Estimation of Gladstone Area Water Board's productivity growth rate

A report prepared for Gladstone Area Water Board | 24 May 2024

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1 Introduction

1.1 Background

The Queensland Competition Authority (QCA) has indicated that it intends to apply a base-step-trend approach to set Gladstone Area Water Board's (GAWB's) operating expenditure (opex) allowances over a regulatory period. This involves:

- First establishing an efficient level of base year opex (in a selected base year). The QCA's approach is to accept the actual level of base year opex as efficient provided that it is lower than the allowance set by the QCA for that year; and
- Then, trending the base year level of opex forward (accounting for expected changes in input costs, output growth and productivity) to develop a forecast of opex for each year of the forthcoming regulatory period.

In order to implement the 'trend' component of the base-step-trend approach, the QCA must decide on the expected rate of productivity improvement in opex over the period.

In its submission for the 2020-2025 regulatory period, GAWB proposed a static efficiency target of 1% p.a. of its controllable operating expenditure. GAWB's proposed efficiency target was not compounding. Instead, the target was netted off the base year expenditure in the year which it was applied.

The QCA considered advice from its expenditure consultant, KPMG, and decided to apply GAWB's 1% target, but applied it as an annually compounded rather than a static adjustment. Its view was that this was a reasonable approach within the range of targets adopted by other Australian regulators.

1.2 Our instructions

We have been asked by GAWB to develop an appropriate estimate of the productivity growth rate for application in the QCA's base-step-trend framework for setting opex allowances in its next regulatory submission. GAWB has asked us to have regard to the following, where feasible and appropriate, when developing our estimate of an appropriate productivity growth rate:

- the techniques that the QCA and its consultants are likely to consider as part for the 2025-2030 regulatory period; and
- recent regulatory precedent.

1.3 Key findings

In this report, we have:

- Considered the data available for developing empirical estimates of an appropriate productivity growth rate. This includes data compiled from the National Performance Review (NPR) dataset. We concluded that the NPR data are not sufficiently reliable to derive robust estimates of the productivity growth rate for bulk water suppliers. However, the NPR data are sufficiently reliable and complete to derive productivity growth rate estimates for urban water distribution businesses (i.e., businesses in a closely-related industry to GAWB's).
- Considered the techniques that are commonly used for the purposes of developing estimates of the productivity growth rate, including:

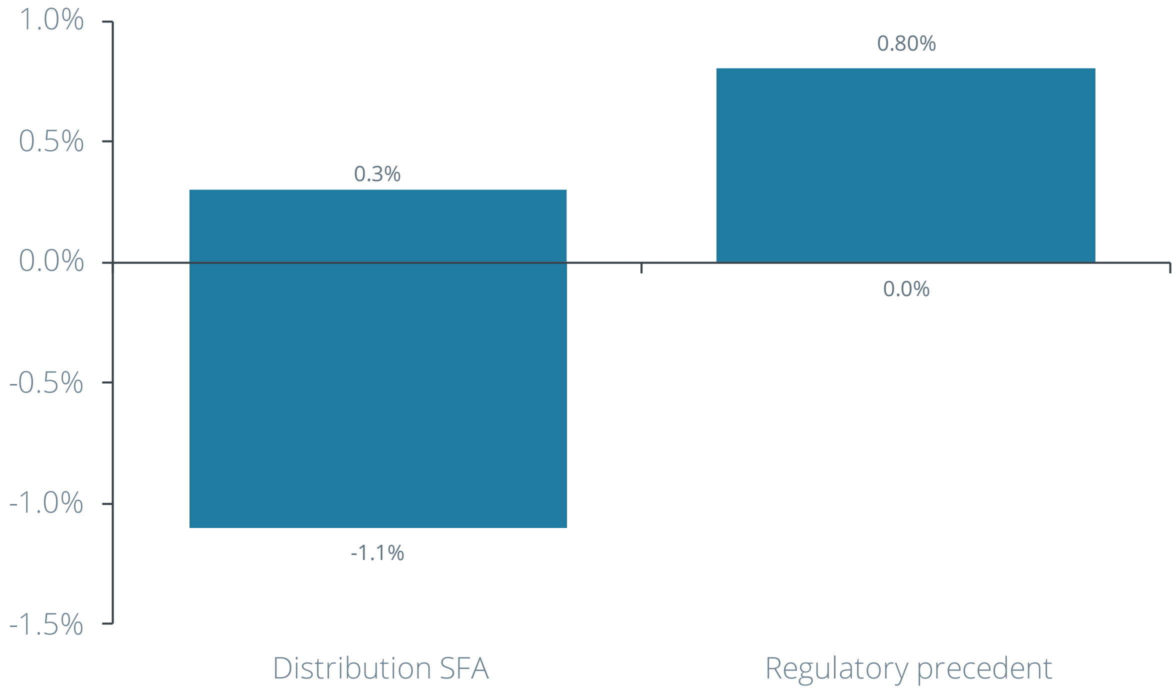
- Total Factor Productivity (TFP) analysis;
- Stochastic Frontier Analysis (SFA); and
- Data Envelopment Analysis (DEA).

In this report, we use SFA to derive productivity growth rate estimates for water distribution businesses of similar scale to GAWB. SFA is one of the techniques that the QCA's adviser KPMG recommended for the purposes so estimating the productivity rate. We conclude that there are insufficient data to estimate reliably the productivity growth rate for GAWB or water distribution businesses using DEA or TFP analysis. We have previously used TFP analysis to provide further productivity growth estimates, including for Seqwater. However, in this case it was not possible for GAWB to collect, process and provide the required data that we would need for such analysis. As we explain in this report, it was possible to implement the SFA approach using data from water distribution businesses around Australia (which operate in a closely related industry to bulk water providers such as GAWB) to derive estimates of an appropriate productivity rate.

- Considered the productivity growth rates applied in several regulatory decisions relating to water businesses between 2017 and 2023.

The estimates of the productivity growth rate using these different methods are summarised in **Figure 1**.

Figure 1: Summary of annual productivity growth rate estimates from different sources



Source: Frontier Economics

We consider that an annual productivity growth rate (reflecting frontier shift efficiency) of +0.2% p.a. could be supported by this evidence.

We note that this productivity growth rate would be consistent with the productivity growth rate applied by the QCA to:

- Seqwater when setting its bulk water charges over the 2018-21 regulatory period; and
- Seqwater and Sunwater when setting prices relating to the supply of water for rural irrigation services for the 2020-24 regulatory period.

1.4 Structure of this report

The remainder of this report is organised as follows:

- Section 2 provides an overview of the methods and approaches available for estimating the productivity growth rate, and the data currently available to implement each approach;
- Section 3 presents estimates of the productivity growth rate for Australian water distribution businesses of a similar scale to GAWB;
- Section 4 surveys and interprets the productivity growth rates applied in a sample of recent regulatory decisions; and
- Section 5 presents our overall conclusions, given the evidence compiled in this report, and provides our recommended productivity growth rate for GAWB.

2 Methods for estimating the productivity growth rate

2.1 Frontier shift versus catch-up

As explained in section 1, when applying a base-step-trend framework for determining the opex allowance for a regulatory period, the QCA determines efficiency targets for the regulated business. The efficiency target may be broken into two separate components:

- Catch-up efficiency, which refers to the improvements in efficiency that an inefficient business is expected to make to catch up to businesses on the efficient production frontier; and
- A shift in the efficient production frontier for the industry as a whole due to changes in technology, input costs, regulatory requirements and other cost drivers that affect all businesses in the industry. Under the base-step-trend framework, this 'frontier shift' is sometimes referred to by regulators as the productivity growth rate or "continuing efficiency".

The QCA has itself recognised this distinction. For example, in its GAWB 2020-2025 Final Report, the QCA explained that:[1]

> *Regulators typically apply two types of efficiency adjustments to controllable opex:*
>
> - *a catch-up efficiency—a firm-specific target to move a business closer to the efficient frontier (typically measured as the best performing comparable businesses)*
> - *a continuing efficiency—an industry-wide target reflecting the movement of the efficient frontier over time as productivity improves, for example, due to innovation.*

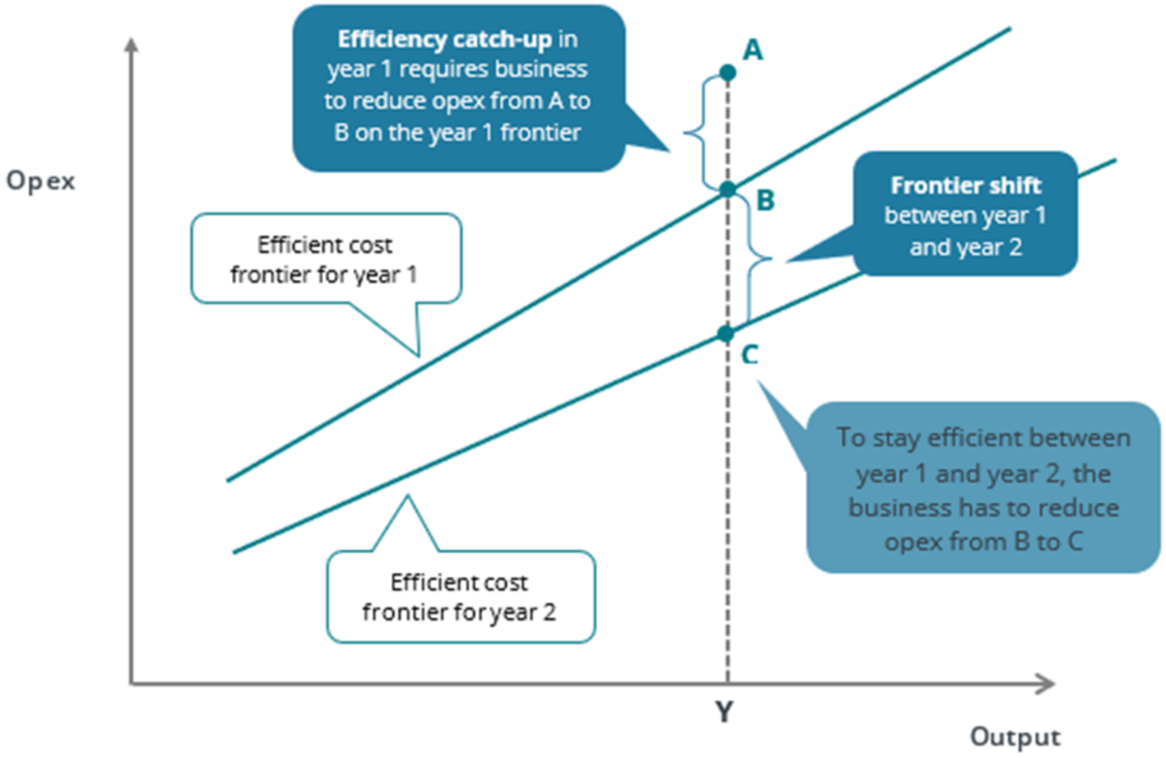
These two aspects of the efficiency target are illustrated in **Figure 2**. The Figure shows the efficient opex cost frontiers for two years, year 1 and year 2. The cost frontier in year 2 is lower than in year 1 due to improvements in productivity. This is referred to as frontier shift.

If, in year 1, a business had output at Y and opex at A, then its opex would be larger than the efficient level of opex for an output of Y (shown as B). For the business to reach the opex frontier in year 1 it would have to reduce its opex in year 1 from A to B in order to "catch up" with the efficient frontier.

A business with output Y in year 1 and opex at B is efficient in year 1 since it is operating on the efficient opex frontier. If output doesn't change between years 1 and 2, then in order to stay efficient in year 2, the business will have to reduce its opex to C to keep up with the downward "frontier shift" for opex due to productivity improvements.

[1] QCA, *Gladstone Area Water Board price monitoring 2020–25 Part A: Overview, Final Report*, May 2020, p. 43.

Figure 2: Efficiency catch-up and frontier shift



Source: Frontier Economics

In the base-step-trend regulatory framework, the catch-up element of efficiency improvement is considered when determining the level of efficient opex in the base year for the regulatory period. The frontier shift component (or the "continuing efficiency" factor, as the QCA refers to it) is accounted for in the trend term. In this report we focus on this second aspect of the efficiency target, namely, the shift in the efficient production frontier over the forthcoming regulatory period (i.e., frontier shift) because we have been asked to estimate the continuing efficiency factor relevant to the trend component of GAWB's opex forecast.

Furthermore, under the QCA's existing approach, a regulated business's actual base year opex is deemed to be efficient (i.e., not requiring any catch-up efficiency adjustment) if it is lower than the allowed opex in that year. We understand that GAWB's actual opex in the base was lower than the allowance in that year. Therefore, no catch-up efficiency adjustment is required to GAWB's actual base year opex. Since the scope for catch-up efficiency has already been dealt with through assessment of the efficiency of GAWB's base year opex, it is appropriate that the estimate of the continuing efficiency factor focus only on frontier shift, rather than a combination of frontier shift and catch-up efficiency.

A forecast of frontier shift during the upcoming regulatory period may be informed by an estimate of the historical change in productivity. However, the ability to estimate the historical rate of productivity accurately is typically limited by:

- incomplete historical data;
- uncertainty and difficulty over how the inputs and outputs of the business are to be measured;

- the ability to control properly for factors unrelated to productivity changes that could influence a business's inputs and outputs; and
- the shortcomings of the models available to estimate the historical rate of productivity (noting that there are many different techniques for estimating the historical rate of productivity, each with their own strengths and weaknesses).

Furthermore, it is important to recognise that the historical change in productivity may not be reflective of what is achievable or realistic over the forthcoming regulatory period. There are two main reasons for this:

- The estimated historical rate of productivity change may include an element of catch-up as well as a shift in the efficient production frontier. In practice, it can be challenging to separate these two effects using the standard techniques and models available for measuring the historical rate of productivity. The forecast of the productivity growth rate should only reflect expected frontier shift, and should exclude any contribution to historical estimates of productivity growth due to catch-up. Conflating the two is likely to result in the achievable future productivity growth rate being overstated. This would result in the business receiving an opex allowance that is lower than the efficient or feasible level.
- The impact on opex of changes in technology and other cost drivers over the forthcoming regulatory period may not be the same as over the historical period used to estimate the past change in productivity.

This means that even if one could estimate the historical productivity growth rate with complete certainty (which is generally not possible, for the reasons explained above), there may still be uncertainty over the extent of continuing efficiency achievable by a regulated business over a future regulatory period. Therefore, a considerable degree of caution and judgment is required when determining the continuing efficiency targets that are to be imposed on a regulated business when setting its expenditure allowances for a future regulatory period.

2.2 Key approaches for estimating productivity growth rate

There are three main approaches to estimating the productivity growth rate:

- approaches based on index numbers, which can be split in Total Factor Productivity (TFP) and Partial Factor Productivity (PFP);
- econometric approaches – one of the most common being Stochastic Frontier Analysis (SFA); and
- data envelopment analysis (DEA).

The QCA has previously indicated that it may consider these three approaches as part of its review processes.[2] The following sections discuss each of these in turn.

2.2.1 Index based approaches

Index based approaches to productivity measurement take an index of a measure of output and divide it by an index of a measure of input. Changes in this ratio over time provide a measure of the rate of change in productivity over time.[3] If the measure of output is an aggregate measure

2 "However, the QCA may consider undertaking further analysis before the next review using techniques such as total factor productivity, stochastic frontier or data envelopment analysis." QCA (2018), Seqwater Bulk Water Price Review 2018–21, p.31.

3 The approach can also be applied to several businesses at the same point in time (cross-sectional productivity comparisons), or several businesses across time (multilateral productivity comparisons).

that captures the levels of all outputs produced by a business, and the measure of input is an aggregate measure of the levels of all the inputs used by that business to produce those outputs, then the index is referred as a total factor productivity (TFP) index.

Examples of outputs often considered for water utilities are the volume of water delivered, customer numbers and network size. Examples of inputs are opex and capital. Both opex and the capital input may be broken down further into sub-categories, e.g. labour, chemicals and energy, or water treatment plants and pipes.

The rate of change in the TFP index is a measure of the total productivity growth factor. This can provide information on performance from one year to the next, and when averaged over a number of years, it provides an indication of longer-term growth in productivity. However, we note that changes in TFP capture the combined effect of catch-up in efficiency and the shift in the efficient frontier. While there are no formal methods for separating these two aspects of a change in productivity, by inspecting the year to year changes in the TFP index, one may be able to identify periods when catch-up seems to dominate the change in TFP versus periods where frontier shift is more likely to be the driving factor.

It is also possible to construct a range of partial factor productivity (PFP) indices. The most common examples are the PFP index for opex and the PFP index for capital input. In both of these indices, the numerator of the index ratio is the aggregate measure for total output, while the denominator is either opex or a measure of capital inputs. These PFPs provide an indication of the productivity of the business in terms of opex spending or the use of capital.

We note that TFP and PFP analysis can be performed for an individual firm or for a number of firms collectively, e.g., the industry as a whole. In addition, when combining different outputs into a single output measure, or different inputs into a single input measure, it is necessary to use appropriate weights. There are a number of different approaches to calculating these weights. The most commonly used approach is a method known as the Törnqvist Index.

2.2.2 Econometric methods

There are several econometric techniques that are used by regulators to undertake benchmarking analysis, for example:

- Least Squares estimation of an average cost function;
- Corrected Ordinary Least Squares (COLS);
- Least Squares panel estimation with fixed effects (FE) or random effects (RE); and
- Stochastic Frontier Analysis (SFA).

All these methods involve essentially the same approach:

- assuming that costs are a function of one or more cost drivers and a time trend $\boldsymbol{t}$ to capture changes in productivity over time:

$$\boldsymbol{Cost_{it} = \beta_0 + \beta_1 OutputOne_{it} + \beta_2 OutputTwo_{it} + \beta_3 t + residual_{it}};$$

- estimating this econometric relationship between costs and cost drivers;
- using the fitted relationship to define an efficient frontier or reference cost function; and
- interpreting the distance between the firm in question and the estimated efficient frontier as an estimate of catch-up efficiency.

In the case of SFA, an allowance is also made for random statistical noise in the differences between the firm in question and the estimated efficiency frontier.

The estimated coefficient on the time trend t can be interpreted as an estimate of the productivity growth rate, having accounted for the business's cost drivers, catch-up efficiency and random statistical noise. However, as with any statistical analysis, estimates of efficiency and the productivity growth rate will only be reliable if all relevant cost drivers are accounted for properly in the model (i.e., if the model is specified correctly), and if the data used in the analysis are reliable.

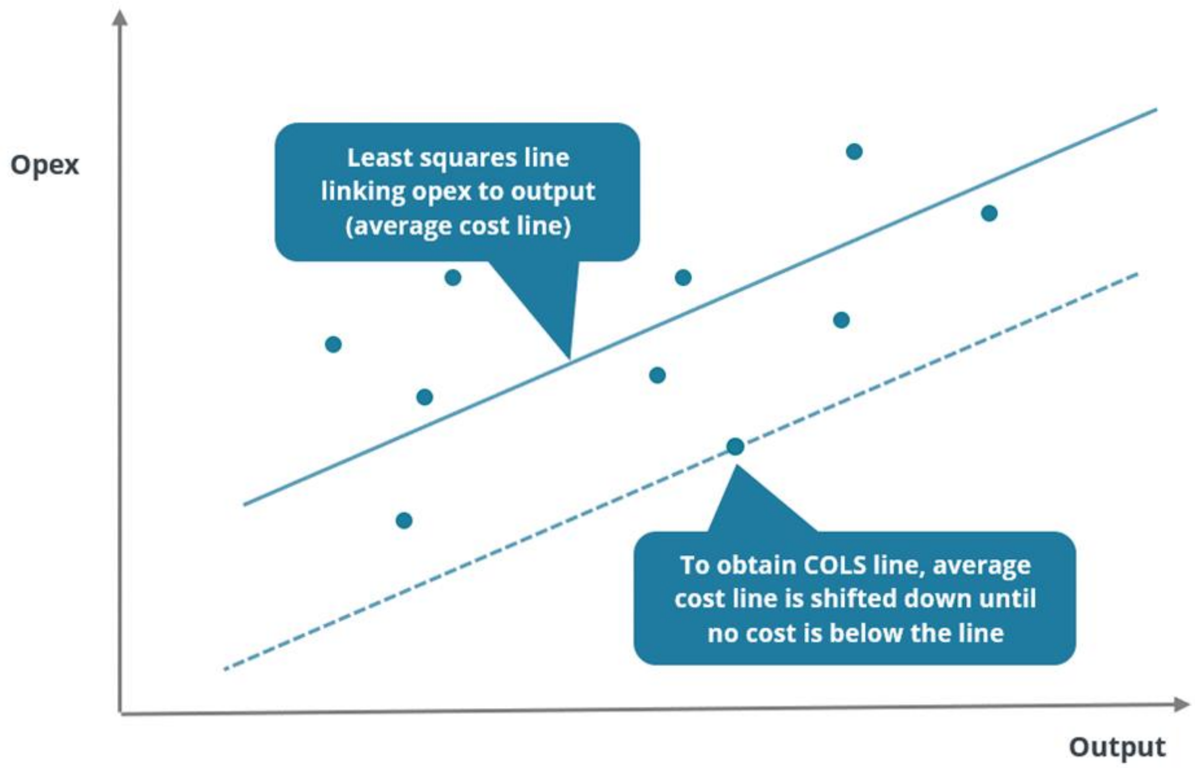
Least squares (LS) and Corrected Ordinary Least Squares (COLS)

Figure 3 illustrates the first two of the above approaches. The least squares (average) cost function is indicated by the solid line in the chart. Based on a sample of observations, it shows the estimated average opex used in the sample to produce different levels of output.[4] For illustrative simplicity, we have drawn this average cost line as a straight line, but in practice non-linear functions are often used to fit the relationship between costs and cost drivers.

By comparing the opex of individual observations with the average cost line, one can determine whether a business is using more or less opex than the average business would use to produce the same level of output.

The Corrected Ordinary Least Squares (COLS) function is obtained from the average cost line by shifting the average cost line down in a parallel fashion until there are no points below the line, and there is one point (or several points) exactly on the line. This is illustrated in **Figure 3** by the dashed line. The businesses on the dashed line are regarded as being efficient. For other observations, the vertical distance between the point and the dashed line is a measure of the business' inefficiency.

Figure 3: Least squares (LS) and Corrected Ordinary Least Squares (COLS)



Source: Frontier Economics

[4] This sample could be a single business over a period of time, or several businesses at the same point in time, or a combination of the two.

If panel data are available, that is, data on several businesses over a number of years, then variants of the COLS approach can be estimated. In this approach, each business is assumed to have an efficiency factor that is constant over time, that can be represented by either a fixed effects or random effects approach. Rather than evaluating the efficiency of each individual observation relative to the frontier or average cost function, this approach produces estimates of each business' average efficiency over the sample period relative to the most efficient business.

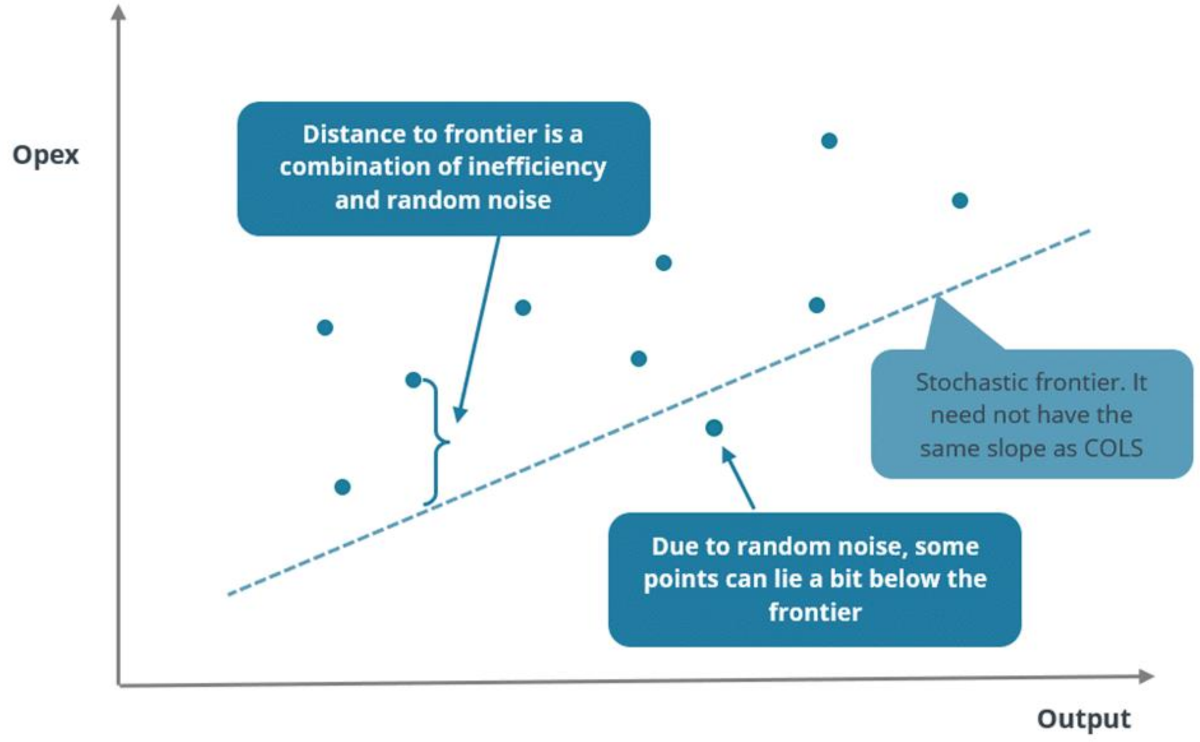
Stochastic frontier analysis (SFA)

Stochastic frontier analysis (SFA) is a more sophisticated econometric approach to estimating efficiency. Instead of interpreting the residual term in equation (1) above as representing only inefficiency, this term is now interpreted as a combination of an inefficiency component as well as random noise. This is illustrated in **Figure 4** below. Because allowance is made for a random noise term in the model, it is possible that some observations lie slightly below the frontier cost line.

Estimating a model that decomposes the residual term in this way requires additional statistical assumptions and a more advanced estimation technique than least squares estimation. It also requires a larger sample to achieve reliable results. However, if the assumptions underlying the model are satisfied, the estimates of the inefficiency terms and the productivity growth rate are likely to be more precise than when using the least squares and COLS methods.

The Australian Energy Regulator (AER) has relied on SFA models in regulatory reviews for electricity distribution networks since 2014. SFA studies for urban water distribution utilities have also been undertaken on behalf of the Essential Services Commission of Victoria (ESC) and for the Independent Competition and Regulatory Commission (ICRC).

Figure 4: Stochastic frontier analysis (SFA)



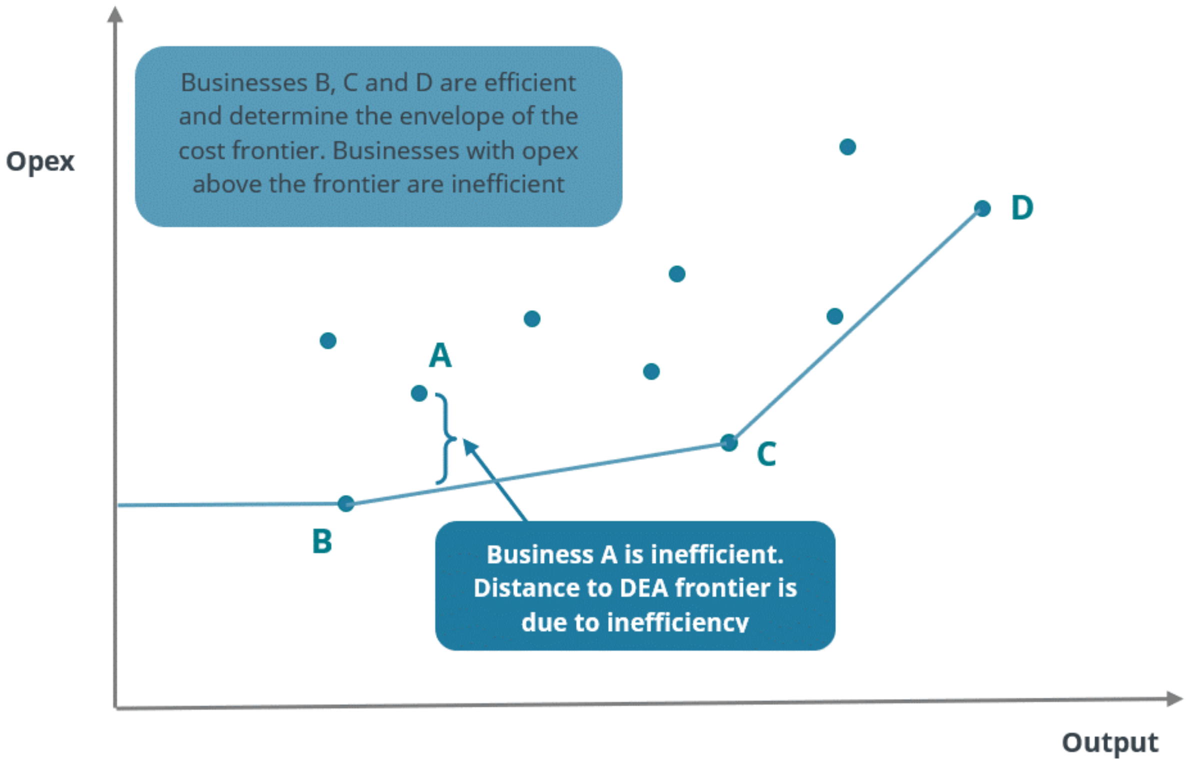
Source: Frontier Economics

2.2.3 Data envelopment analysis (DEA)

Another technique widely used for benchmarking is data envelopment analysis (DEA). This is a non-parametric technique in that it does not specify a particular functional form for the relationship between cost and the cost drivers. Instead, it uses linear programming to fit a piece-wise linear envelope to the data to derive an estimate of the efficient frontier, as illustrated in **Figure 5**. Any business whose cost is higher than the efficient frontier is considered to be inefficient. The DEA technique does not make any allowance for random noise in the data.

If DEA is applied over time, the shift in the frontier over time can be used to estimate the rate of productivity growth. However, this approach requires a considerable amount of data in order to implement reliably since separate frontiers need to be estimated for each point in time.

Figure 5: **Data envelopment analysis (DEA)**



Source: Frontier Economics

2.3 Data availability

The analysis in this report has relied on information from the National Performance Report (NPR) database produced by the Bureau of Meteorology.[5]

The NPR database provides data on Australian water utilities, including bulk water providers and water distribution networks, which is a closely related industry. The most recent release of the data was used, which provides data up to and including the 2022-23 financial year, going as far back as 2002-03 for some utilities and variables.

While the NPR database does provide opex data for bulk water utilities, there are significant gaps in this dataset. For WaterNSW there are no opex data for 2012-13 through 2017-18, with 2018-19

[5] Bureau of Meteorology, National Performance Report database, available at http://www.bom.gov.au/water/npr/docs/2022-23/Urban_NPR_The_complete_dataset_2022-23.xlsx

opex almost twice that of subsequent years. For Seqwater opex data are missing for 2014-15 and 2016-17. Moreover, the opex for Seqwater in 2015-16 is reported as $932,847 (in real $FY2023), which is implausibly low. The opex data provided is the total across all cost categories – there is no decomposition into different cost categories such as labour or electricity.

2.4 Conclusion

In light of the data available to us and the data requirements of different methodological approaches, we concluded that it would be feasible to estimate an SFA model for urban water distribution businesses using the NPR dataset. This would provide an estimate of average productivity growth over the sample period in an industry that is closely related to bulk water supply, with similar cost drivers. We chose SFA over other econometric approaches because SFA enables operational inefficiency to be considered separately from random noise. We also considered that the sample of urban water distribution businesses in the NRP dataset is large enough to make SFA feasible.[6]

We also considered applying a DEA approach to estimate the productivity growth rate for the urban distribution businesses. However, we concluded that DEA modelling would present technical challenges, as it would require estimation of separate efficient frontiers for each historical year in the dataset. The productivity growth rate would then need to be estimated by analysing the change in the efficient frontier between years. However, due to gaps in the dataset, the frontiers for different years would be based on samples of different sizes and comprised of different businesses. Hence the efficient frontiers in different years would not be comparable.[7] In our view, this would make the estimate of the productivity growth rate using DEA unreliable.

[6] While the NPR data for the water distribution businesses also has some quality issues, given there is a much larger sample of distribution businesses than bulk supply businesses, and the fact that the SFA model allows for random errors in the data, data quality issues will have much less impact on the results for the distribution businesses than for the bulk supply businesses.

[7] For a discussion of the difficulties in comparing the results of separate DEA analyses carried out on samples of different sizes see Zhang, Y. and Bartels, R. (1998), "The effect of sample size on the mean efficiency in DEA with an application to electricity distribution in Australia, Sweden and New Zealand", *Journal of Productivity Analysis*, 9, 187-204.

3 Productivity growth rate estimates for water distribution businesses

3.1 Introduction

Given the difficulties in deriving reliable estimates of the historical productivity rates of bulk water businesses (as discussed in the previous section), in this section we seek to estimate the productivity growth rate in a closely-related industry. A relevant industry for which data is available is the urban water distribution industry. In this section we discuss the approach and present the results of our analysis for the urban water distribution industry. The dataset used for this analysis is the data on urban water utilities in the NPR dataset. This dataset is described in more detail in section 3.3.

3.2 Estimation approach used

In choosing an approach for estimating the productivity growth rate for urban water distribution utilities, we considered the properties of the different approaches discussed in section 2. Using the average or COLS cost function approaches would ignore, possibly substantial, inefficiencies for some of the businesses, which could distort the estimation of the productivity growth rate. On the other hand, as discussed in section 2.4, use of DEA to estimate the productivity growth rate would present technical problems.

SFA does not suffer from these issues. It makes an allowance for inefficiency. And a time trend is included to estimate the shift in the efficient frontier over time. We also note that it is one of the approaches suggested by KPMG in its advice to the QCA in relation to Seqwater's 2018 price review,[8] and it was used by Economic Insights to estimate the productivity growth rate for the Victorian urban water distribution businesses in a study commissioned by the ESC in 2017.[9]

In view of the above considerations, we decided that the most appropriate approach for the task at hand is the SFA approach. A description of the SFA approach is provided in section 2.2. We used the Stata statistical software package to estimate the SFA models.

3.3 Description of data used in the analysis

The NPR database provides data for 89 water utilities for the period 2002-03 through to 2022-23.[10] While some of these businesses are, at least in part, bulk water utilities, the vast majority are urban water distribution utilities. After removing pure play bulk water utilities and sewerage only utilities, the NPR database provides data on the activities of 80 water distribution utilities.[11]

We noted in earlier sections that the NPR data for the bulk supply businesses exhibits substantial shortcomings in terms of data quality. In our opinion this means that the NPR data on bulk water suppliers cannot be used to obtain reliable estimates of productivity growth rate GAWB. While there are also shortcomings associated with the quality of data for the water distribution businesses, these data issues do not seem as severe as for the bulk water supply businesses.

8 QCA, *Seqwater Bulk Water Price Review 2018–21*, Final Report, March 2018, p. 31.

9 Economic Insights (2017), *Victorian Urban Water Utility Benchmarking*, Report prepared for the Essential Services Commission.

10 Bureau of Meteorology, National Performance Report database, available at http://www.bom.gov.au/water/npr/docs/2022-23/Urban_NPR_The_complete_dataset_2022-23.xlsx

11 This includes SA Water and Water Corporation – Perth.

Moreover, using a much larger sample mitigates the problem to some extent when using the SFA model, since the SFA model allows for random errors. This allows data errors to be considered as statistical noise that contributes to the imprecision of estimates but does not invalidate the estimates of the model parameters.[12]

With the larger number of utilities in the urban water distribution sample, statistical techniques such as SFA become feasible, whereas using such techniques on the bulk water supply sample consisting of only five utilities would produce very unreliable results.

We think it is reasonable to use data on water distribution businesses to estimate the productivity growth rate for GAWB for the following reasons:

- GAWB and water distribution businesses operate in the same broader industry, and are classified by the Australian Bureau of Statistics—using the Australian and New Zealand Standard Industrial Classification (ANZSIC) system—as operating in the 'water supply, sewerage and drainage services' industry.
- GAWB uses very similar inputs to production as the distribution businesses. For instance, GAWB and the water distribution businesses employ similar forms of labour and capital (e.g., pipeline assets, pumping stations, water treatment plants, etc.).
- GAWB transports bulk water directly to end-users in the same way many distributors do—albeit that all of GAWB's customers are large industrial users, whereas most of the customers served by the distribution businesses tend to be residential users.
- Many water distribution businesses (particularly the council-owned businesses, but also major distributors such as Hunter Water) own and operate their own water storage assets (dams and catchments) in the same way GAWB does.

In short, we think that the factors that drive the productivity of water distribution businesses are likely to be similar to those that drive GAWB's productivity. Therefore, it is reasonable to use estimates of the productivity rate for water distribution businesses as a proxy for the productivity rate that is applicable to GAWB.

3.4 Measures of inputs and outputs used

Following the approach used by Economics Insights in its 2017 report for the ESC, and the 2021 Frontier Economics report for Seqwater,[13] we treat real opex as the dependent variable (i.e., the input) in the SFA model. To obtain real opex, we deflated the nominal operating costs in the NPR dataset using an equally weighted combination of the CPI and the EGWWS WPI, in line with the approach used by Economic Insights.[14,15]

We considered three output variables for the analysis:

- Water supplied;[16]

[12] This holds if the data errors are in the dependent variable (opex in the present case). If there were sizable errors in the data for other variables used in the model, we would have a so-called errors-in-variables issue, which would result in statistically inconsistent estimates.

[13] Frontier Economics, *Estimation of Seqwater's productivity growth rate*, June 2021, p. 30. Available at https://www.qca.org.au/wp-content/uploads/2021/06/attachment-9-frontier-economics-estimation-of-seqwaters-productivity-growth-rate-productivity-stc2.pdf

[14] Economic Insights (2017), *op cit.*

[15] We note that the NPR data expresses opex as real 2023 dollars, inflating using average CPI over the four quarters in each financial year.

[16] NPR variable W11: Total urban water supplied (ML). Data from the 2018 dataset is appended to the 2023 dataset.

- Number of connections; and
- Mains length.

3.5 Results from SFA models

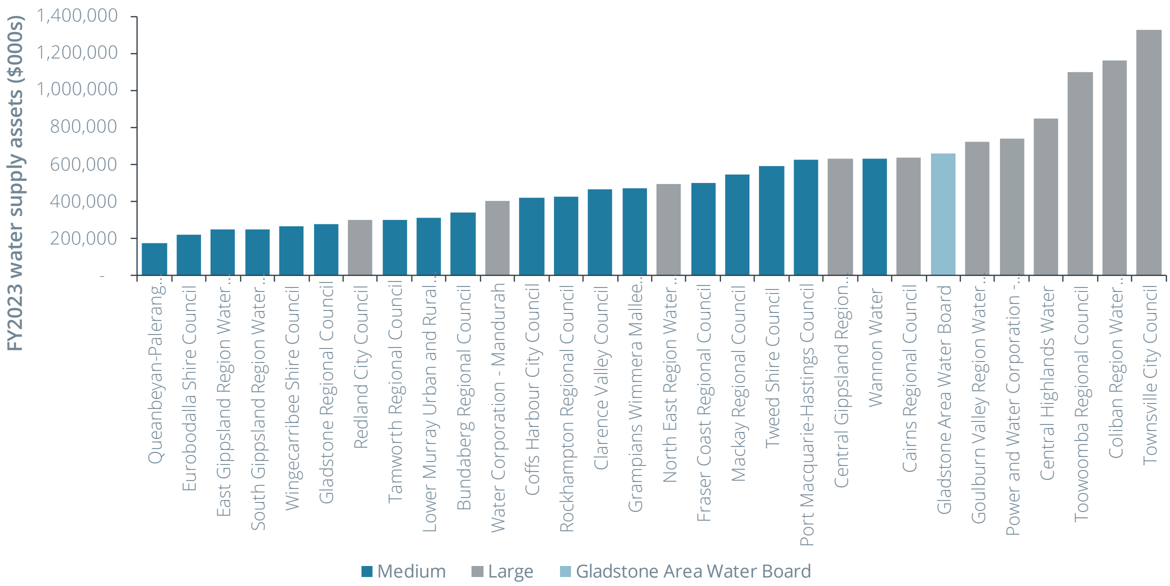
The NPR database allocates the businesses into categories based on the number of connections:

- Small – 10,000 to 20,000 connected properties;
- Medium – 20,000 to 50,000 connected properties;
- Large – 50,000 to 100,000 connected properties; and
- Major – more than 100,000 connected properties.

When estimating SFA models for different combinations of size categories for the urban water distributors, we found that the estimates for the productivity growth rate (frontier shift) were sensitive to the size category. This could, in part, be due to scale economies.

To find a suitable subsample to use as a benchmark for GAWB, we compared GAWB's size to the size of the urban water distributors. However, since GAWB is a bulk water business rather than a distributor, the number of connections is not an appropriate measure for comparing the size of GAWB with the urban water distributors. Instead, we have compared GAWB with the distributors on the basis of asset value (written-down replacement cost) and revenue, using data reported to the NPR database. These comparisons are shown in **Figure 6** and **Figure 7**.

Figure 6: GAWB's asset value compared to urban water distributors



Source: Frontier Economics analysis of NPR data

It is clear from these charts that, in terms of these measures of scale, GAWB is comparable in size to a 'large' water distributor, although possibly on the central portion of the size distribution of 'large' distributors. In view of this, we consider that it is appropriate to focus on SFA estimates of the productivity growth rate for the water distributors in the 'large' urban water distributors. However, this category is fairly small, consisting of just 13 utilities. Hence, we undertook an SFA analysis for three expanded samples:

- A sample consisting of the 'major' plus 'large' urban water distributors, consisting of 30 utilities in total.
- A sample consisting of the 'large' plus 'medium' urban water distributors, consisting of 35 utilities in total.
- A sample consisting of the 'major' plus 'large' plus 'medium' urban water distributors, consisting of 52 utilities in total.

The estimation was carried out in three stages:

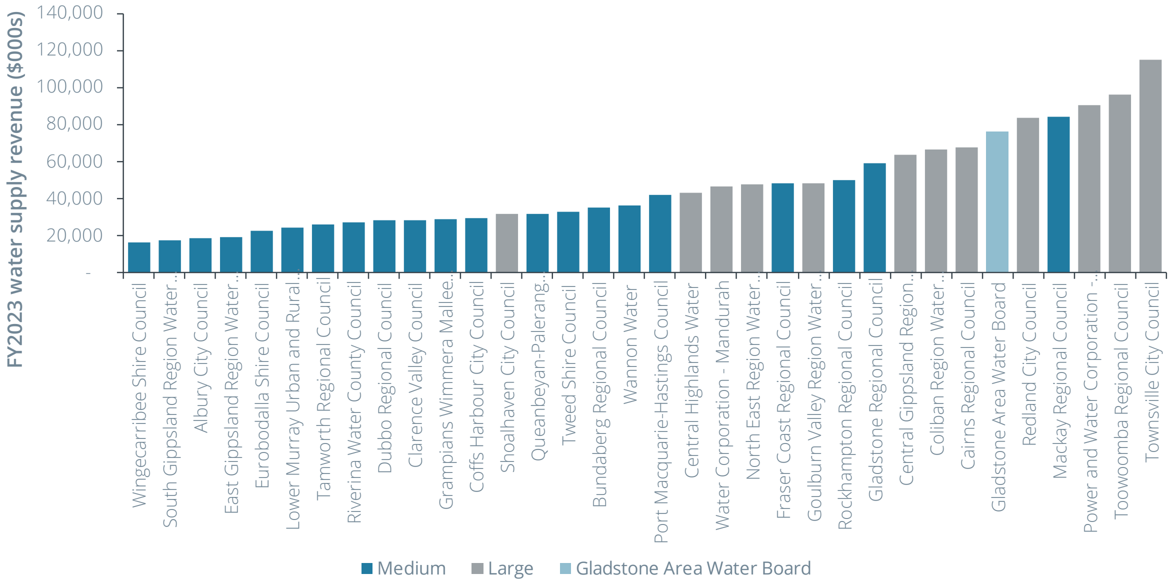
1. First an SFA model was fitted using all the data for a given subsample.
2. Next, we removed any 'outlier' observations and re-estimated the model. We re-estimated the model using three alternative approaches for removing 'outlier' observations:
    a. Removing all of a utility's observations if at least one observation for the utility has a residual at least 0.25 in absolute terms[17] (aggressive);
    b. Removing an observation if the observation has a residual at least 0.25 in absolute terms (conservative); and
    c. Removing an observation if the observation has a residual at least 0.25 in absolute terms and removing all of a utility's observations if at least two observations for the utility has a residual at least 0.25 in absolute terms (hybrid).

    The final sample sizes for the various distributor categories and outlier removal approaches considered are provided in **Table 1**.
3. Finally, we selected the outputs for inclusion in the final model specification using an iterative process. Starting with a constant and a time trend, we successively added output variables to the model if that improved the fit of the model to the data, as assessed by a commonly used statistical criterion known as the Bayesian Information Criterion (BIC).[18]

Figure 7: GAWB's revenue compared to urban water distributors

17 That is, the actual opex was 25% above or below the fitted value implied by the model.

18 We also carried out a selection procedure in the reverse direction, starting with all output variables in the model and successively removing variables if they were insignificant or had the wrong sign. This yielded the same specifications as the forward approach.



Source: Frontier Economics analysis of NPR data

Table 1: **Final sample sizes for different distributor categories and outlier approaches**

Sample	Aggressive	Conservative	Hybrid
Major + Large	213	348	295
Large + Medium	249	446	367
Major + Large + Medium	373	626	525

Source: Frontier Economics analysis of NPR data

Our selection procedure led to a specification in which the only output driver of opex in the model is the number of customer connections for the combined 'large' and 'major' sample, and the number of customer connections and water supplied for the 'major' only sample. However, we also derived results for a second model specification in which all three output variables – number of connections, water supplied and mains length – are included in the model. In all specifications, the dependent variable in the model is real opex, and opex as well as the output variables are specified in natural logarithm form.

Table 2 presents the estimates of the productivity growth rates produced by the nine different SFA models discussed above (three different samples and three different outlier removal approaches for each sample). These productivity growth rates are taken as minus one multiplied by the estimate of the coefficient on the time trend.[19] The table shows that, over the period 2008-09 to 2022-23, the estimated productivity growth rate for urban water distribution businesses of similar scale to GAWB was negative for all nine models, with the estimates ranging from a 0.3% p.a. decline in productivity to a 1.0% p.a. decline in productivity. The estimates of the rate of productivity change are statistically significantly different from zero.

[19] We note that, in principle, the coefficient on the time trend may capture several effects, such as changes in regulatory obligations, in addition to productivity changes.

Table 2: Estimated productivity growth rates for urban water distributors using SFA – use selected drivers

Sample	Aggressive	Conservative	Hybrid
Major + Large	-1.0%	-0.7%	-0.7%
Large + Medium	-0.8%	-0.3%	-0.4%
Major + Large + Medium	-0.8%	-0.5%	-0.5%

Source: Frontier Economics analysis of NPR data for the period 2008-09 to 2022-23

The results for the specifications including all three output variables were very similar to those in **Table 2**, with several small differences, identified in **Table 3** in **bold** font.

Table 3: Estimated productivity growth rates for urban water distributors using SFA – use all drivers

Sample	Aggressive	Conservative	Hybrid
Major + Large	**-1.1%**	**-0.8%**	**-0.8%**
Large + Medium	**-0.9%**	-0.3%	-0.4%
Major + Large + Medium	**-0.9%**	-0.5%	-0.5%

Source: Frontier Economics analysis of NPR data for the period 2008-09 to 2022-23

We note that in a previous report for Seqwater conducting a similar analysis of productivity trends in water distribution utilities, we found that the large and major sample had a productivity growth rate of -1.9%.[20] This result used connections only, as in the models used above. This differs from the estimate of -0.8% in **Table 2** above, which applies the same outlier removal approach. This is largely due to changes in the NPR data since we prepared our 2021 report for Seqwater.

We inspected the data for the large and major utilities over the period 2009-2020 (the same period used in the Seqwater report) and compared to the data in the Seqwater report. We find that the data are identical, with two exceptions:

- The Seqwater report did not have data for Central Coast Council in 2020; and
- The Seqwater report did not include Shoalhaven City Council in the Large and Major sample as it was classified as Medium in the NPR dataset used.

Using the final dataset used as in **Table 2** above, and removing all observations after 2020, we obtain an estimate of -1.3%. Thus, the difference between the two estimates is approximately half due to direct impact of the additional three years of data, and the other half due to differences in the sample.[21]

20 Frontier Economics, *Estimation of Seqwater's productivity growth rate*, June 2021, p. 30. Available at https://www.qca.org.au/wp-content/uploads/2021/06/attachment-9-frontier-economics-estimation-of-seqwaters-productivity-growth-rate-productivity-stc2.pdf

21 Which includes the reclassification of Shoalhaven City Council from Medium to Large, the addition of data for Central Coast Council for 2020, and the revised outlier removal.

3.6 Conclusion

We have applied SFA to estimate the historical average productivity growth rate of urban water distribution businesses of similar scale to GAWB using NPR data up to 2022-23. Our analysis indicates that, over the period 2008-09 to 2022-23, the average annual productivity growth rate in these businesses was negative with estimates of the change in productivity ranging between -0.3% p.a. and -1.1% p.a., depending on the sample used and the model specification.

4 Regulatory precedent

4.1 Introduction

When setting the opex efficiency target rate for GAWB in its 2020 decision, the QCA (and its adviser, KPMG) considered the efficiency targets determined by other regulators in Australia. We have therefore also considered the opex efficiency targets set in recent regulatory decisions that relate to water businesses and whether or not those efficiency targets include catch-up efficiency or reflect the continuing efficiency only as the measure of productivity growth. **Table 4** below presents the regulatory decisions we considered, the efficiency targets determined in those decisions and our assessment as to whether the targets are likely to include catch-up efficiencies.

Table 4: Regulatory decisions considered

Decision	Reference	Efficiency target	Likely to include catch-up efficiency?
ERA – Water Corporation (2017)	The efficient costs and tariffs of the Water Corporation, Aqwest and Busselton Water, Final Report	0.75% p.a.	No
ESC – Melbourne Water (2021)	Melbourne Water final decision	1.2% p.a.	Yes
ESC – Yarra Valley Water (2023)	Yarra Valley Water final decision	1.7% p.a.	Yes
ESC – South East Water (2023)	South East Water final decision	2.0% p.a.	Yes
ESC – Barwon Water (2023)	Barwon Water final decision	2.0% p.a.	Yes
ESC – Coliban Water (2023)	Coliban Water final decision	1.4% p.a.	Yes
ESC – Central Highlands Water (2023)	Central Highlands Water final decision	1.0% p.a.	Yes
ESC – Gippsland Water (2023)	Gippsland Water final decision	1.7% p.a.	Yes
ESC – Goulburn Valley Water (2023)	Goulburn Valley Water final decision	1.0% p.a.	Yes
ESC – Wannon Water (2023)	Wannon Water final decision	1.0% p.a.	Yes

Decision	Reference	Efficiency target	Likely to include catch-up efficiency?
ESC – Lower Murray Water (2023)	Lower Murray Water final decision	1.1% p.a.	Yes
ESC – GWMWater (2023)	GWMWater final decision	1.4% p.a.	Yes
ESC – East Gippsland Water (2023)	East Gippsland Water final decision	1.0% p.a.	Yes
ESC – South Gippsland Water (2023)	South Gippsland Water final decision	1.4% p.a.	Yes
ESC – Westernport Water (2023)	Westernport Water final decision	1.5% p.a.	Yes
ESCOSA – SA Water (2020)	SA Water Regulatory Determination 2020, Final Determination: Statement of Reasons	0.5% p.a.	No
ESCOSA – SA Water (2024)	SA Water Regulatory Determination 2024, Draft Decision: Statement of Reasons	0.9% p.a. flat 0.36% p.a. compounding	No
ICRC – Icon Water (2023)	Regulated water and sewerage services prices 2023-28, Final Report	1.2% p.a.	Yes
IPART – Sydney Water (2020)	Review of prices for Sydney Water, Final Report	0.8% p.a.	No
IPART – WaterNSW's Greater Sydney prices (2020)	Review of prices for Water NSW Greater Sydney, Final Report	0.8% p.a.	No
IPART – Hunter Water (2020)	Review of prices for Hunter Water Corporation from 1 July 2020, Final Report	0.5% p.a.	No
IPART – Water Administration Ministerial Corporation (2021)	Review of prices for the Water Administration Ministerial Corporation from 1 October 2021 to 30 June 2025, Final Report	0.7% p.a.	No
IPART – Central Coast Council (2022)	Review of Central Coast Council water prices – Summary, Final Report	0.7% p.a.	No

Decision	Reference	Efficiency target	Likely to include catch-up efficiency?
IPART – WaterNSW's Murray to Broken Hill Pipeline (2022)	Review of WaterNSW's prices for the Murray River to Broken Hill Pipeline, Final Technical Report	0.7% p.a.	No
IPART – WaterNSW's rural bulk water prices (2022)	Review of Water NSW's rural bulk water prices From 1 October 2021 to 30 June 2025, Final Report	0.7% p.a.	No
IPART – Essential Water (2022)	Review of Essential Water's prices for water and wastewater services in Broken Hill, Final Technical Report	0.7% p.a.	No
IPART – Sydney Desalination Plant (2023)	Sydney Desalination Plant Pty Ltd Review of prices to apply from 1 July 2023, Final Report	0.7% p.a.	No
OTTER - TasWater (2022)	2022 Water and sewerage price determination investigation final report	1.5% p.a.	Yes
QCA – GAWB (2020)	Gladstone Area Water Board price monitoring 2020–25 Part A: Overview, Final Report	1.0% p.a.	Yes
QCA – Sun Water (2020)	Rural irrigation price review 2020-24 Part B: Sunwater, Final Report	0.2% p.a.	No
QCA – Seqwater (2020)	Rural irrigation price review 2020–24 Part C: Seqwater, Final Report	0.2% p.a.	No
QCA – Seqwater (2022)	Seqwater Bulk Water Price Review 2022–26	0% p.a.*	No

*Source: Various regulatory decisions. Note: Whilst not stated explicitly in all decisions, we understand that the productivity growth rates in the decisions reported in this Table are compound rather than static rates. Note: * The QCA applied no efficiency target (i.e., 0% productivity rate) in this decision as Seqwater had proposed a credible efficiency program setting out a pathway to reveal efficient costs over the regulatory period.*

4.2 Interpretation of recent regulatory precedent

Table 4 above indicates that the opex efficiency targets adopted in recent regulatory decisions range from 0% in the QCA's most recent decision in Seqwater's bulk water price review to 2.0% (the ESC decision for South East Water and Barwon Water). However, several of these decisions are not relevant to the QCA's task of estimating a productivity rate for use within the base-step-trend framework, and therefore should be disregarded.

This is because under the QCA's base-step-trend framework, catch-up efficiency is accounted for when determining an efficient level of base year opex from which to forecast the regulated business's opex requirement over the next regulatory period. This means that that the productivity rate in the 'trend' component of the base-step-trend forecast must reflect frontier shift only. If the productivity rate adopted is determined by considering past regulatory decisions that conflate the catch-up efficiency and frontier shift targets set by other regulators, this would result in double-counting of catch-up efficiency within the QCA's forecast of efficient opex. This, in turn, would result in opex allowances that are unrealistically low and below the efficient level that the regulated business would require to operate its regulated assets safely and reliably over the regulatory period.

Therefore, any past regulatory decisions on efficiency targets that reflect a combination of catch-up efficiency and frontier shift should be exclude from any analysis that the QCA would rely on to benchmark the productivity rate applied to GAWB.

4.2.1 Efficiency targets set by the ESC include catch-up and continuing efficiency

During the previous QCA price review for the GAWB, the QCA's adviser, KPMG, recommended that the QCA apply an efficiency target of 1.8% p.a. to GAWB. KPMG derived that recommended efficiency target by reference to the average of the efficiency targets proposed by Victorian water businesses in the 2018 PREMO price reviews.

However, in the final GAWB decision, the QCA adopted a more conservative efficiency target of 1.0%, and in doing so stated the following:[22]

> *We note the basis for KPMG's recommended efficiency factor. However, we are mindful that comparisons with efficiency factors applied in other specific contexts should be made cautiously. For example, some of the larger adjustments by the Victorian water businesses in the 2018 PREMO review may have been proposed in the context of growing retail demand forecasts, which is different to the demand for bulk water faced by GAWB in 2020–25 (Chapter 8). Consequently, we adopted a more conservative approach and applied GAWB's proposed efficiency target of 1 per cent...*

We agree with the QCA that caution is warranted when considering the relevance to GAWB of efficiency targets proposed by water businesses (and accepted by the ESC) in Victoria. This is because the ESC's approach is likely to result in businesses including firm-specific efficiency targets that go beyond the productivity growth rate or frontier shift that is to be reflected in GAWB's trend component.

The ESC uses the base-step-trend approach to set opex allowances. Specifically, the ESC begins by observing the actual level of opex incurred by the business in the nominated base year (normally the penultimate year of the current regulatory period. The ESC refers to this as the "baseline year expenditure". The ESC then: [23]

- removes any non-controllable expenditure;
- removes any one-off or non-recurring expenditure items incurred in that year (including business transition costs), and adds any normally occurring items that did not occur in that year; and

[22] QCA, *Gladstone Area Water Board price monitoring 2020–25 Part A: Overview, Final Report*, May 2020, p. 45.

[23] ESC, *2023 water price review Guidance paper*, 26 October 2021, p. 30.

- removes any further ongoing cost savings or efficiency commitments that will be realised in the final year of the current regulatory period (i.e., typically the year after the base year).

The ESC adopts the resulting adjusted level of actual base year opex as an appropriate starting point from which to forecast opex over the next regulatory period. The ESC does *not* make any adjustment for catch-up efficiency to the actual base year opex incurred by the business. Rather, the catch-up efficiency target is incorporated into the ongoing efficiency target.

After the baseline year expenditure is established, the ESC applies an annual rate of increase in opex over the next regulatory period allowing for growth in expenditure to reflect customer growth and ongoing efficiency improvements (i.e., the ongoing efficiency target). The ESC then allows for any step changes for expenditure above the base year.

In addition, the ESC's PREMO rewards businesses for pursuing and delivering ambitious efficiency improvements. Specifically, under the PREMO framework, Victorian businesses that offer (and deliver successfully) high efficiency improvements are rewarded with a higher return on equity allowance. That is, the water businesses regulated by the ESC are rewarded, through the allowed rate of return, for pursuing and delivering ambitious efficiency improvements. This means that the efficiency improvements targeted by water businesses under a PREMO framework are likely to reflect a combination of catch-up efficiency and frontier shift efficiency. As we have noted earlier in this report, the QCA ought to reflect only frontier shift (rather than catch-up efficiency) when setting the opex efficiency target for GAWB. To the extent that the efficiency targets proposed by Victorian water businesses reflect both catch-up and frontier shift efficiencies, those efficiency targets would overstate the productivity growth rate (i.e., the rate of frontier shift) that is relevant to GAWB.

We also note that the ESC efficiency targets vary greatly from business to business, ranging from 1.0% p.a. to 2.0% p.a. for the 2023 water price reviews and ranging from 1.0% to 3.1% for the 2018 water price reviews. If the efficiency targets reflect the frontier shift which, by definition, applies to the whole industry, then the efficiency targets would be the same for all businesses. The fact that the ongoing efficiency targets set by the ESC (as presented in **Table 4**) varies between businesses indicates that those efficiency targets reflect both catch-up and ongoing efficiency.

For these reasons, our view is that the QCA should exclude any efficiency targets set by the ESC when considering an appropriate productivity target for GAWB. The efficiency targets set by the ESC do not reflect frontier shift alone, so would not be a reliable basis on which to set a pure frontier shift target for GAWB.

4.2.2 Efficiency target set by OTTER

The efficiency target set by OTTER in 2022 when determining TasWater's regulated charges of 1.5% p.a. was informed by two considerations:[24]

- 1.5% the median efficiency target amongst the benchmarks target for the Victorian water business considered by Deloitte for the ESC in 2018; and
- Claimed productivity improvements reported by TasWater between 1 July 2016 and 30 June 2020, which ranged from 2.3% to 6.1%.

The first consideration has been discussed above where the efficiency targets set by the ESC are likely to include catch-up efficiency and should not be used to estimate the frontier shift alone applicable to GAWB.

[24] OTTER, *Investigation into TasWater's prices and services for the period 1 July 2022 to 30 June 2026, Final Report, May 2022*, pp. 61-62

The second consideration likely implies that the large, historical claimed productivity improvements reported by TasWater includes catch-up efficiency. Thus, basing a higher efficiency target on historical productivity improvements is unlikely to solely relate solely to incremental frontier shift efficiency gains.

Therefore, in our opinion, the efficiency targets proposed by and set out by OTTER should be excluded from consideration for the purposes of determining a productivity rate applicable to GAWB under the base-step-trend framework.

4.2.3 Efficiency target set by ICRC

An efficiency target of 1.2% p.a. was set by ICRC in 2023 when determining Icon Water's regulated charges. This rate includes both the industry-wide efficiency target and the firm-specific target. This efficiency target was based on benchmarking evidence by ICRC's consultant that considered four regulatory final decisions, 10 regulatory draft decisions and six regulatory proposals, of which 15 were related to the Victorian and Tasmanian water businesses. As discussed above, it is very unlikely that the efficiency targets set by the ESC and OTTER in their most recent decisions relate solely to incremental frontier shift efficiency gains.[25] For these reasons, the QCA should disregard the efficiency target set by the ESC when considering the appropriate productivity rate to apply to GAWB.

4.2.4 Efficiency targets set by other regulators

A summary of the remaining efficiency targets which the QCA should consider is as follows:

- IPART has adopted a continuing efficiency productivity growth rate ranging from 0.5% p.a. to 0.8% p.a. from its most recent price reviews.
- For SA Water, ESCOSA adopted a continuing efficiency productivity growth rate of 0.5% p.a. in its 2020 final decision and has proposed a continuing efficiency productivity growth rate equivalent to 0.36% p.a. in its 2024 draft decision.
- The ERA has applied a productivity growth rate to the Water Corporation of approximately 0.75% p.a. across aggregate opex.
- The QCA has previously adopted a continuing efficiency target of 0.2% p.a. of base year controllable opex for Seqwater and Sun Water's rural irrigation price reviews in 2020.
- The QCA has most recently applied no efficiency target (i.e., a 0% productivity rate) for Seqwater's bulk water price review in 2022 as Seqwater had proposed a credible efficiency program setting out a pathway to reveal efficient costs over the regulatory period.
- The QCA considered advice from its expenditure consultant, KPMG, for the previous GAWB expenditure review.[26] In that report, a productivity growth rate of 2.5% p.a. was incorrectly attributed to the Water Corporation by KPMG. In its 2017 determination for the Water Corporation, the ERA determined an efficiency target that reduced real base operating expenditure per connection by 2.5% p.a. This is the figure that KPMG appears to have reported. However, as the ERA explained in its 2017 final decision, this efficiency target per connection translates into a productivity growth rate of 0.75% p.a. when applied to the Water

[25] MJA, *Icon Water 2023-28 expenditure review, Final report, 24 April 2023*, p. 22

[26] KPMG, *Gladstone Area Water Board expenditure review, Final report prepared for Queensland Competition Authority May 2020*

Corporation's aggregate opex.[27] Hence, KPMG should have considered the much lower figure of 0.75%, rather than the productivity growth rate of 2.5%.

4.3 Conclusions

The opex efficiency targets adopted in recent regulatory decisions range from 0% p.a. to 2.0%. However, as we have explained in this section, most of the regulatory decisions that make up this range should be disregarded as they are not relevant to determining an estimate of pure frontier shift, which is what is required as the relevant productivity rate estimate in the QCA's base-step-trend framework. This is because:

- A number of recent regulatory decisions conflate catch-up efficiency and frontier shift when determining the productivity growth rate. However, under the QCA's framework, the productivity growth rate applied in the trend component of the base-step-trend approach should only reflect frontier-shift efficiency. Incorporating a measure of catch-up efficiency in the trend component and assessing the base year level of opex for efficiency (as is typically done when applying the base-step-trend approach) would effectively double-count catch-up efficiency, thereby producing an opex allowance that would be below the efficient level.
- Relatively high efficiency targets proposed by Victorian water businesses in the 2018 PREMO and 2023 PREMO reviews may have been proposed in the context of growing retail demand forecasts, which may be different to the demand for GAWB.
- The PREMO framework rewards water businesses for setting and then delivering against ambitious efficiency targets with a higher-than-standard return on equity allowance. This is a fundamental difference from the QCA framework, and may explain the relatively high efficiency targets proposed by some Victorian water businesses in recent determinations.
- Some regulatory decisions (e.g., OTTER's 2023 decision for TasWater and the ICRC's 2023 decision for Icon Water) determined the productivity growth rate by reference to decisions by other regulators, which reflect both frontier shift and catch-up efficiency targets.
- The productivity growth rates applied by the ERA was reported incorrectly by the QCA's adviser, KPMG. KPMG advised the QCA in 2018 that the ERA had applied a productivity growth rate of 2.5% p.a. to the Water Corporation. This represents a misunderstanding on KPMG's part. In fact, the ERA has clarified that the productivity growth rate it applied to the Water Corporation is approximately 0.75% p.a. across aggregate opex.

Taking the factors above into account, in our view, recent regulatory determinations would support a productivity growth rate (reflecting frontier shift) that is more in the range of 0% p.a. to 0.8% p.a. as shown in **Table 5**.

Table 5: Relevant regulatory decisions considered

Decision	Reference	Productivity growth rate
ERA – Water Corporation (2017)	The efficient costs and tariffs of the Water Corporation, Aqwest and Busselton Water, Final Report	0.75% p.a.
ESCOSA – SA Water (2020)	SA Water Regulatory Determination 2020, Final Determination: Statement of Reasons	0.5% p.a.

27 ERA, *Inquiry into the efficient costs and tariffs of the Water Corporation, Aqwest and Busselton Water, Final Report, 10 November 2017*, pp. 36-37

Decision	Reference	Productivity growth rate
ESCOSA – SA Water (2024)	SA Water Regulatory Determination 2024, Draft Decision: Statement of Reasons	0.36% p.a.
IPART – Sydney Water (2020)	Review of prices for Sydney Water, Final Report	0.8% p.a.
IPART – WaterNSW's Greater Sydney prices (2020)	Review of prices for Water NSW Greater Sydney, Final Report	0.8% p.a.
IPART – Hunter Water (2020)	Review of prices for Hunter Water Corporation from 1 July 2020, Final Report	0.5% p.a.
IPART – Water Administration Ministerial Corporation (2021)	Review of prices for the Water Administration Ministerial Corporation from 1 October 2021 to 30 June 2025, Final Report	0.7% p.a.
IPART – Central Coast Council (2022)	Review of Central Coast Council water prices – Summary, Final Report	0.7% p.a.
IPART – WaterNSW's Murray to Broken Hill Pipeline (2022)	Review of WaterNSW's prices for the Murray River to Broken Hill Pipeline, Final Technical Report	0.7% p.a.
IPART – WaterNSW's rural bulk water prices (2022)	Review of Water NSW's rural bulk water prices From 1 October 2021 to 30 June 2025, Final Report	0.7% p.a.
IPART – Essential Water (2022)	Review of Essential Water's prices for water and wastewater services in Broken Hill, Final Technical Report	0.7% p.a.
IPART – Sydney Desalination Plant (2023)	Sydney Desalination Plant Pty Ltd Review of prices to apply from 1 July 2023, Final Report	0.7% p.a.
QCA – Sun Water (2020)	Rural irrigation price review 2020-24 Part B: Sunwater, Final Report	0.2% p.a.
QCA – Seqwater (2020)	Rural irrigation price review 2020–24 Part C: Seqwater, Final Report	0.2% p.a.
QCA – Seqwater (2022)	Seqwater Bulk Water Price Review 2022–26	0% p.a.*

*Source: Various regulatory decisions. Note: Whilst not stated explicitly in all decisions, we understand that the productivity growth rates in the decisions reported in this Table are compound rather than static rates. * The QCA applied no efficiency target (i.e., 0% productivity rate) in this decision as Seqwater had proposed a credible efficiency program setting out a pathway to reveal efficient costs over the regulatory period.*

5 Overall estimate of productivity

In this report, we have:

- Estimated the historical productivity growth rate of Australian water distribution businesses of similar scale to GAWB, using SFA; and
- Investigated recent, relevant regulatory precedent on the productivity growth rates adopted by regulators in Australia in order to reflect frontier shift efficiency.

The estimates of the productivity growth rate using these different methods are summarised in **Table 6**.

Table 6: Summary of evidence

Approach	Conclusion on productivity growth rate
SFA estimates of historical productivity growth rate of Australian water distribution businesses of comparable scale to GAWB	-0.3% p.a. to -1.1% p.a.
Recent regulatory precedent	0% p.a. to +0.8% p.a.

Source: Frontier Economics

Given this evidence, we consider that it would be reasonable for the QCA to apply an annual productivity growth rate (reflecting frontier shift efficiency) of +0.2% p.a. This rate would be consistent with the productivity growth rate applied by the QCA to:

- Seqwater when setting its bulk water charges over the 2022-26 regulatory period; and
- Seqwater and Sun Water when setting prices relating to the supply of water for rural irrigation services.

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