| **Institution:** Loughborough University |
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| **Unit of Assessment:** C17 – Business and Management Studies |
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| **Title of case study:** Influencing the 2020-25 Water Price Caps in England and Wales using Efficiency Benchmarking |
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| **Period when the underpinning research was undertaken:** 2009-2020 |
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| **Details of staff conducting the underpinning research from the submitting unit:** | | |
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| **Name(s):**<br><br>Karligash Kenjegalieva (now Glass)<br><br>Anthony Glass | **Role(s) (e.g. job title):**<br><br>Professor of Financial Economics<br><br>Senior Lecturer in Economics (now Professor of Managerial Economics at the University of Sheffield) | **Period(s) employed by submitting HEI:**<br>January 2006 to April 2007, September 2007 to present<br><br>August 2008 to February 2020 |

| **Period when the claimed impact occurred:** February 2017 to December 2020 |
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| **Is this case study continued from a case study submitted in 2014?** No |
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| **1. Summary of the impact** (indicative maximum 100 words)<br><br>Water companies in England and Wales are monopolies, so the regulator, Ofwat, protects customers by setting maximum prices. Research by Professors Karligash Kenjegalieva and Anthony Glass underpinned the cost models adopted by consultancy Economic Insight and five water companies. The models influenced Ofwat in setting maximum retail costs for the 2020-2025 period for Bristol, Thames, Wessex, Affinity and Yorkshire at levels that represented realistic costs for the companies, with Bristol and Yorkshire even allowed higher costs than proposed. The research was also instrumental in the successful provisional outcome of Yorkshire's appeal to the Competition and Markets Authority (CMA) against Ofwat's price determination. Kenjegalieva and Glass's work has thus helped achieve a balance between maintaining service standards and delivering value for money to the approximately 10.7 million households the five companies serve. |
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| **2. Underpinning research** (indicative maximum 500 words)<br><br>The companies responsible for supplying water, wastewater treatment and related retail services in England and Wales have regional monopolies. As a result, their prices are not driven down by competitive pressure from rivals. The industry regulator, Ofwat, acts in the interests of customers by setting caps on prices.<br><br>For the 2020-2025 period Ofwat did this through a process known as the 2019 Price Review (PR19). The task in this process is to compare companies' relative cost performance to determine the appropriate levels of their efficient costs and thus their price caps. A balance must be struck between companies' cost allowances – which have to be high enough to fulfil public service responsibilities such as flood defence and cutting leakages – and the need to provide value to customers.<br><br>Different approaches to measuring efficiency have different implications for the calculation of efficient costs. Ofwat has used two econometric approaches: short-term efficiency (cost performance that varies over time) and long-term efficiency (cost performance that persists |
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over time). Kenjegalieva and Glass have contributed to the definition and use of these methods in their research. Crucially, they have also proposed that a non-econometric approach, data envelopment analysis (DEA), be used to measure water companies' cost efficiency. DEA, a concept from the operations research/management science literature, is a linear programming technique that estimates the efficiency of a company relative to its industry peers.

The academics and advisers involved in previous price reviews were typically public utility economists with specialist knowledge of the water industry in England and Wales. Rather than duplicate this industry insight, Kenjegalieva and Glass have drawn on their research at Loughborough to offer specialist knowledge on econometric efficiency measurement – resulting in a paradigm shift in the role of academics in determining water companies' efficient costs.

Kenjegalieva and Glass's research on cost modelling pertinent to water companies can be traced back to the calculation of the efficiencies of decision-making units, such as countries and firms, using DEA. This work combined DEA with econometric efficiency measurement and showed the complementarity of the two approaches **[R1]**. Kenjegalieva and Glass then calculated the long-term productive efficiencies of decision-making units, introducing the idea of efficiency spill-ins and spill-outs to and from a unit **[R2]**.

Subsequent research, published in the leading journal for efficiency measurement, developed a rigorous extension of the method to calculate long-term efficiencies and the spillovers of these between decision-making units **[R3]**. This was followed by a survey and review of methods of calculating short-term and long-term efficiencies **[R4]** – a study that proved highly influential in shaping the methods used in the water industry.

Later work provided evidence of the application of efficiency measurement techniques at the firm level **[R5]**. This, too, proved extremely influential, in part because of the firm-level application of Kenjegalieva and Glass's methods.

Finally, Kenjegalieva and Glass calculated the short-term and long-term retail cost efficiencies of English and Welsh water companies **[R6]**. Retail price caps have always been set at price reviews, but 2019 marked the first occasion when models were used to set them. This research, co-authored with private sector economists at leading consultancy Economic Insight, represented the first published estimation of retail models for English and Welsh water companies.

**3. References to the research** (indicative maximum of six references)

**R1** Kenjegalieva, K, Simper, R, Weyman-Jones, T, and Zelenyuk, V (2009): 'Comparative analysis of banking production frameworks in Eastern European financial markets', *European Journal of Operational Research*, volume 198, pages 326-340
https://doi.org/10.1016/j.ejor.2008.09.002

**R2** Glass, AJ, Kenjegalieva, K, and Paez-Farrell, J (2013): 'Productivity growth decomposition using a spatial autoregressive frontier model', *Economics Letters*, volume 119, pages 291-295
https://doi.org/10.1016/j.econlet.2013.03.002

**R3** Glass, AJ, Kenjegalieva, K, and Sickles, RC (2016): 'A spatial autoregressive stochastic frontier for panel data with asymmetric efficiency spillovers', *Journal of Econometrics*, volume 190, pages 289-300
https://doi.org/10.1016/j.jeconom.2015.06.011

**R4** Glass, AJ, Kenjegalieva, K, Sickles, RC, and Weyman-Jones, T (2019): 'An overview of issues in measuring the performance of national economies', in Greene, W, and ten Raa, T (eds), *Palgrave Handbook of Economic Performance Analysis,* Palgrave MacMillan
https://doi.org/10.1007/978-3-030-23727-1_17

**R5** Glass, AJ, and Kenjegalieva, K (2019): 'A spatial productivity index in the presence of efficiency spillovers: evidence for US banks, 1992-2015', *European Journal of Operational Research*, volume 273, pages 1165-1179
https://doi.org/10.1016/j.ejor.2018.09.011

**R6** Williams, S, Pickard, C, Glass, K, and Glass, A (2020): 'Benchmarking water retail cost efficiency in England and Wales', *International Journal of the Economics of Business*, volume 27, pages 431-467
https://doi.org/10.1080/13571516.2020.1790979

R1, R2, R3, R5 and R6 are published in long-established academic journals with rigorous peer-review processes and international editorial boards. These journals are of high/very high international standing. The collection in which R4 appears features leading academics working in the area of efficiency and productivity analysis and is co-edited by Professor William Greene, of Stern School of Business, New York University, editor-in-chief of the *Journal of Productivity Analysis*, a leading journal in the field.

**4. Details of the impact** (indicative maximum 750 words)

Appropriate use of modelling methods by Ofwat, consultants and water companies themselves is essential. If Ofwat sets a company's caps too low, it may not have enough resources to fulfil its public service responsibilities, and, if they are too high, customers will be charged too much. To guard against an imbalance between the interests of firms and those of customers, Kenjegalieva and Glass's research underpinned the efficiency measurement in five regulated companies. This impacted the 2020-2025 cost allowances for Bristol, Thames, Wessex, Affinity and Yorkshire and the 10.7 million households they serve – representing 37% of connected households in England and Wales and a total bill size of GBP3.06 billion in 2016/2017. The specific impacts are detailed below.

• *Influenced efficiency modelling methods adopted by Economic Insight*

A major pathway to impact, as well as constituting impact in itself, was via the Economic Insight consultancy. Kenjegalieva and Glass designed and delivered a training course based on their research for all consultancy staff during the preparations for the PR19 consultation, explaining statistical (i.e. econometric) methods for measuring efficiency and the associated STATA computer codes. A Director of Economic Insight stated in 2017 that the training put the team "in a stronger position to secure assignments from the water companies, with immediate commercial benefits to the team and the companies" **[S1]**.

Acknowledging the broader capacity-building impact of the course, the Director added: "The water companies and Ofwat have benefited from knowledge transfer and are now considering the appropriate approach for PR19 in a new light" **[S1]**. As a result, there were several additional assignments involving water companies with which Kenjegalieva and Glass did not work directly: South West Water, Northumbrian Water and Welsh Water, for all of which Economic Insight produced publicly available reports.

Kenjegalieva and Glass's advice to Economic Insight on accurately measuring retail efficiencies in work for Bristol Water, Thames Water and Wessex Water was particularly important, as retail was a new element in the price determination covering important functions such as customer services, debt management and customer-side water efficiency initiatives and leaks. A report on retail efficiencies by Economic Insight for Pelican Business Services, the joint retail arm of Bristol and Wessex, was included in the business plan

Wessex submitted to Ofwat and was made publicly available on Ofwat's website **[S2]**. The report stated: "The scope of [Kenjegalieva and Glass's] input included providing advice, in advance of our modelling, on a range of issues that we subsequently reflected in our overarching approach; providing an independent review and critique of our modelling, which, ultimately, we reflected upon in a number of refinements to our analysis." **[S2]**

There were similar benefits to Economic Insight from Kenjegalieva and Glass's advice on accurately measuring retail efficiency in work for Thames, which is by far the largest company in the industry **[S3]**. As a result of this successful collaboration, the relationship between Economic Insight and Kenjegalieva and Glass was extended to involve the researchers directly working with companies, leading to the following impacts.

• *Influenced retail price caps for Bristol Water, Thames Water, Wessex Water and Affinity Water*

These companies' models, which Kenjegalieva and Glass played an important role in producing, were used as the basis for their proposed 2020-2025 retail costs in their PR19 business plans. The modelling enabled all four companies to conclude that the retail cost allowances Ofwat set were acceptable to them, thus averting any further challenges on this issue – for example, an appeal to the Competition and Markets Authority.

As these models showed Bristol's retail operations were relatively cost-efficient vis-à-vis other companies, Ofwat rewarded the company with a retail cost allowance of GBP50.8 million for 2020-2025 – 1.7% higher than the company hoped for **[S4]**. The Head of Economic Regulation at Bristol stated in 2020: "The modelling expertise of Professor [Karligash] Glass to accurately estimate Bristol Water's retail cost efficiency was particularly beneficial". In 2021 he added that their modelling regarding regional wage variation "likely contributed to us being able to recover at least £500,000 in efficient retail costs that we would not otherwise have been able to." **[S4]**

Kenjegalieva and Glass took a lead role in drafting a response from Bristol to an enquiry from the Director of Economics at Ofwat and Head of Cost Assessment for PR19 **[S4]**. This was to provide technical advice on constructing and interpreting a variable to reflect a company's number of dual-service customers. Kenjegalieva and Glass also brought similar advice on factors that may impact a company's cost to the attention of wider industry stakeholders **[S5]**.

The Economic Regulation Manager at Thames noted in 2020 that the retail cost allowance Ofwat set for the company "was regarded as a good outcome for Ofwat, the company and, importantly, its customers", adding: "The modelling expertise... was particularly beneficial, as it helped to understand better Thames Water's retail cost and its retail cost drivers" **[S6]**. A particular issue was modelling the effects of population transience, which affects Thames substantially: to put the scale of this impact into context, the company's revenue from its retail activities relates to 5.4 million households – 18.9% of the sector as a whole **[S6]**.

Wessex stated in 2021 that the modelling carried out by Kenjegalieva and Glass had been highly valuable, helping to incorporate variables such as social deprivation and population transience in order to determine efficient retail cost levels in the firm's business plan **[S7]**. The company's Director of Regulation noted: "[Their work] was consistent with regional wage variation not being an important driver of (efficient) total retail cost variation across companies. In our view, this helped persuade Ofwat not to include regional wage related variables in its finalised models." **[S7]**

Affinity Water serves 3.6 million people living in the south east of England. The company's Senior Regulatory Economist stated in 2021 that modelling by Kenjegalieva and Glass produced robust estimates of the cost impact of population transience. He added: "As a result of this, following a consultation, Ofwat ultimately included transience variables in its

finalised model suite. We estimate that in value terms, this was worth around £3 million to Affinity Water" **[S8].**

*• Enabled Yorkshire Water's cost modelling and successful CMA appeal*

The Head of Regulation at Yorkshire acknowledged the role of Kenjegalieva and Glass's research in determining the company's retail cost allowance for the 2020-2025 period, noting: "[It] enabled retail cost efficiency models to be built that accurately reflected the relative efficiency of Yorkshire Water's retail operations. Ofwat recognised this and... set Yorkshire Water's retail cost allowance at £322 million for 2020-2025, which was a substantial £48.7 million (18%) more than the company had requested." **[S9]**

Notwithstanding the benefits of this original settlement, Yorkshire appealed to the CMA. A key motivation was to increase its allowed revenues from water supply to support the resilience of its operations in response to factors such as climate change and higher demand. To this end, Kenjegalieva and Glass took a lead role in introducing new DEA models to show that Yorkshire's water supply business was consistently relatively cost-efficient. The assessment from the models was that Yorkshire needed higher revenues to improve its leakage performance, as there was limited scope for improvement via cost-efficiency savings. Yorkshire's Head of Regulation stated: "[The] CMA's provisional outcome on Yorkshire Water's appeal concurred with this assessment... The upshot was that Yorkshire Water's appeal was (provisionally) successful and will (provisionally) lead to a £93 million increase in company revenue (for the period to April 2025) to finance increased expenditure to reduce leakages. The CMA will provide the final outcome of the company's appeal in due course." **[S9]**

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**5. Sources to corroborate the impact** (indicative maximum of 10 references)

Please note that Kenjegalieva is referred to as Glass in some documents. All material at web-links is also provided to REF as PDFs.

**S1** Testimonial from Director, Economic Insight, December 2017

**S2** *Household Retail Cost Assessment for PR19 – Final Report for Bristol Water and Wessex Water*, Economic Insight, 2018 (see page 14)

**S3** Testimonial from Director, Economic Insight, September 2017

**S4** Testimonials from Head of Economic Regulation, Bristol Water, July 2020 and February 2021

**S5** *Comments on 'Cost Assessment for PR19: A Consultation on Econometric Cost Modelling'*, 2018
https://www.ofwat.gov.uk/wp-content/uploads/2018/03/KA-Glass-consultation-comments.pdf

**S6** Testimonial from Economic Regulation Manager, Thames Water, June 2020

**S7** Testimonial from Director of Regulation, Wessex Water, February 2021

**S8** Testimonial from Senior Regulatory Economist, Affinity Water, February 2021

**S9** Testimonial from Head of Regulation, Yorkshire Water, February 2021