023) suggest that these concerns may have to be addressed via separate enforcement mechanisms. It also shows that the current lax mechanism does not appear to have limited shirking by WaSCs.

5.2. Ensuring financeability

Ofwat has a duty to ensure that water companies are financeable. This has been interpreted as ensuring that Ofwat's regulatory policies do not imperil the financeability of their operations. This could be the case if the frontier was set too stringently and water companies might not cover their costs over the period of the PR and faced a not insignificant probability of going bust. This is an important consideration. Applying a more stringent frontier than that set by Ofwat in PR19 may carry some risks. Such risks are at the highest when the frontier is set by the most efficient firm, if such a firm is an outlier and/or the regression estimates cannot explain a significant share of cost variation. However, given that the most efficient firm may not be that efficient in the end (Section 4.2), unless the one-off gradual correction proposed above is implemented, we consider such risk are not very high.

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35 See Section 3.3. In addition, while the CMA assessed five cost adjustment claims: four from Anglian, relating to capital maintenance, sludge transport, APH and proportion of load treated, and one from Yorkshire, relating to changes in treatment complexity, but it rejected all of them (CMA, 2021, para 6.22).

The risks for financeability are likely to come mostly from unpredicted or unpredictable exogenous factors. Unexpected changes do occur and may call for a radical rethinking from time to time. For example, a significant reduction in rail passenger demand was due to increased time spent working from home during and post Covid lockdown, a reduction in gas demand may come from an unexpectedly mild winter and/or a reduction in the use of the electricity distribution grid may come from a sudden increase in electricity storage capacity replacing additional distribution capacity. All these factors may reduce demand or increase costs resulting in ex ante allowances set ex ante becoming insufficient to cover the cost of supply.

The most appropriate way to limit concerns about financeability seems to be to introduce more flexible mechanisms rectifying initial decisions that proved incorrect or unexpected changes that are outside management control (such mechanism already exists under the current framework in the form of a request for redetermination). This is a difficult balancing exercise and easier to do when the risk is on the cost side. If firms were allowed to pass through a large part of their costs and reopen past determinations (an important condition in Shleifer's original argument), yardstick competition would increasingly resemble to cost-plus regulation, which does not have nice incentive properties. If, on the other hand, pass-through was not allowed under any circumstances, the risk is that an event outside management control may affect the viability and financeability of a WaSC or WoC. A recent example is that of Thames Water. More than half of the firm's debt is currently linked to a measure of inflation, the Retail Prices Index (RPI), which is historically higher than the rate of inflation, the CPIH, which drives its revenue allowances. An unpredicted increase in the rate of inflation over PR19 has led to a growing wedge between RPI and CPIH.[36] It is unclear whether this was under management control. If the change from RPI to CPIH was not predictable by the time Thames Water first negotiated the terms of its debt in the past, then management did not have control. Alternatively, if was not the case, the debt will be soon repaid in full and/or this type of debt can be easily renegotiated today at limited costs, then Thames Water's management has a significant control and should be incentivised to make the appropriate changes to the terms of its debt, and its allowance should not be increased.

One further important aspect with implications for financeability has not yet been given much attention. Since privatisation and Price Review 1994 (PR94) to today the WaSCs' and WoCs' allowances have been set for a period of five years. This means that laggards are expected to catch up to the efficiency frontier over a five-year period. Whether this is a sufficiently long period for laggards to catch up depends on the type of cost savings required to converge to the frontier. Some cost savings are easier to implement than others – i.e. when a firm needs to reduce its workforce. However, in the water sector firms' inefficiency are likely to be embedded into inefficient prior investment – i.e. a leaking water distribution network increasing its maintenance costs and also the cost of water resources. To achieve efficiencies may require a significant time, no matter what the level of investment a firm may be willing to commit to. Therefore, if there was a concern about financeability and this was largely related to the efficiencies that required time to be realised, we consider more appropriate to extend the PR duration to allow time for laggards to catch up rather than set an efficiency frontier, which is too lenient.

If the efficiency frontier raised concerns about financeability we would expect these to bear particularly strongly on the profitability, if not viability, of the least efficient firms. The efficiency ranking observed in PR 19 (see Figure 4), indicates that the less efficient firms may not be able to break-even unless they achieved significant cost savings over the period of PR 19. There are not signs in PR19, or in previous PRs, that less efficient firms struggled to make profits. This indicates that the current efficiency frontier is far from being set too tightly.

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36 Louch, W., Smith, R. and Plimmer, G. "Why Thames Water is under growing strain", *Financial Times*, 29 June 2023, available (downloaded 29 August 2023) at https://www.ft.com/content/4b5dbf6d-1a6f-4812-bcff-3e675c03ebea.

Last but not least, there is also a risk that the financeability duty is currently interpreted too generously for water companies. The aim of yardstick competition is to mimic a competitive market and one effect of rivalry is that inefficient firms may exit the market. The risk of bankruptcy, therefore, plays an important role in incentivising firms to remain efficient. Therefore, it is important that financeability is not interpreted too generously as minimising or even removing the risk that inefficient water companies went bust. In a competitive market inefficient firms will exit, while under yardstick competition the owners of inefficient water companies should face the risk of losing their investment. This mechanism would work as an incentive to shareholders, as long as the proportion of equity relative to debt is not too low. Given the high level of debt that water companies accumulated over the last decades, currently this may not work very well.

5.3. Can we reduce the regulator's asymmetry of information?

The water sector in England and Wales exhibits the highest degree of asymmetry of information of any regulated sector such as telecoms, energy or rail. The reason is that, save for the business retail services, the water sector remains vertically integrated and, thus, there is no stakeholder, other than relatively uninformed consumers with dispersed interests, with some insider knowledge that could challenge the information put forward by water companies. Consumers bodies or associations are in no better position than the regulator. Therefore, there is considerable merit in devising approaches that reduce this asymmetry of information.

Although far from perfect, yardstick competition can reduce, at least in part, the regulator's asymmetry of information. Costs that are benchmarkable, such as modelled base costs show the lowest asymmetry of information. However, this concern is particularly high for all those enhancement costs that are not benchmarked at all and unmodelled base costs. In PR19 the former amounted to £2.5bn (5.4% of totex), while the latter amounted to £3.7bn (8.1% of totex). Currently, the scope of costs for which there is a large asymmetry of information is, therefore, significant. Enhancement costs for which Ofwat has been able to undertake some benchmarking, which amounted to 5.8bn (12.7% of totex), should also be treated with care, given that this was a simple exercise based on cost forecasts put forward by the water companies.

The presence of significant information asymmetry in unmodelled base and enhancement costs means that the risk of error is very large and skewed towards overestimation to ensure that Ofwat cannot be accused of not pursuing its financeability duty. As a result of which, the regulator tends to be more cautious in setting the efficiency frontier. Therefore, firms have an incentive to maintain and, if possible, increase this asymmetry of information to obtain more lenient regulatory conditions. In addition, as argued by the CMA, "*when providing companies with specific funding to undertake additional activities, there is a risk that the company does not subsequently choose to proceed with the scheme while customers nonetheless bear the cost*" (CMA, 2021, para 65). Not only the costs, hence, allowances are likely to be inflated, but the services may not be provided at all. Such behaviour is to be expected, unless there are severe penalties for under- or no delivery and/or firms that misbehaved were penalised in future PRs. Clawing back measures, which would leave the firms no worse off than if they had complied, are an insufficient deterrent because the probability of detection is low. As a result, non-compliance would be the dominant strategy. In addition, firms have also an incentive to reduce the scope of costs that are subject to yardstick competition to further increase the scope of their information asymmetry advantage. For example, the CMA reported some of the appellant water companies argued that customer growth costs should be treated not as base, but enhancement costs (CMA, 2021, para 5.8). Similarly, the appealing firm Anglian challenged Ofwat's enhancement benchmark models as too simple (CMA, 2021, para 5.40). These can be interpreted as attempts to reduce the scope of yardstick competition, even within enhancement costs. For these reasons, it is surprising that in PR19 Ofwat set the efficiency fronter at median value for those enhancement costs, which it could benchmark (CMA, 2021, para 5.11). We would argue that the higher the asymmetry of information, the tighter should be efficiency frontier. Nonetheless, despite

the CMA's acknowledgement that for these costs Ofwat faced and "*acute information asymmetry*" (CMA, 2021, para 5.19), the CMA did not particularly change Ofwat's PR19 approach.

Among the benchmarkable costs there are few opportunities to reduce the asymmetry of information, as all stakeholders have convergent interests. One of such opportunities is cost claims. Sections 4.2 and 5.2 discussed how the current approach is biased and incentivises cost claims that if accepted would increase allowances for the firm putting forward the claim, but not changing the other firms' allowances. This could change if a constraint that overall allowances could not increase was introduced. This would lower all other firms' allowances and provide the latter, which could lose if the claim was accepted, with an incentive to challenge the firm's original cost claim. This mechanism would discourage bogus claims and provide Ofwat additional information to make a better decision on all cost claims.

The area we consider more promising for reducing Ofwat's asymmetry of information is, however, that of currently non-benchmarked costs. For PR19 these include unmodelled base costs and, at least, those enhancement costs, which were non-benchmarkable. However, given that the benchmarking of some enhancement costs was not very sophisticated there is also a case for including these costs in a possible reform. These non-benchmarkable costs could include costs for new activities, for which there is no historical cost record, costs incurred to abide by newly introduced regulation or for costs that only a specific firm, or a subset of firms, incurs. While yardstick competition could not be applied, or fully applied, to these activities, this does not mean that additional information could not be obtained on how to cost these efficiently. Reliance on information provided by the firm can only lead to too generous treatment, if accepted, or wrong decision if rejected as shown by the CMA's reviews of some of these cost items (CMA 2021).

In this light, the WaSC and WoC requested to increase their enhancement costs for PR24 by £36bn or 60% above the level in the PR19 Final Determination. Their proposed increases in base cost models are, instead, more limited at 10%, and reveal very well the WaSCs' and WoCs' incentives to increase the scope of the regulator's information asymmetry. As a result, consumers' bills could see increases between 15% and 66% across the WaSCs and between 11% and 20% for WoCs (Ofwat 2023b and 2023c). Irrespective of whether such increases may be justified, if accepted, at least in part, such proposal would significantly increase the share of costs that would escape yardstick competition. Therefore, it is becoming particularly important to reconsider the approach to unmodelled and enhancement costs to reduce Ofwat's asymmetry of information in PR24 and beyond and look for a mechanism that would at least contain the water companies' incentives.

We consider that possibly the key measure to reduce the regulator's information asymmetry is for firms to run a mandatory competitive procurement exercise for all service elements that are not easily benchmarkable. If appropriately designed, this tendering would reveal the real cost of such services at limited additional costs to the industry and consumers.

Competitive procurement is a useful mechanism because potential suppliers of a given service make bids on how much they would charge for the service. The winning supplier is the one making the lowest bid. If the bidding process is competitive, it reveals information on the efficient cost of provision. Indeed, bidding as a tool to reveal information has been explored by the economic literature on the regulation of natural monopolies. Demsetz (1968) proposes bidding (franchising) as a substitute for economic regulation of natural monopolies. Demsetz argued that although competition is infeasible in a natural monopoly, it may be feasible to have competition for the right to supply the market. Demsetz argued that if inputs to supply the market are available to bidders at competitively determined prices, a reasonable assumption for the water sector, and if there is no collusion amongst bidders, then an auction can achieve a competitive outcome and reveal the efficient costs of providing the service. Laffont and Tirole (1987) formalise Demsetz's idea in a setting where multiple firms bid to realize a one-shot government project. While franchising as a substitute for economic regulation faces some key challenges (some raised for example by Williamson, 1976),

research on this area highlights the potential of competitive bidding to reveal information and mitigate the information asymmetry regulators face.

There are alternative options to implement our proposal. Tendering could be undertaken by the water companies themselves following guidelines on how to run such tenders set by Ofwat. Alternatively, new one-off and specific investments may be procured by a separate entity, with no conflict of interest, whose recommendation and choices must be taken by the water company. Although the former option entails some risks, it may also generate efficiencies and reduce implementation costs, as water companies already rely on some form of formal or less formal tendering for this type of expenditure. Below we assess this option in more detail.

The main risks in allowing water companies to set the procurement process would stem from the conflict of interest they would face. Currently, water companies already use competitive tenders to select input or service providers. However, the cost resulting from this procurement is not used to set water companies' allowances (see Section 3). Simplifying, under the current framework water companies receive an allowance set in advance largely based on their cost forecast and use tendering (for instance, to build a new reservoir) and keep part of whatever savings they may achieve through procurement. In our proposal, competitive procurement would reveal cost information ex ante. This information would be used to set the allowance in those service elements that are not currently benchmarked. As a result, water companies would lose their informational advantage vis-à-vis the regulator. They could counter this by "gold plating" the procurement exercise, design a procurement mechanism that is not competitive or to foster collusion so as to increase the overall procurement cost. In particular, they would want to manipulate the bidding process to favour solutions that increase their totex and, as a result, their Regulated Asset Base (RAB), on which they could earn additional future returns.

In order to address the risk of water companies not running a truly competitive and cost revealing tender it is key that Ofwat oversees these tenders and ensures that they are competitive and reveal the true costs of provision. Water companies would need to follow Ofwat's guidance and/or make proposals to Ofwat on how they would design such tendering mechanism. Ofwat would have the final word and in the extreme could take over the process.

Reliance on competitive procurement in the way we propose is not alien and the current framework envisages it already. In PR19, Ofwat proposed to use Direct Procurement for Customers (DPC) [37] for large infrastructure projects. Water companies should consider DPC for discrete, large-scale enhancement projects expected to cost over £100 million, based on their whole-life totex (Ofwat, 2017). In the Final Determinations Ofwat would decide which DPC projects should go through this route. In PR24, Ofwat has reduced the scope of DPC and included a requirement for water companies to rely on DPC by default, only when projects expected to cost over £200 million, based on whole-life totex (Ofwat, 2022b). Furthermore, in a 2019 report the National Infrastructure Commission (NIC) recommended removing major strategic investments from price control processes, where appropriate, and opening them up for competition (NIC, 2019).[38]

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37 Under DPC a water company competitively tenders for a third party (a competitively appointed provider, or CAP) to design, build, finance, operate and maintain infrastructure that would otherwise have been delivered by the incumbent water company.

38 In particular, the NIC recommended that for "*future price controls, Ofwat and Ofgem should separate consideration of strategic enhancements from the 'standard' periodic price control. Ofwat and Ofgem should develop tendering processes for strategic enhancements, with a clear, public justification required where tendering is not used*" (NIC, 2019, p. 14).

However, there are three key differences between what we propose and Ofwat's and NIC's proposals and, in particular, DPC. First, we consider that procurement should apply to all cost elements that are not benchmarked, rather than only to large infrastructure projects or major strategic projects (as per NIC's recommendation). Second, we consider that it should apply to projects whose costs are expected to be less than £100m. Critically, we consider that this type of thresholds may create incentives for water companies to inefficiently divide investments in smaller chunks so as to avoid the requirement to rely on DPC. This not only is a concern because it evades a cost revealing process, but may also increase the overall totex by inefficiently parcelling projects and potentially losing economies of scale and scope. Third, we consider that water companies should be required to follow this route by default, rather than be requested to consider this as an option, as currently is the case. Ofwat should also be rewarding project aggregation to counter this incentive and potential inefficiency. Hence, we consider Ofwat's recent move to mandate companies to opt for DPC a step in the right direction, though we consider the £200 million threshold too cautious.

6. Conclusion

Yardstick competition has been a very useful and unavoidable tool to regulate local natural monopolies in private ownership. It greatly reduces the asymmetry of information faced by the regulator and leads to better outcomes for consumers. While recognising that by itself yardstick competition cannot solve all the difficulties faced by the regulator, we consider that its application could be reformed, improved and should be complemented by additional tools, when yardstick competition cannot be employed. We have two main proposals.

First, we consider that there is scope for the efficiency frontier to be set more tightly by considering two limitations of yardstick competition, which have, so far, been overlooked. Yardstick competition cannot provide incentives to become more efficient than the most efficient of the local natural monopolies. But the latter is unlikely to be efficient in the first place. Furthermore, yardstick competition cannot ensure that, if the water sector had accumulated significant inefficiencies before privatisation, these would be eroded over time in successive PRs, even by applying a frontier shift adjustment. We recognise that a tighter efficiency frontier may raise concerns about the financeability of the water companies. While we consider that such concerns may be overstated and should be interpreted less generously towards water companies than currently, we consider that there are tools to address this concern, such as using averages of the most efficient firms and, more importantly, lengthening the duration of the PR to provide more time for laggards to catch up.

Second, we argue that insufficient attention was drawn to the fact that a not insignificant share of the water companies' costs is not subject to any yardstick competition at all and some only to a very weak form benchmarking. For these costs Ofwat suffers a large asymmetry of information, which is very likely to lead to cost overestimation. The water companies' incentive is to increase the scope of services whose costs are not benchmarkable and there are some clear indications that the proportion of these costs may substantially increase in PR24. We consider that these requests would increase the regulator's asymmetric information would be highest and should be resisted. Our proposal is to rely on market mechanisms, such as procurement exercises, to ensure that Ofwat can have relevant evidence to do so and close, or at least limit, the information gap with the regulated firms.

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