Queensland Competition Authority

Inflation forecasting

March 2021

SUBMISSIONS

Public involvement is an important element of the decision-making processes of the Queensland Competition Authority (QCA). Therefore, submissions are invited from interested parties concerning this issues paper. The QCA will take account of all submissions received within the stated timeframes.

Submissions, comments or inquiries regarding this paper should be directed to:

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1   ABOUT THE REVIEW

1.1   Why are we undertaking this review?

The treatment and estimation of expected inflation can have significant impacts on the revenues of regulated entities and the prices paid by their customers.

We currently estimate expected inflation by combining Reserve Bank of Australia (RBA) forecasts where available in the short-term and the midpoint of the RBA target band thereafter. In recent reviews, we have estimated expected inflation over a 10-year term for the purposes of indexing the regulatory asset base (RAB) and applying an associated adjustment to revenue.[1] Our method of forecasting inflation has been subject to some discussion in our recent regulatory reviews.[2]

Our final position paper will provide guidance to stakeholders on what we consider are the appropriate data sources and approach for estimating inflation in future regulatory reviews.

1.2   What is inflation?

Inflation is the general increase in prices in the economy over time. Forecast inflation is used to index the RAB and apply an associated inflation adjustment to revenue, derive input price growth, and apply price smoothing to maintain prices in real terms.

1.3   Scope of the review

This review covers appropriate methods for estimating expected inflation, for all uses in revenue and price modelling.

1.4   Review process

We are seeking stakeholders' views on the appropriate method for estimating expected inflation in our future regulatory reviews and on any other issues that they propose we should consider in our estimation of expected inflation. We invite submissions on any aspect relating to our consideration of inflation matters by **30 April 2021**.

An indicative timeframe for key milestones for this review is provided below.

Initial stage	Mid-stage	Final stage
Issues paper March 2021	Draft position paper June 2021	Final position paper September 2021
Stakeholder submissions due 30 April 2021	Stakeholder submissions due July/August 2021	

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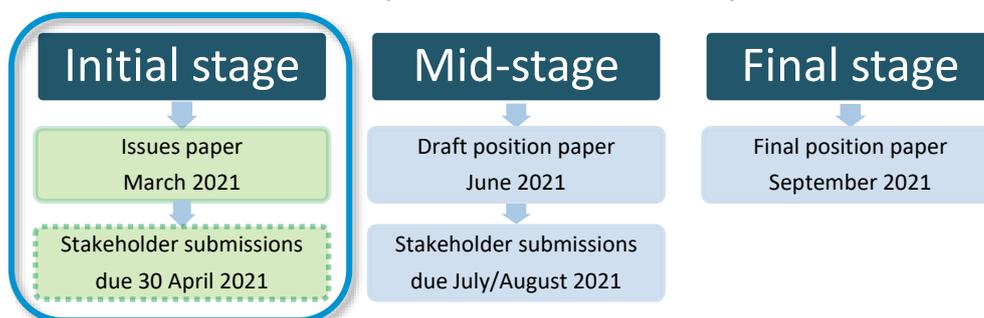
[1] QCA, *Queensland Rail 2020 draft access undertaking*, decision, 2020, p. 75; QCA, *GAWB price monitoring 2020–25*, final report, 2020, p. 22.

[2] For example, QCA, *Aurizon Network's 2017 draft access undertaking*, decision, 2018, pp. 56–68; QCA, *Queensland Rail 2020 draft access undertaking*, decision, 2020, pp. 76–77; QCA, *GAWB price monitoring 2020–25*, final report, 2020, pp. 22–23.

1.5   Consultation questions

We invite stakeholders to comment on the following specific consultation issues:

(1)   Over what term should we forecast the inflationary gain deduction we use to derive the 'return on capital' component of allowable revenues?

(2)   Should we use the same expected inflation estimate (including the use of the same inflation forecasting term) for all purposes when modelling prices, or should we derive a different forecast inflation estimate for each purpose? Under what circumstances should we apply an input cost escalator that differs from our expected CPI inflation measure?

(3)   Should we maintain our existing approach to estimating expected inflation?

(4)   If we continue to use short-term RBA forecasts in our forecasting methodology, should we consider using a multi-year transition path to our estimate of long-term inflation expectations? If so, what factors should we consider in our choice of transition path?

(5)   How should we derive medium- to long-term inflationary expectations, particularly over a shorter forecasting period where expected inflation may not reach the midpoint of the RBA's target range?

(6)   Should we consider the use of market-based measures of inflation expectations as either the primary estimation method or to derive long-term inflationary expectations?

(7)   If we continue to use RBA forecasts in our estimation methodology, are there certain circumstances where the RBA's trimmed mean forecast should be used?

(8)   When using expected inflation measures for the different purposes in revenue and price modelling, are there local considerations that could make the Brisbane consumer price index (CPI) preferable to the national CPI?

Stakeholders are also invited to comment on any other matters that they consider are relevant to our estimation of expected inflation.

2 INFLATION AND THE REGULATORY FRAMEWORK

In Australian regulatory practice, investors (of regulated firms) generally earn a regulated rate of return to compensate them for the opportunity cost of funds they provide for investment in regulated infrastructure assets. Since investment in long-lived assets requires an expectation that the rate of return will keep pace with the rate of inflation in the economy, the regulatory framework takes investors' inflationary expectations into account when determining the regulated rate of return.

The framework also ensures that other costs of regulated businesses, such as efficient operating expenditure (opex), keep pace with suitable escalation rates, including the rate of inflation in the economy, where appropriate.

By taking account of inflation in this way, the framework supports incentives for appropriate investment and operational decisions.

2.1 Inflation and the regulated rate of return

We typically estimate the rate of return (or return on capital) as the weighted average cost of capital (WACC), which is a weighted average of the regulated firm's costs of equity and debt.[3]

Under our general approach to estimating the return on capital component of allowable revenues, we undertake the following steps at the start of each regulatory period:

- Estimate the post-tax nominal WACC that implicitly includes expected inflation.

- Calculate the nominal return on capital by multiplying the opening regulatory asset base (RAB) by the nominal WACC.

- Deduct an 'inflationary gain' from allowable revenues. This avoids the double counting of inflation that would otherwise occur from indexing the RAB by inflation and applying a nominal rate of return that also embodies inflation.

- Roll forward the RAB by indexing the RAB by forecast inflation and deducting depreciation.

At the end of a regulatory period, we update the indexation of the RAB over the regulatory period to reflect actual rather than forecast inflation (Figure 1).

Figure 1   Inflation adjustment for return on capital component of revenues

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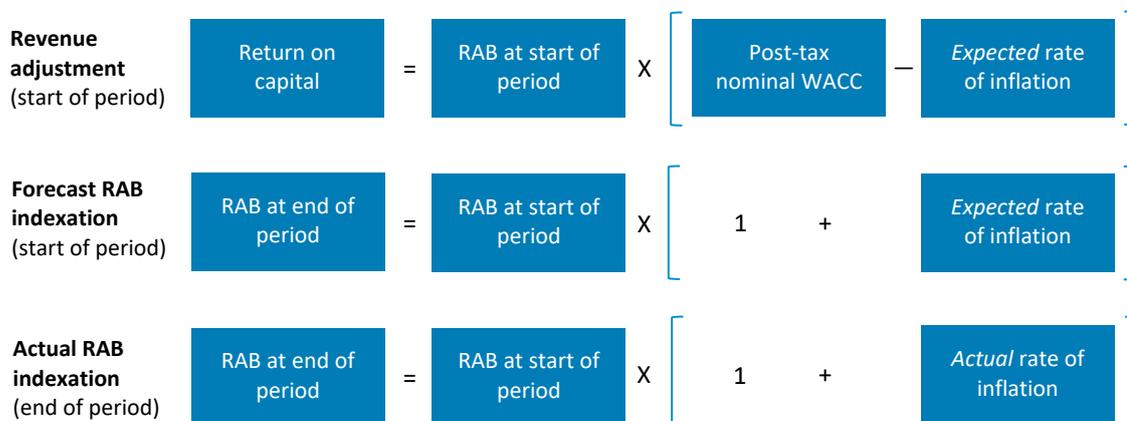
[3] We are currently reviewing our approach to determining reasonable rates of return for regulated entities.

As a simple example, imagine an asset that is used to generate income for a one-year period, with an estimated nominal rate of return of 7 per cent. Imagine further that investors expect inflation to be 2 per cent over the period, such that the expected real rate of return is around 5 per cent.

Under our existing approach, the real rate of return will remain constant at around 5 per cent, but the actual (ex post) nominal rate of return will vary with actual inflation. If actual inflation turns out to be 1 per cent, the nominal rate of return will be around 6 per cent.[4] Similarly, if actual inflation is 3 per cent, the nominal return will be around 8 per cent.

In our previous irrigation water pricing reviews, we have used the alternative renewals annuity approach (rather than a RAB-based approach) to recover renewal capital expenditure. Under this approach, we used our estimate of expected inflation to derive the real post-tax WACC from the nominal post-tax WACC using the Fisher equation.[5] We have then used this real post-tax WACC as the discount rate in calculating the renewals annuity in real terms.

2.1.1   Inflation objectives

For water pricing investigations, the *Queensland Competition Authority Act 1997* (QCA Act) (ss. 26(1)(f) and 170ZI(1)(i)) states that we must have regard to the effect of inflation. The pricing principles in access provisions (s.168A) do not explicitly state that we must have regard to the effect of inflation, but instead require that we have regard for prices at least meeting the efficient costs of providing access to the service.

Consistent with other Australian regulators, our existing approach targets an approximate real rate of return on investments in regulated infrastructure assets.[6] We deduct expected inflation from the nominal return on capital so that the regulated firm is effectively receiving the initial real rate of return (as shown in Figure 1). We then provide inflation compensation by indexing the RAB over time using actual inflation.

Our existing real rate of return approach assumes that investment in long-lived infrastructure assets requires an (ex ante) expectation of real returns that are achievable. In this way, a regulatory framework that targets ex ante real returns is consistent with efficient costs.

2.1.2   Term for forecasting inflation

The appropriate term is required to derive the expected rate of inflation. In our current approach, there is a mismatch in the term of expected inflation between:

- the 10-year expected inflation implicit in the 10-year nominal risk-free rate in the WACC

- the expected inflation over the term of the regulatory period for the RAB roll-forward.

In recent regulatory reviews, we have forecast the expected inflation rate over a 10-year period for consistency with the period over which we estimated the nominal WACC.[7] We considered that a 10-year expected rate of inflation was the appropriate adjustment so that the regulated firm

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[4] Comprising an initial real return of 5 per cent in annual allowable revenues plus actual inflation of 1 per cent included in the ex post RAB indexation.

[5] The Fisher equation outlines the relationship between the nominal rate of return, inflation and the real rate of return.

[6] Like the AER, we implement this using a nominal framework including a post-tax nominal WACC. Other Australian regulators (including the ACCC, ERAWA, IPART and ESCOSA) implement this using a real framework.

[7] See, for example, QCA, *GAWB price monitoring 2020–25*, final report, 2020.

received the 10-year initial real return in allowable revenues as well as compensation for actual inflation via ex post indexation of the RAB.[8]

However, because of the mismatch, the inflation gain deducted from revenues determined at the start of each regulatory period (based on 10-year expected inflation) will not, in expectation, necessarily match the amount of actual inflation by which the RAB will be indexed over the regulatory period.[9] As a result, the nominal return expected to be received by investors may differ from the nominal WACC. The extent of the mismatch will depend on the term structure of inflationary expectations.[10]

In part for this reason, the Australian Energy Regulator (AER) has recently adopted a regulatory term matching approach to estimating expected inflation.[11] The Independent Pricing and Regulatory Tribunal (IPART) also employs this approach.[12]

Table 1 compares the inflation term options in calculating the return on capital.

Table 1   Comparison of inflation term options

Feature	*Term matches rate of return (10 years)*	*Term matches regulatory period (3–5 years)*
Outcome being targeted	Real return (10-year real WACC) in allowed cash flows derived as 10-year nominal WACC less 10-year expected inflation.[a] Ex post nominal WACC will vary with inflation outcomes.	Real return in allowed cash flows derived as 10-year nominal WACC less shorter-term (3–5 years) expected inflation. Ex post nominal WACC will vary with inflation outcomes.
Ex ante expected return	10-year real WACC and shorter-term (3–5 years) expected inflation. Ex ante nominal return mismatch over the regulatory period.	10-year nominal WACC return over the regulatory period (equivalent to 10-year real WACC and 10-year expected inflation).

a *This target is approximate, as the Fisher equation is not used to derive the real WACC.*

Question 1

Over what term should we forecast the inflationary gain deduction we use to derive the 'return on capital' component of allowable revenues?

2.2   Other uses of inflation

We generally estimate opex of regulated businesses in nominal terms by estimating an efficient base year for opex, then escalating this base year amount using input cost escalators over the duration of the regulatory period. We also convert the efficient capital expenditure (capex) program of regulated businesses from real terms to nominal dollars using input cost escalators.

Our previous reviews have used expected consumer price index (CPI) inflation as an input cost escalator (or component of the input cost escalator) for some input cost categories. However, we

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[8] This was the approach the AER used until recently. It is also adopted by other regulators including the Essential Services Commission of South Australia (ESCOSA).

[9] Lally, M, *Review of the AER's Inflation Forecasting Methodology*, 2020, pp. 4–9.

[10] For example, if inflationary expectations over a 10-year horizon are higher than inflationary expectations over the shorter regulatory period, then more inflation would tend to be deducted from revenues relative to the inflation by which the RAB is expected to be actually indexed.

[11] AER, *Regulatory treatment of inflation*, final position paper, 2020, pp. 35–48. The AER also considered that the use of a regulatory term matching approach was more responsive to changes in current market conditions.

[12] IPART, *Review of our WACC method*, final report, 2018, pp. 76–77.

have sometimes used input-specific and/or sector-specific cost escalators for other input cost categories such as labour and electricity costs.

In addition, we also use a forecast measure of inflation to smooth revenue or price changes over the regulatory (or longer-term) period.

Table 2 summarises the different uses of expected inflation in revenue and price modelling.

Table 2   Various uses of expected inflation in revenue and price modelling

Use	Approach in previous QCA reviews
RAB-based capital costs calculation	We have used an estimate of expected CPI inflation to escalate the opening RAB over the regulatory period (at the time of our price review) and deduct inflationary gain amount from the annual allowable revenues.
Renewals annuity calculation	In our previous irrigation price reviews, we have used an estimate of expected CPI inflation to derive the 10-year real post-tax WACC from the 10-year nominal post-tax WACC using the Fisher equation. We used this real post-tax WACC as the discount rate in calculating the renewals annuity in real terms.
Opex and capex escalation	We have used an estimate of expected CPI inflation to escalate base year opex for some input cost categories (such as operations costs and the non-labour component of maintenance costs) over the regulatory period. We have also used input-specific and/or sector-specific cost escalators for some cost components (including labour and electricity costs) where underlying cost pressures differ from expected CPI inflation. We have also used expected CPI inflation and other cost escalators to convert forecast capex over the regulatory period from real to nominal terms. For example, in our recent Gladstone Area Water Board (GAWB) review we applied our forecast Queensland wage price index to the labour cost component of GAWB's capital program.
Revenue/price smoothing	In our recent GAWB and irrigation price reviews, we used an estimate of expected CPI inflation to derive prices that increase by expected inflation over the regulatory period and ensure the present value of expected revenue from prices and the revenue requirement over the regulatory period are equal.

Sources: QCA, *GAWB price monitoring 2020–25*, *final report, 2020*; QCA, *Queensland Rail 2020 draft access undertaking*, *decision, 2020*; QCA, *Rural irrigation price review 2020–24*, *final report, 2020*.

Question 2

Should we use the same expected inflation estimate (including the use of the same inflation forecasting term) for all purposes when modelling prices, or should we derive a different forecast inflation estimate for each purpose? Under what circumstances should we apply an input cost escalator that differs from our expected CPI inflation measure?

3 METHODS FOR ESTIMATING EXPECTED INFLATION

3.1 Assessment approach

Taking into consideration the matters we are required to consider under the QCA Act in our investigations, the appropriate method of estimating expected inflation should be:

- accurate—the method should aim to deliver accurate estimates of expected inflation. Given that expected inflation is unobservable, it is desirable that the method minimises differences between forecast and actual over the forecasting period—that is, the method should provide the best unbiased estimate of expected inflation over the forecasting period

- robust—the method should produce high quality estimates of expected inflation under all economic circumstances

- simple, transparent and replicable—the method should derive expected inflation using a transparent process that is understood by key stakeholders.

3.2 Information sources

Expected inflation is not observable and therefore needs to be estimated. Possible measures of expected inflation include:

- RBA short-term inflation forecasts—the RBA publishes one-year and two-year ahead forecasts for CPI and trimmed mean (or underlying) inflation on a quarterly basis

- survey-based forecasts—these measures compile information provided by different types of professional forecasters on their inflation expectations over a defined period

- market-based forecasts—these measures seek to derive market participants' expectations for inflation from financial market data on inflation swaps or bonds

- model-based forecasts—standard models such as a single-equation standard Phillips curve model can be used to forecast short-term inflation.

There are two key surveys of professional forecasters:

- the quarterly RBA survey of market economists for one year, two years and over the long term (average annual inflation over the next 5 to 10 years ahead)

- Consensus Economics' surveys of market economists covering one, two, three, four and five years ahead and covering long-term expectations (average annual inflation over the period 6 to 10 years ahead).

These forecasters are well-informed and invest significant resources into developing their expectations for inflation. The measures have long and consistent time series. However, the relatively small number of respondents may not be representative of the broader population.[13]

Survey-based forecasts tend to be licenced and subscription-based products, with only some of the survey-based measures publicly available. The RBA publishes short-term inflation expectations (one and two years ahead) based on its survey of market economists and the survey

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[13] Moore, A, *Measures of Inflation Expectations in Australia*, RBA Bulletin, December 2016, p. 25.

of union officials.[14] The RBA also publishes long-term inflation expectations in graph form from Consensus Economics (average over 6 to 10 years ahead) and from market economists and union officials (average over the next 5 to 10 years ahead).[15]

The RBA publishes the 10-year break-even inflation rate, as well as individual bond yield data that allows the calculation of break-even inflation over other forecast periods.[16]

3.3 Possible methods for estimating expected inflation

The methods that we will investigate further can be categorised as follows:

- our existing approach, which derives the geometric mean of the RBA's short-term CPI forecasts with an immediate transition to the midpoint of RBA's target band (2.5%) for the remaining years of the adopted inflation term

- a refined version of our existing approach that combines short-term inflation forecasts with alternative options for the transition path and long-term inflation forecast

- the approach of deriving inflation expectations over the term of the forecasting period using market-based measures derived from bond or inflation swap data.

3.3.1 Our existing approach

In recent reviews, we have forecast inflation using publicly available data from the RBA.[17] Our method has taken the geometric mean of the short-term RBA inflation forecast one year and two years out, and the midpoint of the RBA's medium term inflation target range (2.5%) for the remaining years of the forecast period. Other regulators have also recently used this approach.[18]

We have used this approach to estimating expected inflation over long-term periods (10 years), as well as over shorter-term periods, including one-year and the length of the regulatory period.

This method is simple, transparent, and replicable—with all information being publicly available.

> ## Question 3
> Should we maintain our existing approach to estimating expected inflation?

3.3.2 Possible refinements to our existing approach

Most other Australian regulators also estimate forecast inflation using a combination of RBA short-term forecasts with a transition to medium- and long-term inflation estimates.[19]

However, in recent reviews, some regulators have modified this general approach to incorporate a multi-year transition period to the medium-term inflation forecast. In particular:

- The AER modified its existing approach by applying a linear glide path from the RBA short-term inflation forecasts to the midpoint of the RBA's inflation target band (2.5%) in the final year of its 5-year geometric mean.

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[14] RBA, *Statistical Tables*, G3—Inflation Expectations.

[15] For example, RBA, *Statement on Monetary Policy*, February 2021, p. 56, graph 4.15.

[16] RBA, *Statistical Tables*, G3—Inflation Expectations, F2—Capital Market Yields—Government Bonds—Daily.

[17] QCA, *GAWB price monitoring 2020–25*, final report, 2020; QCA, *Queensland Rail 2020 draft access undertaking*, decision, 2020; QCA, *Rural irrigation price review 2020–24*, final report, 2020; QCA, *Aurizon Network's 2017 draft access undertaking*, decision, 2018.

[18] For example: IPART, *Review of prices for Sydney Water from 1 July 2020*, final report, 2020.

[19] See Appendix A for a summary of the inflation forecasting methods used by other Australian regulators.

- The Essential Services Commission of South Australia (ESCOSA) applied a linear glide path from the RBA short-term inflation forecasts to the midpoint of the RBA's inflation target band (2.5%) in year 7 when calculating its 10-year geometric mean.

The AER considered that a multi-year transition path would improve the performance of its approach in periods of economic instability or sustained periods of low or high inflation.[20] ESCOSA adopted a glide path to the long-term inflation target band (rather than the previous one-year transition), given the uncertainty about the transition from the current low inflation environment.[21]

There will sometimes be uncertainty as to when inflation will return to the RBA's target range.

The RBA has defined its inflation target as a medium-term average rather than as a rate (or band of rates) that must be held at all times. The RBA considers that this allows for the inevitable uncertainties that are involved in forecasting, and lags in the effects of monetary policy on the economy, noting that experience in Australia and elsewhere has shown that inflation is difficult to fine-tune within a narrow band.[22]

Inflation has been subdued for a few years now (Figure 2), remaining below the RBA's target band of 2 to 3 per cent. In its February 2021 meeting, the RBA noted that while economic recovery from the covid-19 pandemic was expected to continue, the level of output remained noticeably below its pre-pandemic trajectory and that the high unemployment rate and considerable spare capacity in the economy were expected to result in subdued wages growth and inflation over coming years.[23]

Figure 2   Australia—CPI inflation (year-end on a quarterly basis)
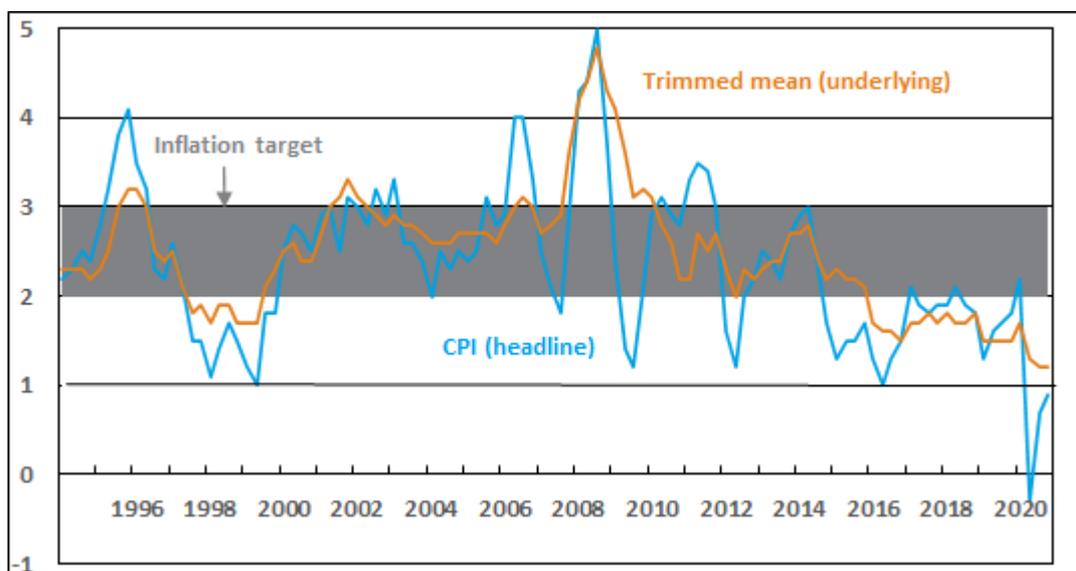
Notes: Excludes interest charges. Adjusted for the tax changes of 1999–2000.

Sources: RBA Statistical Table G1 – Consumer Price Inflation; ABS, Consumer Price Index, Australia, December 2020, Table 8: CPI: Analytical Series, Weighted Average of Eight Capital Cities, cat. no. 6401.0.

At the time of writing, longer-term bond yields in the United States have increased significantly on the back of positive news on vaccines and the likelihood of significant fiscal stimulus. As noted

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[20] AER, *Regulatory treatment of inflation*, final position paper, 2020, p. 6.

[21] ESCOSA, *SA Water Regulatory Determination 2020,* final determination: statement of reasons, 2020, pp. 223–224.

[22] RBA, *Inflation Target*, viewed 26 February 2021.

[23] RBA, *Minutes of the Monetary Policy Meeting of the Reserve Bank Board,* 2 February 2021, viewed 3 March 2021.

by the RBA, this increase in bond yields partly reflects an increase in expected inflation over the medium term, to rates that more closely reflect central banks' targets.[24] However, while there has been a similar increase in the Australia bond market amid the ongoing economic recovery, the RBA considers that it will be some time before the labour market is tight enough to generate wage increases consistent with achieving the inflation target. The RBA expects this not to be achieved until 2024 at the earliest.[25]

There is therefore some uncertainty as to when inflation will return to the target range. There is also some evidence that inflation expectations may be temporarily influenced by changes in the actual rate of inflation[26] suggesting incomplete anchoring of expectations in the shorter term.[27]

Question 4

If we continue to use short-term RBA forecasts in our forecasting methodology, should we consider using a multi-year transition path to our estimate of long-term inflation expectations? If so, what factors should we consider in our choice of transition path?

Both the AER and ESCOSA set the length of the transition (or glide) path based on when they expected inflation to return to the midpoint of the RBA's inflation target band:

- The AER said that its analysis of proprietary and confidential data supported its conclusion that expected inflation would reach 2.5 per cent by about year 5.[28]

- ESCOSA said that the length of its glide path (ending in 2026–27) was consistent with the Consensus Economics projection of average long-term inflation of around 2.5 per cent over the period 6 to 10 years ahead (i.e. 2026 to 2030) in the RBA's May 2020 Statement on Monetary Policy.[29]

The RBA has previously clarified that the target of inflation averaging between 2 and 3 per cent does not imply that inflation should average the midpoint of 2.5 per cent.[30] The RBA recently noted:

> Consensus and market economists' long-term inflation expectations are around 2–2½ per cent and remain consistent with the Bank's medium-term inflation target.[31]

If we are seeking to estimate expected inflation over the regulatory term, this may require estimates of expected inflation up to the third (for a 3-year regulatory term) to fifth year ahead. However, there is some uncertainty as to whether, in the short-to-medium term, an anchor of 2.5 per cent remains appropriate. In its March 2021 meeting, the RBA said it did not expect actual inflation to be sustainably within the 2 to 3 per cent target range for at least three years.[32]

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[24] RBA, *Statement by Philip Lowe, Governor: Monetary Policy Decision*, media release, 2 March 2021, viewed 3 March 2021.

[25] RBA, *Statement by Philip Lowe, Governor: Monetary Policy Decision*, media release, 2 March 2021.

[26] See McKibbin, WJ and Panton, AJ, *Twenty-five Years of Inflation Targeting in Australia: Are There Better Alternatives for the Next 25 Years?*, Hutchins Centre on Fiscal and Monetary Policy at Brookings Working Paper no. 41, 2018, p. 16.

[27] One would expect that if inflation expectations were well-anchored, actual inflation should not influence (or be influenced by) long-term inflation expectations.

[28] AER, *Regulatory treatment of inflation*, final position paper, 2020, p. 50.

[29] ESCOSA, *SA Water Regulatory Determination 2020*, final determination: statement of reasons, 2020, pp. 227–229.

[30] Kearns, J and Lowe, P, 'Overview of the decade', in RBA, *Australia's prosperous 2000s: Housing and the Mining Boom*, Research Discussion Paper (RDP) 2011-07, 2011, viewed 26 February 2021.

[31] RBA, *Statement on Monetary Policy*, February 2021, p. 55.

[32] RBA, *Minutes of the Monetary Policy Meeting of the Reserve Bank Board*, 2 March 2021.

> ### Question 5
> How should we derive medium to long-term inflationary expectations, particularly over a shorter forecasting period where expected inflation may not reach the midpoint of the RBA's target range?

3.3.3   Market-based methods

Market-based measures of inflation expectations can be derived from bond or inflation swap data. Market participants have strong and direct incentives to form accurate expectations for inflation, so they are likely to be well informed.

The break-even method can be applied to estimate expected inflation using bond yield data. The break-even inflation rate is derived by applying the Fisher equation[33] to nominal and indexed Commonwealth Government bond yields over a specified averaging period.

Break-even inflation can generally be replicated by stakeholders, as bond yield data is publicly available on the RBA website. However, nominal and indexed bonds with the same maturity dates are typically not available, so interpolation is required.

The fixed price of an inflation swap can also provide a market-based estimate of long-term inflation expectations. In an inflation swap, counterparties agree to exchange payments that are linked to the predetermined fixed inflation rate and actual inflation rate. CPI is the reference for the actual inflation rate used for the inflation swap, and the fixed price paid (the swap rate) can be interpreted as a forecast of inflation.

Inflation swaps are not transacted through organised exchanges, so comprehensive data is not readily available. Estimates may not be representative, as inflation swaps may reflect the views of a small number of market makers. Given that this market is not particularly active, prices may not always be based on actual transactions.[34]

In previous reviews we noted biases that may be incorporated in market-based measures.[35] Market-based estimates include an inflation risk premium[36], which may cause inflation expectations to be biased upwards or downwards. There is evidence that the inflation risk premium varies over time, which makes it hard to predict and account for it in calculations. Indexed bonds may include a liquidity risk premium[37], which may bias inflation expectations downwards using the break-even method.

> ### Question 6
> Should we consider the use of market-based measures of inflation expectations as either the primary estimation method or to derive long-term inflationary expectations?

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[33] The Fisher equation outlines the relationship between the nominal rate of return, inflation and the real rate of return.

[34] Moore, A, *Measures of Inflation Expectations in Australia*, RBA Bulletin, December 2016, pp. 27–29.

[35] QCA, *Aurizon Network's 2017 access undertaking*, decision, 2018, pp. 52–55; *Queensland Rail's 2020 access undertaking*, decision, 2020, p. 76.

[36] An investor who is risk averse would require a positive (or if expectations are deflationary, a negative) risk premium on nominal bonds (which carry inflation risk) as compared to indexed bonds to be indifferent between the two. The fixed price of an inflation swap also includes an inflation risk premium.

[37] This represents the risk to investors of lower certainty of selling the asset quickly without affecting the price since the market for indexed bonds is comparatively illiquid when compared to the market for nominal bonds.

4 OTHER METHODOLOGICAL ISSUES

4.1 Measure of inflation

Under our standard approach to the treatment of inflation, the initial real rate of return is adjusted for actual (ex post) inflation outcomes by indexing the RAB by actual inflation. The RAB therefore represents the recovery of financial investment, as opposed to the value of physical capital reflecting the productive capacity of the assets. Consistent with this view, regulators in Australia generally index the RAB in terms of CPI inflation rather than asset-specific cost indices.[38]

The RBA produces forecasts of two key measures of CPI inflation—CPI (or 'headline') and trimmed mean inflation. CPI is the RBA's forecasts of the Australian Bureau of Statistics' (ABS's) national, all groups, CPI.

Trimmed mean inflation is the RBA's key forecast of underlying inflation. It seeks to reduce the impact of irregular or temporary price changes in the components of the CPI. This estimate is derived by:

- ranking the expenditure classes of goods and services in the CPI in order of their quarterly price changes (in seasonally adjusted terms)

- using the weighted average of the percentage changes from the middle 70 per cent of the distribution of rankings, with expenditure classes at the lower and upper ends 'trimmed'.

> ### Question 7
> If we continue to use RBA forecasts in our estimation methodology, are there certain circumstances where the RBA's trimmed mean forecast should be used?

4.2 National or state capital inflation

In our recent reviews we used the national estimate of expected CPI inflation for forecast RAB indexation, the inflationary gain adjustment, and for escalation of some input cost components. We have, though, also used other Brisbane-based measures for some cost escalation factors such as the wage price index.[39]

However, we have generally accepted Brisbane CPI as an appropriate measure to index the RAB over the regulatory period to reflect actual inflation, except for the use of national CPI under previous access undertakings for DBCT Management.[40] However, other regulators tend to use national CPI for actual inflation when indexing RAB over the regulatory period.

> ### Question 8
> When using expected inflation measures for the different purposes in revenue and price modelling, are there local considerations that could make the Brisbane CPI preferable to the national CPI?

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[38] Similarly, regulators in the UK (such as Ofwat and Ofgem) escalate the RAB using the UK's retail price index.
[39] For example, see QCA, *Rural irrigation price review 2020–24*, final report, 2020.
[40] QCA, *Aurizon Network's 2017 access undertaking*, decision, 2018; QCA, *Queensland Rail's 2020 access undertaking*, decision, 2020; QCA, *Seqwater Bulk Water Price Review*, final report, 2018, pp. 53–54; QCA, *DBCT Management's 2015 draft access undertaking*, final decision, 2016, p. 163.

GLOSSARY

ABS	Australian Bureau of Statistics
ACCC	Australian Competition and Consumer Commission
AER	Australian Energy Regulator
capex	capital expenditure
CPI	consumer price index
ESC	Essential Services Commission
ESCOSA	Essential Services Commission of South Australia
ERAWA	Economic Regulatory Authority, Western Australia
GAWB	Gladstone Area Water Board
ICRC	Independent Competition and Regulatory Commission
IMF	International Monetary Fund
IPART	Independent Pricing and Regulatory Tribunal
opex	operating expenditure
QCA	Queensland Competition Authority
RAB	regulatory asset base
RBA	Reserve Bank of Australia
WACC	weighted average cost of capital

APPENDIX A: FORECASTING METHODS USED BY OTHER REGULATORS

The table below summarises the inflation forecasting methods recently used by other Australian regulators.

Table 3   Inflation forecasting methods used by other regulators

Regulator	Approach
QCA	Our approach in recent reviews has been to derive the 10-year geometric mean of the RBA's short-term CPI forecasts with an immediate transition to the midpoint of RBA's target band (2.5 per cent) for the remaining years of the adopted inflation term.
AER	In the final position paper on its inflation treatment in December 2020, AER decided to estimate expected inflation as the 5-year geometric mean of 1-year and 2-year forecasts from the RBA's Statement on Monetary Policy with 3-year linear glide path (i.e. until year 5) to the midpoint of the RBA target band (2.5%).
ESCOSA	In its review of prices for SA Water from 1 July 2020, ESCOSA estimated expected inflation as the 10-year geometric mean of 1-year and 2-year forecasts from the RBA's Statement on Monetary Policy with 5-year linear glide path (i.e. until year 7) to the midpoint of the RBA target band (2.5%).
IPART	In its review of prices for Sydney Water from 1 July 2020, IPART estimated expected inflation as the 4-year geometric mean of 1-year forecast from the RBA's Statement on Monetary Policy with immediate transition to the midpoint of the RBA target band (2.5%).
ESC	In its final decision for its 2020 water price review for Western Water, ESC estimated expected inflation based on the midpoint of: • the 10-year geometric mean of the RBA forecast CPI for one year and two years ahead and the midpoint of the RBA target inflation band from 3 to 10 years ahead • the 'bond breakeven' inflation rate was implied by the difference between the yields on 10-year nominal and indexed (inflation-linked) Commonwealth Government Securities.
ERAWA	ERAWA generally applies the break-even method to estimate expected inflation, using the Fisher equation and the observed yields of nominal and indexed Treasury bonds.
ICRC	In the draft report for its review of WACC methodologies, ICRC proposed to adopt the AER's approach to forecasting inflation. In its 2018 review of Icon Water, ICRC used the midpoint of the RBA's target band for inflation of 2 to 3 per cent to determine a forecast inflation rate of 2.5 per cent.

Sources: AER, Regulatory treatment of inflation, final position paper, 2020, p. 6; IPART, Review of our WACC method, final report, 2018, pp. 76–80; IPART, Review of prices for Sydney Water from 1 July 2020, final report, 2020, pp. 65–72; ESC, Western Water final decision—2020 Water Price Review, 2020, p. 9; ESCOSA, SA Water Regulatory Determination 2020, final determination: statement of reasons, 2020, pp. 223–229; ERAWA, 2018 and 2019 Weighted Average Cost of Capital, For the Freight and Urban Networks, and the Pilbara Railways, final determination, 2019, pp. 79–80; ICRC, Regulated water and sewerage services prices 2018–23, final report, 2018, p. 107; ICRC, Review of Methodologies for the Weighted Average Cost of Capital, Report 1 of 2021, draft report, 2021, p. 44.

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