BEST ESTIMATE OF INFLATION EXPECTATIONS: ASSESSMENT OF APPROACHES

ENERGY NETWORKS AUSTRALIA

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FINAL REPORT

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1. INTRODUCTION AND BACKGROUND

Energy Networks Australia (ENA) has commissioned Cambridge Economic Policy Associates (CEPA) to provide a report in response to the AER's 2017 inflation review, including the April 2017 AER discussion paper 'Regulatory treatment of inflation' and an ACCC/ AER working paper on setting an inflation estimate[1].

The purpose of this report is to assess the best approaches to estimating market expected inflation only. While the regulatory framework and risk allocation is an important part of the AER's inflation review, this is not within the scope of this paper. Specifically, the ENA has asked us to:

1. Establish criteria for identifying best practice approaches to estimating expected inflation.
2. Review practices in other jurisdictions.
3. Taking Australian conditions into account, identify options, including improvements to the AER's current approach, that are most likely to lead to the most empirically accurate inflation expectations and meet best practice.
4. Assess the options against the criteria, clearly identifying any advantages and disadvantages of each approach.
5. Identify the approach that gives rise to the best estimate of market expected inflation.

1.1. What do the NER and NGR say?

The National Electricity Rules (NER) set out some constraints around the choices available to the AER in determining allowed revenues, including the allowed return. These are important for understanding the role of inflation in the AER's regulatory framework and determining the best estimate of inflation expectations, the focus of this report. The NER stipulate that:

- the allowed rate of return is to be determined using a nominal rate[2];
- the Regulatory Asset Base (RAB) is to be indexed in each year of the regulatory period with a suitable measure of inflation[3];
- the value of the RAB should be rolled forward from one regulatory control period to the next using actual inflation[4]; and

[1] ACCC/ AER Working Paper no11, 'Consideration of best estimates of expected inflation: comparing and ranking approaches', April 2017
[2] NER rr 6.5.2(d)(2) and 6A.6.2(d)(2)
[3] NER rr 6.2.3(c)(4) and 6A.2.4(c)(4)
[4] NER rr 6.5.1(e)(3) and 6A.6.1(e)(3)

- there should be a negative adjustment in the building block model to offset the impact of indexation in the ex-ante model setting (to prevent double counting)[5].

While the National Gas Rules (NGR) are less prescriptive regarding the use of expected inflation than the NER, we note that they require that:

- Financial information provided by a gas network operator must have a recognised basis for dealing with the effects of inflation.[6]
- The depreciation schedule be designed so that an asset is depreciated only once. Depreciation may be adjusted for inflation, if the accounting method approved by the AER permits.[7]
- In relation to the cost of capital, any forecast or estimate must be arrived at on a reasonable basis and represent the best forecast or estimate possible in the circumstances.[8]

1.2. How is inflation used by the AER?

1.2.1. Regulatory framework

The NER dictate that the AER use a nominal Weighted Average Cost of Capital (WACC) and an indexed RAB. The use of a nominal WACC means there is an embedded estimate of inflation in both the cost of debt and equity (which may not be the same).

To avoid double compensation of inflation, the AER use a forecast inflation estimate to measure the expected increase in the RAB through indexation over the regulatory period. This amount is deducted from the depreciation allowance. As such, this offsetting adjustment should be equivalent to using a real WACC and an indexed RAB if the embedded inflation in nominal rates and the AER's forecast are the same.

The building block revenues are calculated in the AER's post-tax revenue model (PTRM), while the roll forward model (RFM) increases the RAB based on actual inflation.

This means there are potentially four different inflation terms involved in setting revenues:

- outturn inflation;
- AER inflation forecast for offsetting adjustment and forecast RAB;
- embedded inflation expectations in nominal cost of debt; and
- embedded inflation expectations in nominal cost of equity.

[5] NER rr 6.4.3(b)(1)(ii) and 6A.5.4(b)(1)(ii)
[6] NGR rr 73 (1), (2) and (3)
[7] NGR rr 89 (1) (d)
[8] NGR rr 74 (1) and (2)

Outturn inflation is based on headline CPI inflation. Further information on the other inflation measures is set out below.

1.2.2. Inflation – embedded in nominal cost of debt

The AER estimate the nominal cost of debt by using a trailing average ('portfolio') approach. This is based on ten-year debt for a BBB+ benchmark in nominal terms.

The nominal cost of debt will have an embedded inflation expectation until the debt matures (i.e. ten years from issuance). As the AER proposes to use a trailing average approach after a transition period, the inflation expectations embedded in the nominal cost of debt will reflect inflation expectations over the trailing average period, not simply the inflation expectations at a point in time.

1.2.3. Inflation – embedded in nominal cost of equity

The AER use ten-year nominal Commonwealth Government Security (CGS) yields over a short period close to the start of the regulatory period to estimate the risk-free rate. The inflation expectations embedded within the nominal rate thus reflect a prevailing view of inflation expectations over this ten-year term.

The MRP is the premium above the risk-free rate and based on the rate of return guidelines, we expect that the inflation term would not be likely to change any of these estimates. The equity beta is neither nominal nor real, with the estimate in the AER's rate of return guidelines not explicitly linked to inflation.

1.2.4. Inflation – AER forecast inflation

The AER's current approach uses forecasts of inflation over a ten-year period to match the term of the securities used in estimating the risk-free rate and cost of debt. A geometric average is used over this ten-year period, with forecasts from the RBA used for the first two years of the period. For the remaining eight years, the mid-point of the RBA's target inflation range (2.0% to 3.0%) is used. This means that the inflation forecast is typically close to the RBA target mid-point i.e. 2.5%.

The AER's previous approach used breakeven inflation, however during the Global Financial Crisis (GFC) fewer issuances and concerns around liquidity of indexed government bonds led to a move away from that methodology. In the decision for SP AusNet Services in January 2008, The AER noted that it *"maintains its view in its draft decision that a market based estimate of inflation is generally preferable to any other method. However, acknowledging the present limitations of both the Fisher equation and inflation swaps, the AER is not aware of a reliable market based alternative that can be mechanistically applied in a similar way to*

these measures. It is in this context that the AER has had to resort to a general approach to forecasting inflation." [9]

As we discuss in Section 4.1.2, since the GFC the Commonwealth Government committed to reissuing index linked bonds and the value of outstanding bonds has increased significantly.

1.3. Principles and implications of current approach

The regulatory framework seeks to compensate investors for forecast inflation for the duration of the regulatory period, after which there is a reset and outturn inflation is used to update the RAB (in the RFM).

The NER prescribe that forecast inflation should use *"a method that the AER determines is likely to result in the best estimates of expected inflation."*[10] The NGR state that an estimate must be arrived at on a reasonable basis and must represent the best forecast or estimate possible in the circumstances[11].

This is not necessarily the same as an approach that provides the best estimates of outturn inflation, which is an important distinction to consider when undertaking an assessment of the most suitable methodology. This means that analysis of how well an inflation expectations measure has performed against outturn inflation does not necessarily provide clear evidence of its performance as an estimate of expected inflation at the point in time it is made.

Based on the terms contained within the NER and NGR, NSPs and/or customers will face the risk of mismatches between forecast and actual inflation ('forecasting risk'). One possible interpretation of the rationale for the use of 'best estimates of expected inflation' in the NER is that this would enable an NSP to best manage the risk allocated to it in a cost-efficient way.

In their submissions to the AER, the NSPs cited that there are two sources of potential forecasting errors that will lead to windfall gains or losses for the NSPs in the absence of risk mitigation/ management:

- *Embedded inflation versus AER inflation forecast* - the nominal WACC contains embedded estimates; if the AER inflation forecast is above (below) this, then the NSPs will receive reduced (increased) revenues.
- *Embedded inflation versus outturn inflation* - if outturn inflation is higher (lower) than forecast inflation, NSPs will receive increased (decreased) revenues relative to a case with no forecasting error.

There are two approaches to reducing the impact of this forecasting error: a) changes to the regulatory framework, either through ex-ante changes or ex-post adjustments, and b) for the

[9] https://www.aer.gov.au/system/files/AER%20Final%20decision.pdf
[10] NER rr 6.4.2(b)(1) and 6A.5.3(b)(1).
[11] NGR r.74.

NSPs to mitigate this risk through the use of financial market products/ hedging if this is available[12].

[12] As the AER's approach to inflation is not based on an actual financial market instrument, the ability to hedge may be limited. This means that the NSPs may bear inflation forecasting risk if the AER's expectation is different from that of the market.

2. CRITERIA FOR ASSESSMENT

In this section, we comment on the criteria used by the ACCC/ AER working paper on the best estimate of expected inflation and provide our own set of criteria.

2.1. Current criteria used by ACCC/ AER

The ACCC/ AER Working Paper no11 uses five assessment criteria to rank approaches to determining the best estimates of expected inflation.

These are:

- relative congruence with market expectations of inflation (whether estimates of a particular approach are more closely correspond to market expectations of inflation);
- robustness;
- transparency;
- replicability; and
- simplicity.

No weights are explicitly assigned to these criteria.

2.2. Suitability of criteria

At a high-level the criteria used by the ACCC and AER align with the NER and NGR, and are broadly in line with better regulation principles. However, in our view the focus is perhaps weighted too heavily towards good regulatory practice (e.g. transparency, replicability, simplicity and elements of robustness), rather than meeting the NGR requirement of using the 'best estimate of expected inflation.'

In addition, we would like to highlight the following points with respect to the definitions used:

- *Relative congruence with market expectations of inflation* - as noted by the ACCC/ AER, relative congruence does not necessarily mean the absence of biases. In addition, relative congruence with market expectations of inflation in the past does not infer relative congruence in the future if circumstances have changed. From a cost of capital perspective, recovering efficient costs should mean recovering inflation expectations priced into debt and equity.
- *Robustness* - the working paper discusses an absence of reaction to short-term inflation changes and not changing in light of inflation shocks. We agree that a measure should ideally be stable and predictable, but this does not have to be at the cost of using an estimated inflation rate that does not reflect prevailing rates. As the

AER states in its Rate of Return guidelines, its approach should reflect market conditions.[13]

- *Simplicity, transparency and replicability* – in our view, as we discuss below, we do not think an approach should necessarily be marked down for not being relatively simple if the approach itself is transparent and replicable.

2.3. Proposed criteria

We believe there are two groups of assessment criteria: 1) best estimate of expected inflation, and 2) best regulatory practice.

2.3.1. Best estimate of expected inflation

We propose two criteria related to the best estimate of expected inflation:

- congruence with the regulatory framework; and
- congruence with market expectations of inflation.

We have retained the criterion set out by the ACCC/ AER in relation to congruence with market expectations.

The new criterion is included to ensure that the measure is chosen with reference to the principles and regulatory framework used by the AER, rather than in isolation. For instance, as the ACCC/ AER not the NER's statement of 'best estimate of expected inflation' is to abstract for undertaking a comparative assessment.[14] As another example (discussed in Section 3.2), Ofgem and Ofwat use different inflation estimates for different elements of their revenue-cap approaches, one to align with its approach to the cost of capital and one for the revenue profile. While this could be considered as an implicit criterion, including it explicitly allows for consideration of issues such as the time period covered by the estimate, the allocation of risk and consistency with the objective of the forecast.

2.3.2. Best regulatory practice

We have proposed two criteria relating to best regulatory practice:

- objective and evidence-based; and
- transparency and replicability.

These two measures are related to those criteria put forward by the ACCC/ AER in the working paper. Our first criterion replaces robustness, and specifies that an estimate that is supported by solid evidence requires limited subjectivity and fewer assumptions.

[13] AER, *Better Regulation: Explanatory Statement – Rate of Return Guidelines,* December 2013, page 24.
[14] ACCC/ AER Working Paper No11, page 7.

We have grouped transparency and replicability as these are very closely related in what they are trying to achieve. We have not included the criterion of simplicity. While we consider that this is a pragmatic, including it may lower the ranking of a preferable methodology because it may be relatively more complex. We consider that transparency and replicability achieve the desired outcome of better regulation, without than a simplicity criterion.

2.3.3. Conclusion

This gives four criteria for our assessment:

1) Congruence with regulatory framework.
2) Congruence with market expectations of inflation.
3) Objective and evidence-based.
4) Transparency and replicability.

The first criterion drives a number of decisions, not least of which is the second criterion – that market expected inflation is the focus. It also sets out other requirements, for example that the expectations should have a similar time horizon to the calculation of the cost of capital.

We consider that congruence with market expectations of inflation is the most important criterion. The 'objective and well-evidenced' criterion is a secondary assessment that asks whether, at any given point in time, the approach will generate an estimate that does reflect market expected inflation over the time period in question, without requiring relatively subjective adjustments.

While we acknowledge that 'transparency and replicability' is a spectrum, it is our view that as long as the approach(es) achieve 'transparency and replicability', and insofar as possible, is accessible to all stakeholders, then there is no explicit need to rank approaches against this criterion. In other words, we treat the transparency and replicability criterion essentially as a pass/ fail criterion. For example, a bond breakeven inflation approach that uses publicly available data from the RBA, without adjustment, could be considered to be as transparent and replicable as using the RBA's short-term forecasts. However, transparency and replicability could be lost if an adjustment to the bond breakeven inflation was made using data that is not publicly available, requires complex adjustments or the approach is not clear to all stakeholders.

In Section 4, we use these assessment criteria to evaluate options for estimating expected inflation.

3. OPTIONS FOR ESTIMATING MARKET EXPECTATIONS OF INFLATION

3.1. Options discussed by the AER

The AER considered four options to estimating expected inflation:

- current approach ('RBA inflation target' approach);
- survey-based approaches to estimating expected inflation ('survey' approach);
- 10yr bond breakeven inflation rate ('breakeven inflation' approach); and
- 10yr expected inflation rate implied from zero coupon inflation swaps ('inflation swap' approach).

The first two options can be considered as non-market approaches, while the latter two options are market-based approaches.

3.1.1. Non-market approaches

RBA Inflation target

This was the ACCC/ AER's favoured option (as set out in Working Paper no11). They considered that this approach was simple to apply, transparent and easily replicable. Their analysis indicated that long-term inflation expectations have been anchored to the RBA target band for a number of years, are relatively stable over time and did not respond to short-term inflation shocks.

The ACCC/ AER saw this estimation method as being unbiased while the RBA's inflation targeting is perceived to be effective, and inflation expectations are anchored to the target band[15].

Surveys

The ACCC/ AER ranked the survey-based approach as the worst of the four options. They noted that a restriction of this approach, when estimating ten-year inflation expectations, is that publicly available surveys are typically limited to two year forecasts and so do not cover the entire period. The ACCC/ AER considered that when long-term inflation expectations are anchored to the RBA's target band, this approach does not provide sufficient benefits above using the inflation target to justify its use. The ACCC/ AER does note that Consensus Economics provides longer term forecasts, but they note that this is not publicly available (although anyone can purchase the forecasts directly from Consensus Economics) and they are not available as frequently.

[15] The use of eight years at the central band means that the remaining two years need to be significantly higher or lower for the overall inflation estimate to fall outside of the RBA's target inflation band of 2-3%.

In addition, the ACCC/ AER noted some general issues with the use of surveys. This included the selection of respondents, potential herding behaviour, wording of the questionnaire, non-respondent bias and evidence reflecting median expectations rather than probability weighted averages.

3.1.2. Market-based approaches

Breakeven inflation

The ACCC/ AER concluded that this was their third-best option in light of the biases and risk premia that potentially affect the estimates from this method (these are set out in Section 4.1.2). They considered that there were more potential instances of distortions than under the inflation swaps method, and a lack of consensus on how to adjust for these and greater volatility. The ACCC/ AER noted that there were multiple approaches available to fitting a yield curve and estimating ten-year breakeven inflation.

Zero coupon inflation swaps

The ACCC/ AER concluded that inflation swaps were preferable to breakeven inflation (and ranked second overall). They based this off of studies from the US and UK indicating that the net impact of any bias is likely to be small. The ACCC/AER was noted that some uncertainty existed on whether biases and risk premia such as hedging costs in Australian inflation swaps are insignificant.

With both of the market-based methods, the AER noted that adjusting for distortions was complex and subjective.

3.2. Regulatory precedent

We have reviewed other Australian and international regulatory precedent with respect to forecasting inflation. This has also been used as the basis for developing alternative options for the AER.

While the approaches have varied across regulators, UK regulators have typically focused on matching their approach to the cost of debt with breakeven inflation to derive a real cost of debt allowance. Ofgem has acknowledged the presence of distortions in its breakeven inflation analysis, however it has assumed away any impact on the breakeven inflation rate. Ofwat, relying on analysis from the Bank of England, makes an adjustment to its breakeven inflation for inflation risk premia.[16]

[16] The inflation risk premia estimate (estimated using a fitted model) was based on an average from 1997 to 2007. Analysis by the Bank of England showed that post the GFC the inflation risk premia varied significantly year-on-year. The Bank of England also noted that the inflation risk premia could be in either direction depending on macroeconomic conditions (or forecasts). See Bank of England, Quarterly Bulletin, 2012 Q3, Volume 52, no. 3.

The New Zealand Commerce Commission's (NZ CC's) approach, similar to the AER's in that it uses the Reserve Bank of New Zealand's (RBNZ's) short term forecasts and medium-term CPI target, appears to recognise that there is persistence from shocks and slower reversion to the CPI target. At the time of writing this report, we have not been able to establish from the NZ CC's documentation why it chose a three-year reversion to the CPI target.

The Australian state-based regulators use a mix of different approaches, ranging from IPART's current approach (which is very similar to the AER's), to the ESC and ERA approaches which use breakeven inflation. IPART has used a number of different approaches over the years, switching from a bond breakeven inflation rate (BBIR) to swaps breakeven, then to RBA forecasts. In its March 2015 justification for using RBA forecasts in preference to breakeven, IPART note that there is a risk that the Commonwealth Government may stop issuing indexed linked bonds again and that the RBA based approach is simpler than breakeven inflation (although IPART note that breakeven inflation is simpler than using swaps).

The table below summarises the regulatory precedents reviewed in Annex A. This table sets out the approaches the regulators have used for the implicit or explicit inflation contained within the estimated cost of capital. We note that while Ofgem and Ofwat use breakeven inflation in deriving a real cost of capital, they respectively use Bank of England targets or survey estimates of inflation for profiling revenues.

Table 3.1: Summary of inflation used in cost of capital

Regulator	Approach to inflation
Ofgem	Breakeven inflation used to calculate real cost of debt and (implicitly) cost of equity. No adjustments (liquidity and inflation risk premia expected to offset one another).
Ofwat	Breakeven inflation used in cost of debt and cost of equity, though less mechanistically than Ofgem. Adjustment made for inflation risk premium.
NZ CC	RBNZ short-term forecast and then mid-point of RBNZ target inflation range used with three-year glide path.
IPART	A nominal risk-free rate based on a combination of a prevailing forty-day average and a longer ten-year average is used for both the cost of debt and the cost of equity, based on government bond yields. One-year RBA inflation forecast and the middle of the RBA's target band of inflation, i.e. 2.5%, for the following nine years.
ERA	Breakeven inflation is used as the basis for estimating expected inflation, taken over the same forty day averaging period as for the nominal risk-free rate.
ESC	Uses 'paired bond' (breakeven inflation) approach to derive a real cost of capital, although cost of debt is based on a nominal cost.

Source: Regulators' determinations, CEPA analysis

3.3. Alternative options to the ACCC/ AER's options on expected inflation

The regulatory precedents provide two variations to the four options proposed by the ACCC/ AER.

Glide path

The NZ CC use a similar approach to the AER, utilising RBNZ inflation forecasts. However rather than assume a direct move to the Central Bank's target inflation band after the end of the forecast period, they assume a three-year glide path from the short-term inflation forecasts to the target inflation point. This is an option that we include for consideration as part of our assessment.

Adjusted market estimates

The ACCC/ AER report discusses the presence of different types of bias. Market-based estimates with an adjustment could be used as an alternative approach on either breakeven inflation or inflation swaps. Both approaches are considered in our assessment.

Ofwat has explicitly adjusted for an inflation risk premium in setting its inflation estimates and this is an example of an approach that could be used by the AER, if robust evidence on any bias in the Australian market based estimates is available[17].

Key points:

- In most, but not all, of the case studies we reviewed the regulator chose to align the inflation expectation approach with the data sources/ methods used to determine other elements of the cost of capital.
- Variations to some of the AER's four main options have been adopted by other regulators (e.g., glide path to an inflation target or adjustment to the market based approaches).

[17] The Ofwat approaches was based on a single Bank of England study (Quarterly Bulletin, 2012 Q3, Volume 52, no. 3), using an average from 1997-2007, i.e., excluding the GFC. Single year estimates provided in the same report for 2010 to 2012 indicated negative inflation risk premia.

4. ASSESSMENT

In this section, we consider the options (identified in Section 3) against our assessment criteria (identified in Section 2). While we do not undertake a full assessment, or replicate the extensive detail undertaken by the ACCC/ AER in the working paper, we provide additional evidence relevant to the inflation review and our evaluation of the evidence against our assessment criteria.

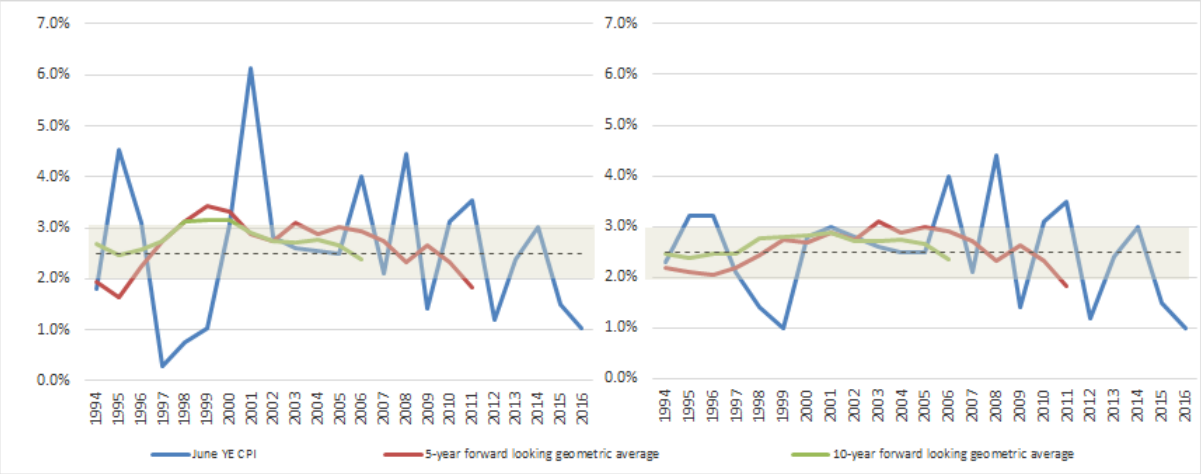
4.1. Understanding the issues

4.1.1. Historic inflation expectations

Historical assessment – CPI

For most economic forecasting models, the best test of how accurate they are is to compare their predictions against outturn data. In this case, this is less relevant as we are considering which approach provides the best estimate of market expectations of inflation at a given point in time. We have however reviewed historical CPI, since the introduction of inflation targeting, and graphed outturn CPI along with 5-year and 10-year forward looking geometric averages of outturn inflation. This is shown in the figures below, where we present unadjusted CPI and CPI adjusted for interest and tax changes.

Figure 4.1: Historical CPI (June year-on-year change) – LHS is actual CPI and RHS is CPI excluding interest and tax changes[18]



Source: RBA (Series ID GCPIAG and GCPIETCYP). CEPA analysis

As set out in the ACCC/ AER paper, since the introduction of inflation targeting in 1993, long-run average historical inflation has been consistent with the mid-point of 2.5%. However, our analysis shows that while the 10-year averages (with the most recent 10-year period ending

[18] For example, the 2006 ten-year forward looking geometric average covers the growth in CPI during the period 2006 to 2016.

in June 2016) have been for the most part within the target band, they have tended to vary from the mid-point.

The analysis also indicates that, while there is year-on-year volatility, the averages tend to persist above or below the mid-point.[19] For example, from 1996 until 2005 the forward-looking geometric average of outturn inflation is persistently above the mid-point of the band. It is only when the downward-trending inflation from 2009 is taken into account that we see the forward-looking outturn 10-year inflation come down. We would expect that if there were rapid reversion to the mid-point of the band the averages would not remain above/ below the mid-point for an extended period of time.[20]

Key point:

- Outturn CPI, if viewed over timeframes similar to those used in the rate of return estimation, indicates that CPI tends to persist above/ below the mid-point of the RBA's band.

Divergence between RBA inflation target and market estimates

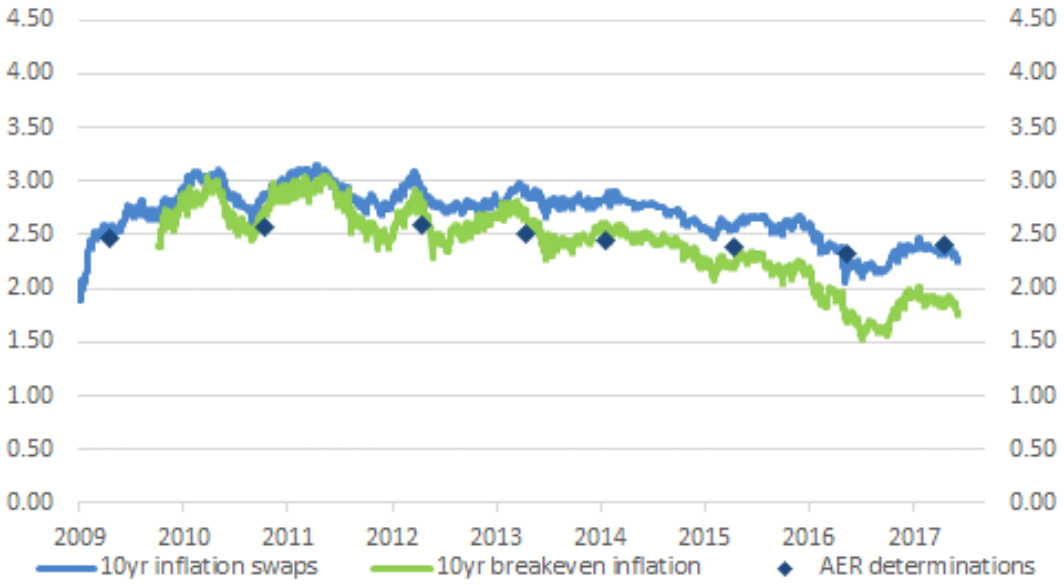
The figure below shows that over the 2009-14 period, the RBA inflation target approach has historically led to outcomes that are broadly aligned with breakeven inflation and slightly below the inflation swap estimates. However, in the 2015-17 period, the RBA inflation target approach results in significantly higher estimates than breakeven inflation (>50bps) and is slightly above inflation swap estimates. We discuss the possible reason for this in Section 4.1.2, however we think that this is a function of higher costs being required to enter into inflation swaps due to the introduction of capital requirements, combined with global trends leading to inflation expectations being less anchored to the RBA target band mid-point.

The increasing divergence raises the question of whether the RBA inflation target approach can still be considered to be reflective of market expectations.

[19] The estimation of the length of persistence or mean reversion relies on relatively complex econometric models, the assumptions around which will vary by practitioner. We have not sought to develop such a model for this report. While we have not done an exhaustive review of the literature for models estimating persistence, an example of a model covering 13 OECD countries including Australia is in Canarella, Giorgio and Miller, Stephen M., *Inflation Persistence Before and After Inflation Targeting: A Fractional Integration Approach* (January 30, 2014). Eastern Economic Journal, July 2015. The authors in this study identified inflation persistence in Australia even after inflation targeting was introduced.

[20] Outliers of course affect averages, and it could be argued that these push the averages up/ down, however this does not clearly explain why the averages continually remained above the mid-point, particularly on the upside from 1996 to 2005.

Figure 4.2: The AER's determinations relative to market-based inflation estimates



Source: Bloomberg, CEPA analysis of the AER's determinations
Note: Due to the limited number of index linked bonds being issued around the GFC Bloomberg does not provide estimates for the period from 20 April 2007 to 8 October 2009.

The breakeven and inflation swaps series are somewhat volatile as they reflect constantly changing market views. As points (or averages over a period) would be used to set the expectations over the price controls, the expectations used in the PTRMs would not introduce additional price volatility. The AER's approach, by its construction does not appear volatile, even though the RBA's two-year short-run inflation forecasts can and at times do vary materially from the mid-point of its band.

Key points:

- The three different inflation approaches have clearly diverged from 2013, with the difference becoming increasingly pronounced since 2015.
- Raw breakeven inflation and swaps inflation data is more volatile (reflecting that they are continuously measured), however as the estimate used does not currently vary over the price control these approaches would not introduce additional price volatility.

4.1.2. Explanations for increasing divergence between approaches

The issue of divergence between market-based and survey-based evidence is discussed in the RBA's March 2017 bulletin, where the authors stated that[21]:

"*The divergence between inflation expectations measures over recent years, especially between the market-implied and professional forecasters' measures at longer horizons, raises a question about which expectations measures are better able to predict future inflation….Conversely, if the market-implied measures – which have experienced larger*

[21] https://www.rba.gov.au/publications/bulletin/2017/mar/pdf/bu-0317-4-inflation-expectations-in-advanced-economies.pdf

declines over recent years – are better predictors of future inflation, this would suggest that underlying inflation is expected to be lower than many central banks' inflation targets. This would make the task of returning inflation to target more difficult, especially in an environment where policy rates are already low and unconventional monetary policy tools have been deployed extensively."

The divergence between estimates under different approaches means that we have to consider what is causing the difference between the three measures. This comes down to two areas: (1) are there distortions in the market estimates that mean they do not reflect 'true' inflation; and/or (2) whether inflation expectations are still anchored to the RBA target.

An area that received much attention in the ACCC/ AER report was the effect of distortions in market based approaches – which include biases and risk premia.[22] The ACCC/ AER identified biases/ risk premia that exist with both breakeven inflation and inflation swaps. Table 4.1 below shows many of the distortions in market-based estimates identified by the ACCC/ AER are contained within nominal yields, can vary in direction, and/ or may be relatively small.

Table 4.1: Description of potential distortions

Potential biases and risk premia	Description	Applies to which approach	Direction of typical impact on the inflation estimate[23]	Applies to which leg of inflation estimate?
Inflation risk premium	Bondholders may demand higher return for bearing the risk of inflation on nominal bonds.	Both	↑ Overestimates inflation	Nominal
Counterparty default risk premium	The risk that the counterparty to a swap will fail to fulfil its obligations outlined in the swap agreement.	Inflation swap	↑ Overestimates inflation	Both nominal and real
Hedging Costs	Costs associated with opening, maintaining and closing positions in supplying the derivatives markets.	Inflation swap	↑ Overestimates inflation	Real
Convexity bias	Bond prices respond asymmetrically to changes in yield – bond prices rise with yield volatility. This pushes forward rates down below expected future rates. Since nominal bonds usually exhibit higher volatility of yields, the downward bias is stronger on nominal bonds compared to indexed bonds.	Breakeven inflation	↓ Underestimates inflation	Nominal and real
Liquidity premium	Index-linked bonds are less liquid than nominal bonds due to their relative market sizes.	Breakeven inflation	↓	Nominal and real

[22] Note, we have tried to use 'bias' and 'biases' in a similar way to the ACCC/ AER for consistency, but we note that 'bias' can be defined differently.

[23] Assuming that positive inflation is expected. We also note that, while these are typical directions it has been noted in the literature that direction of biases can be affected by the macroeconomic conditions.

Potential biases and risk premia	Description	Applies to which approach	Direction of typical impact on the inflation estimate[23]	Applies to which leg of inflation estimate?
			Underestimates inflation	
Inflation indexation lag	A lag exists between the actual movements in inflation and the adjustments applied to indexed bond cash flows.	Both	↓ Underestimates inflation	Real
Differences in inflation measures	The personal price index of investors may be different to CPI, thus the index-linked bond is not perfectly hedged.	Breakeven inflation	↓ or ↑	Real
Mismatched pattern of cash flows	In real terms, coupon payments on indexed bonds are fixed while coupon payments on nominal bonds decline in real terms over their maturity.	Breakeven inflation	↓ or ↑	Both nominal and real
Changes to the demand for and supply of index-linked bonds	External factors e.g. hedging instruments or central banking rules, change relative pricing without changes to inflation.	Breakeven inflation	↓ or ↑	Real
Added sensitivity due to coupon-payments	Forecasts on coupon paying bonds may be more sensitive to changes in short term inflation expectations than zero-coupon bonds.	Breakeven inflation	↓ or ↑	Both nominal and real

Source: CEPA analysis of the ACCC/ AER working paper

In our view, when considering any distortions in the inflation expectations, it is important to link back to the NER and NGR ('Rules') and the intentions set out there. In our view, to be consistent with the Rules, the regulatory framework needs to allow an NSP to recover its efficient costs, which could include financial costs that are the result of investors' biases. The regulatory framework should: (1) only allow the recovery of distortions that affect efficient costs (i.e. that cannot be reasonably diversified away or avoided); and (2) ensure that any efficient biases/risk premia are only recovered once.

We further note that the nominal WACC estimate used by the AER utilises market evidence that are not free from distortions, for example the yields on nominal government and corporate bonds. As an example, the inflation risk premium identified for breakeven inflation is present in nominal bond yields. The takeaway is that investors are not all risk neutral and can require additional returns to compensate them for bearing this risk.

This has been discussed by the competition body in the UK, the Competition and Markets Authority (CMA) who stated that[24]:

"*In order to estimate the risk-free rate applicable over the period of our investigation, we have had reference to two sources. The first is index-linked gilt yields, which have negligible default and inflation risk. The second source is nominal gilt yields, which also have negligible default risk but which do have inflation risk (and, therefore, should contain an inflation risk premium).*"

In this section, we first consider:

- whether changing levels of distortions in inflation swaps has led to a divergence between inflation swaps and breakeven inflation; and
- whether different types of distortions in breakeven inflation, in particular liquidity premia, has led to this estimate understating inflation.

We then assess whether inflation expectations are still anchored to the mid-point of the RBA's band.

Distortions in inflation swaps

As set out in Table 4.1, the ACCC/ AER identified biases/risk premia that exist with both breakeven inflation and inflation swaps. One bias that applies to inflation swaps - but not to breakeven inflation - is the impact of hedging costs. Hedging costs reflect the opportunity cost to investment banks of offering derivatives, given the capital that is required to be held in reserve for the transaction (the capital requirements increase with the tenor of the swap being offered). These capital requirements have increased since the GFC among banks operating in the G20 countries due to the gradual implementation of the Basel III Accord (from 2013 to 2019)[25] and other banking regulations designed to deleverage the banking industry.

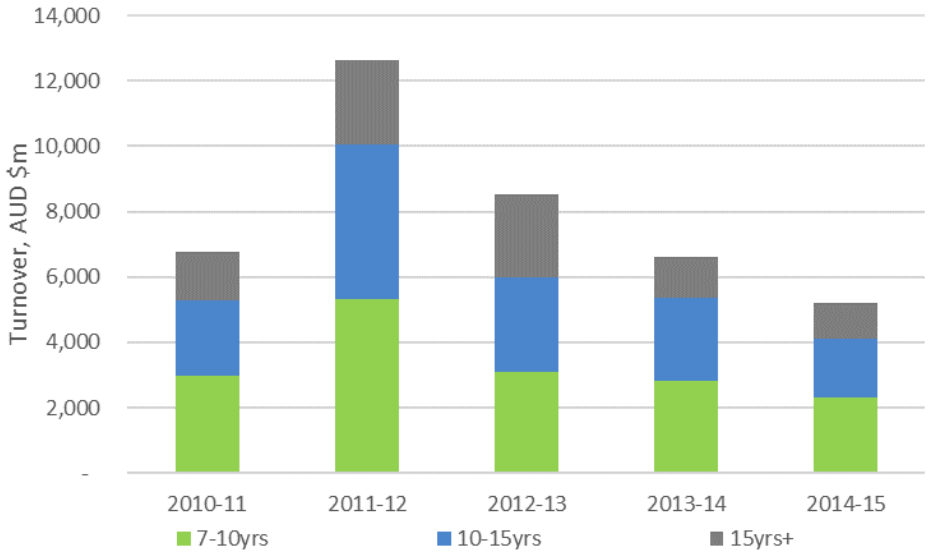
As noted by Devlin and Patwardhan (2012), regulatory changes (likely referring to actual and proposed Basel requirements) may have impacted banks dealing in the inflation swaps market as these banks are required to set aside more capital against derivative exposure. The authors postulate that this requirement may have introduced a systematic bias into inflation swap rates. The increased capital requirements may explain the increasing gap between inflation forecasts implied through breakeven inflation and inflation swap evidence in the past several years.

The figure below shows the decrease in longer maturity inflation swaps. With less liquidity in the swaps market, a higher implied inflation estimate can be expected.

[24] https://assets.publishing.service.gov.uk/media/559fb6ce40f0b61567000049/Appendix_10.4_The_cost_of_capital.pdf

[25] http://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Economics/Completed_inquiries/2010-13/postGFCbanking/report/c03

Figure 4.3: Annual turnover of longer maturity inflation swaps, 2010-11 to 2014-15



Source: AFMA Australian Financial Markets Data. Note that information on maturity of swaps prior to 2010-11 is not available, while the survey was not conducted after 2014-15.

The ACCC/ AER working paper noted that demand for floating rate exposure is likely to be greater than the fixed leg for inflation swaps in Australia.[26] This excess demand on the floating rate leg will depress the price of the fixed rate leg. A decreased price on this fixed rate leg means a higher yield. One reason for excess demand on the fixed leg would be the increasing capital requirements for provision of the floating rate leg of the swap.

This demand-supply imbalance may mean that unadjusted swap yields overstate 'true' estimates of market inflation, as per the 'hedging costs bias' referenced by the ACCC/ AER[27].

Key points:

- There is reduced turnover in longer-term inflation swaps over recent years.
- Reduced liquidity in the inflation swaps market and an increasing demand-supply imbalance are affecting pricing.
- This has led to an increasing upwards bias on the inflation swaps measure of inflation, relative to a 'true' estimate of inflation.

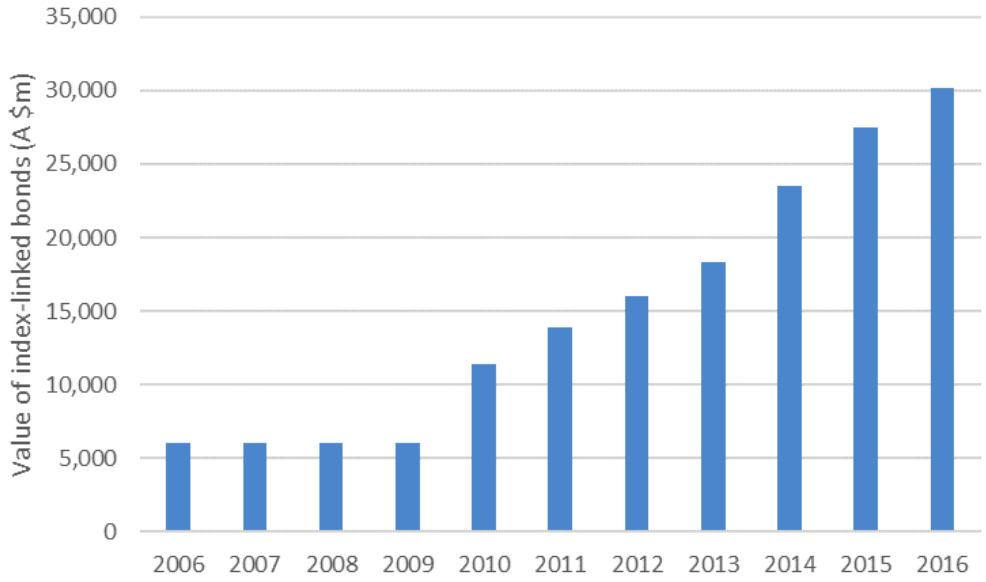
Distortions in breakeven inflation

The ACCC/ AER has highlighted issues experienced with breakeven inflation around the GFC, with a shortage of issuance and a lack of liquidity. As noted by the ACCC/ AER, since the GFC there has been an increasing number of index-linked bond issuances. This is expected given the Australian Government's 2013 explicit aim to keep the market for index linked securities liquid, and the Australian Office of Financial Management's (AOFM's) stated objective "to

[26] For reference see, Devlin and Deepika Patwardhan (2012), *Measuring market inflation expectations*, Treasury Roundup Series, Issue 2, p 11-12.
[27] Noting that this is less of a 'bias' than a simple demand and supply imbalance.

ensure that the secondary market for Treasury Bonds and Treasury Indexed Bonds is liquid and efficient."[28] Figure 4.5 shows the outstanding face value of indexed bonds issued by the Australian government. There was no issuance over the 2007 to 2009 period, but there was a significant increase in the value of indexed bonds outstanding in 2010 as the issuance programme re-started.

Figure 4.4: Index-linked Commonwealth Govt securities, 2006-2016



Source: AOFM. Note: Figures presented are face value and do not include accretion. Figures are taken at the midway point of the calendar year.

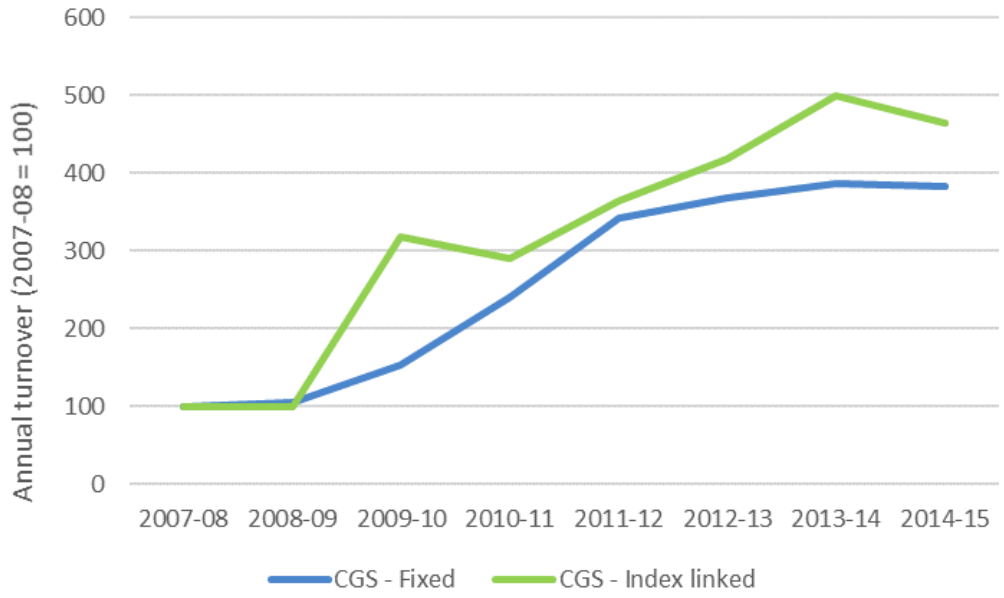
The turnover of index-linked government bonds has followed growth in nominal government bonds. As such, changes in liquidity of index-linked government bonds is unlikely to be driving the divergence in inflation expectations between breakeven inflation and the AER's current inflation estimation approach.

The Australian Financial Markets Association (AFMA) conducts an annual survey of Australian Financial Markets that collects on turnover of government debt securities and derivatives. Figure 4.6 shows the turnover of both nominal and indexed bonds issued by the Australian Commonwealth Government. Since indexed bonds were issued again, the turnover of these bonds has been at least aligned with their nominal equivalent in relative terms (though significantly lower in absolute terms).[29]

[28] See CEO presentation, The Australian Government Bond Market, The Australian Government Fixed Income Forum, Tokyo, 1 December 2013 and http://aofm.gov.au/publications/annual-reports/annual-report-2015-16/part-2-performance-and-outcomes/.

[29] In 2014-15 the face value of fixed CGS was $332,916m while the face value of index linked CGS was $26,068m.

Figure 4.5: Turnover of Australian government bonds

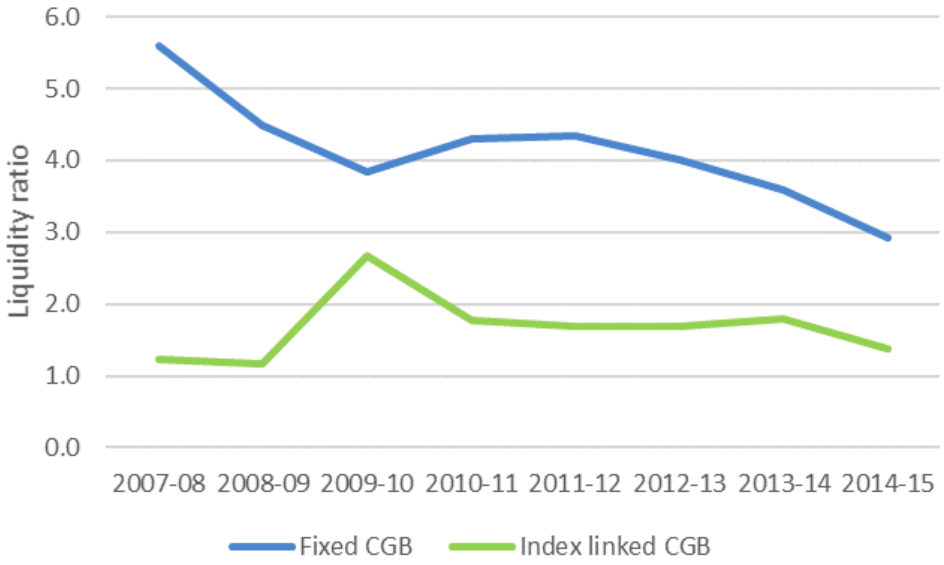


Source: AFMA. Figures are on a financial year basis (July to June).

Survey evidence from the AFMA (presented in Figure 4.6) can be combined with analysis of government bonds outstanding by the AOFM to derive relative measures of turnover. One such measure is the liquidity ratio, calculated as the annual turnover divided by the value of bonds outstanding. A higher liquidity ratio would indicate a reduced need for a 'liquidity premium'. We need to look at both nominal and indexed bonds to understand whether there is a directional bias reflected in breakeven inflation. This analysis has been undertaken in relative terms (i.e., comparing ratios over times and reviewing trends) rather than assuming any threshold for liquidity (i.e., that a value greater than 1 implies a liquid market).

Considering the liquidity ratios of both nominal and indexed bonds in Figure 4.7, we see that there was an issue in 2008 with a drop in the liquidity of indexed bonds. However, when the Australian government announced that they would start re-issuing indexed bonds, liquidity improved (with a spike in the year immediately following).

Figure 4.6: Liquidity ratios for Australian Government Bonds



Source: AOFM, AFMA

Note: Ratio is calculated as annual turnover relative to the value of bonds outstanding in terms of market value[30]. Figures are averages of quarterly figures referenced by the AOFM.

Figures are on a financial year basis (July to June). Note, the survey to collect this evidence has been not conducted since 2014-15.

Although further evidence is not available post-2014-15 from this survey, the evidence we have seen does not indicate a fall in liquidity in 2015-16:

- The AOFM Financial Report for 2015-16 sets out that "Annual secondary market turnover for Treasury Bonds was $1.2 trillion and for Treasury Indexed Bonds $0.05 trillion in 2014-15. Liaison suggests that turnover in 2015-16 was broadly similar. **This is adequate for the market to function effectively."** [31] (Our emphasis.)
- The value of index linked CGS issuance in 2015-16 (shown in Figure 4.4) increased from 2014-15.

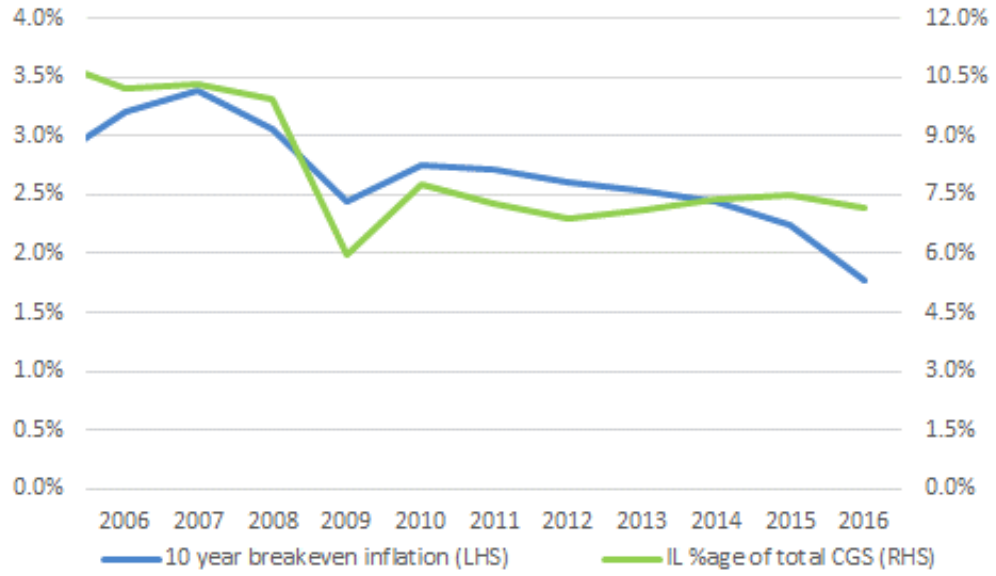
A further piece of analysis we can examine is the relationship between the proportion of index-linked bonds outstanding as a proportion of total Australian Government securities. (see Figure 4.7). This indicates that there is a relationship between the proportion of index-linked bonds and breakeven inflation. While, there seems to be a divergence from 2015, as evidence presented above points to continued strong liquidity in the index linked market

[30] Evidence presented by the AFMA includes values using market values and book values. We consider it more appropriate to use market values when estimating the liquidity ratio, noting that this gives lower values than using book values.

[31] http://aofm.gov.au/publications/annual-reports/annual-report-2015-16/part-2-performance-and-outcomes/

through 2015-16,[32] other factors, rather than a lack of liquidity, are likely pushing down market expectations of inflation.

Figure 4.7: Relationship between ILGs and breakeven inflation



Source: RBA, AOFM, AFM (calendar year)

Key points:

- The Government has provided the AOFM with an aim of keeping the index-linked bond market liquid and AOFM has an explicit objective of keeping the secondary market for index-linked bonds liquid.
- As of 2015-16, the AOFM has stated that the indexed bond market has sufficient turnover to function effectively; this indicates that illiquidity may not be materially affecting breakeven inflation.
- We consider that the liquidity ratios indicate that the market has been sufficiently liquid since the issuance of indexed bonds restarted in 2009-10.

Correcting for distortions in market-based approaches

There have been examples of estimating the magnitude of premia in other jurisdictions. However, due to the distortionary impact of the GFC and less data available over a longer time horizon in Australia itself, this is not something that we have undertaken. This explains why the ACCC/ AER working paper mainly presents quantitative estimates from studies in the US and UK, rather than being able to present estimates for Australia.

The Consumer Challenge Panel (CCP) have noted that the ACCC/ AER may have overstated the impact of distortions in choosing a preferred approach and that there are issues with all

[32] A November 2016 PwC report, prepared for AGN, also concluded that "Index CGS are sufficiently "liquid" for their pricing to be a reliable input to the Breakeven model." AGN, *Final Plan Attachment 9.3: Estimating Expected Inflation Using the Breakeven Method*, a report by PwC, December 2016, page 3.

approaches[33]. The CCP also indicated that it would be beneficial to conduct more empirical analysis of Australian data on inflation swaps and discuss this with market participants.

Our assessment of the evidence indicates that on balance over the long term the distortions to the market based estimates are more likely to lead to inflation estimates being overestimated, rather than underestimated. For example, as we have previously noted, Ofwat made an adjustment for inflation risk premium in its most recent price control review (PR14),[34] and a literature review by CEG for Aurizon Network in November 2016 noted the following[35]:

"The overwhelming conclusion of this literature survey is that the above potential sources of bias are small and more likely to result in an over-estimate of expected inflation than an underestimate."[36]

A recent report by the RBA, which analyses inflation expectations in advanced economies, supports the premise of an upwards bias finding in the RBA[37]:

"Market-implied measures are positively biased beyond the 1-year horizon, and this bias increases with the length of the forecast horizon."

The RBA does not specify the magnitude of the bias, and it is relative to outturn inflation rather than expected.

Key points:

- There are a range of distortions that may affect estimates derived from market based approaches.
- Distortions may lead to an over- or under-estimate of inflation.
- Distortions may change over time.
- The available evidence points to distortions in the market based expectations being relatively small, and/ or cancelling each other out to some degree. However, on balance the evidence suggests that they may result in an overestimate of inflation.
- We could not identify Australian evidence (either data or publicly available reports) that we would be confident using to make a robust adjustment to the market based approaches.

[33] Consumer Challenge Panel (2017) Review of Inflation; Public Forum, 14 June 2017.
[34] Alternatively, Ofgem (which assess the data from the same markets as Ofwat) has assumed that biases offset one another and there is no persistent bias.
[35] CEG, *Best Estimate of inflation: revaluations and revenue* indexation, November 2016, page 38.
[36] CEG cite a range of articles and books in its report. These are listed out in Table 5 of its report, pages 39-42. A number of these sources are cited in the ACCC/ AER working paper.
[37] RBA Bulletin March 2017, https://www.rba.gov.au/publications/bulletin/2017/mar/4.html

Inflation expectations becoming unanchored

The December 2016 RBA bulletin discussed whether inflation expectations have become unanchored from the inflation target[38]:

"*Longer-term measures of expectations – particularly those that abstract from near-term inflation – might be informative about the credibility of the central bank's ability to achieve its inflation target. Large deviations in these measures from the inflation target could suggest that long-term inflation expectations have become unanchored, which makes it more difficult for monetary policy to stabilise inflation and output.*"

Governor Stevens of the RBA noted in August 2016 that "*the 'return to normal' at the global level looks like being a very, very slow process. And normal is a different place now."*[39]

The RBA target is based on a target range of 2-3%, so monetary policy remains credible if medium term inflation expectations are within this range. In addition, in 2010 the RBA and Australian government recorded a common understanding of the RBA's responsibility for financial system stability, noting that the inflation target should be based on the medium term and with financial stability being included in their objectives.

Governor Stevens in August 2016 discussed this additional flexibility and what it could mean for inflation[40]:

"We are living in a world in which the ability of monetary policy alone to boost growth sustainably is very likely to be a good deal more limited than we might wish. I think most people can sense this. So we need realism about how much we can expect monetary policy to do, including pushing inflation up quickly. If it were the case that undershooting the target for a period while achieving reasonable growth was the 'least bad' option available, the inflation targeting framework has the requisite degree of flexibility to allow such a course."

Su-Lin Ong, head of economics at RBC, suggested after the June 2017 central bank decision suggests that the option Governor Stevens described is a reality[41]:

"This highlights the focus of monetary policy at present, with considerations around financial stability trumping almost everything else including sub-target inflation."

In light of the reduced ability of monetary policy to affect inflation, we consider that at the moment it likely that a figure in the lower half of the range is more aligned with expected inflation than a figure towards the top end of the range.

Craig James, chief economist at CommSec, noted that the RBA is limited in what it can do and the 'lower for longer' global forces mean that inflation may stay lower over time.[42]

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[38] RBA bulletin December 2016, https://www.rba.gov.au/publications/bulletin/2016/dec/3.html
[39] https://www.rba.gov.au/speeches/2016/sp-gov-2016-08-10.html
[40] https://www.rba.gov.au/speeches/2016/sp-gov-2016-08-10.html
[41] https://www.reuters.com/article/us-australia-economy-rba-idUSKBN19B0BE
[42] https://www.theguardian.com/australia-news/2016/aug/02/reserve-bank-slashes-australias-cash-rate-to-record-low-of-15

"The Reserve Bank is generally seen as a reluctant rate cutter. While central banks in other parts of the world have been forced to reduce rates to near zero, Australia has never been in that position. But these are extraordinary times with technology, 'disruption' and an environment of conservatism driving global inflation rates lower."

Key points:

- In recent years, there has been a clear divergence between breakeven inflation and the mid-point of the RBA's band.
- Recent RBA statements indicate that this divergence may continue for the foreseeable future, and that inflation might be towards the bottom of its band.

4.2. Assessment against the criteria

As previously noted, this report builds on evidence presented in the ACCC/ AER working paper, associated working paper and submissions on the treatment of inflation in the regulatory regime.

Our assessment begins with a review of whether different approaches pass the first hurdle of being transparent and replicable. If this is not the case, then we would recommend that the approach is not used. The use of adjusted breakeven and inflation swaps estimates may or may not pass this criterion. The questions around their potential use are:

- Is an adjustment required? Or can it be assumed away – as Ofgem has explicitly done, and the ERA and ESC appear to do, and as the AER and IPART used to do.
- If an adjustment is required, can it be made in an objective, evidenced-based, transparent and replicable way? For example, Ofwat's approach to adjusting for an inflation risk premia relied on a single publicly available Bank of England report.

While we do consider that adjusting for bias or risk premia that affect the calculation of market inflation expectations is important, we have not identified robust objective evidence for the Australian market that would support an accurate adjustment. Therefore, we have excluded breakeven inflation with an adjustment and inflation swaps with an adjustment from further assessment. As noted, any distortions when considered overall are varied, may be immaterial, and on average may overstate the estimate of expected inflation.

The table below shows our pass/ fail assessment of the options on their transparency and replicability.

Table 4.2: Assessment of options – transparency and replicability

Option	Assessment
RBA inflation target	**Pass** – approach is relatively straightforward.
Breakeven inflation	**Pass** – able to be gathered from reputable sources.
Inflation swaps	**Pass** – able to be gathered from reputable source.

Option	Assessment
Survey	**Marginal** –longer-term forecasts are available from one reputable provider; however, we do not have access to assess the survey.[43]
Glide-path – between the end of the RBA's short-term forecasts and the mid-point of the target	**Pass** – relatively straightforward, although determining the length of the 'glide' may be less transparent depending on the evidence available/ used.

In the table overleaf, we have used a ranking of methods under our remaining assessment criteria.

[43] We note that simply because the survey is behind a paywall does not mean that it is not transparent and replicable. Some options for breakeven and swaps, such as Bloomberg, requires a subscription payment. There are however alternative sources for Bloomberg, such as RBA.

Table 4.3: Assessment of options for estimating expected inflation (rankings are numbered 1-5, with 1 being best)

Option	Congruence with regulatory framework		Congruence with market expected inflation		Objective and evidence-based	
RBA inflation target	=3	Creates inflation forecasting risk if expectations are unanchored to the mid-point of the RBA target range.	4	The RBA's inflation target is the band between 2% and 3%, rather than the mid-point. Therefore, the RBA is willing to accept multiple inflation outcomes over the medium term. The approach does not necessary reflect current market expectations well. Recent RBA statements indicate that it may be difficult for it to get inflation to return to a 'normal' level and undershooting its target is a 'least bad' option.	3	Assumes that, at any point in time, inflation expectations anchored to target mid-point and mean revert within two years. The only reason for this appears to be that it is for this period that the RBA provide short term forecasts, rather than it being a view that this will actually occur. It does not take account of other evidence, including RBA statements (or the macro-economy more generally).
Breakeven inflation	1	Nominal government yields are used in the regulatory framework.	1	Potentially less liquidity and fewer data points relative to inflation swaps. Affected by a number of distortions, but likely less impactful than swaps at present.	2	Market-derived, but slightly less liquid and there is a need to interpolate for different maturities.
Inflation swaps	2	Market-based approach, but not used implicitly in the cost of capital like breakeven inflation is.	2	Market-based approach, but may not indicate 'true' inflation. Affected by a number of distortions – in particular with recent capital requirements. Evidence suggests that swaps, particularly since 2014 due to regulatory requirements, overestimate expected inflation.	1	Fewer assumptions needed if seen as transparent and replicable, less need for interpolation than BE.

Option	Congruence with regulatory framework		Congruence with market expected inflation		Objective and evidence-based	
Survey	=3	It can pick up slightly longer-term views in some cases, however there is no clear evidence it is more robust than RBA forecasting.	=4	Market information may be taken into account, however not as direct an influence as pure market based approaches. If only short-term forecasts are available, it is not clear this approach is more reflective of market expectations than the AER's current approach.	5	Subject to survey collection procedures and less clarity on how forecasters included in the survey formed their views.
Glide-path – between the end of the RBA's short-term forecasts and the mid-point of the target	=3	Potential for less forecasting risk within regulatory period than the current approach, if assume persistence above or below the RBA mid-point target.	3	If persistence exists (which the evidence indicates) in inflation expectations then this performs better than the current approach. Also, arguably has consideration for macro-economy.	4	Estimate required for the time horizon over which expectations trend to the target rate.

4.3. Conclusions

Based on an assessment against our chosen criteria, for which we place the greatest weight on market expectations of inflation that are congruent with the regulatory frameworks, we do not consider that the AER's current approach (i.e. using two years of inflation estimates and the mid-point of the RBA's inflation target range for eight years) represents the best estimate of market expected inflation. In particular, we do not consider that the current approach necessarily reflects macroeconomic conditions that the market based approaches take account of.

Our preferred option is breakeven inflation, without an adjustment. This approach aligns with the regulatory framework, is a market based approach, and is supported by regulatory precedent in Australia and internationally.[44] In our opinion, there are transparent and relatively accessible data sources, and methods that can be used to calculate breakeven inflation.

We agree with the ACCC/ AER conclusions that breakeven inflation estimates are not free from distortions from bias and risk premia. However, the evidence points to distortions varying over time and in direction and magnitude, therefore at any point in time the estimates may over- or under-estimate inflation. Therefore, an argument can be made that if the market based approach is used consistently over a long period the distortions may 'average out'. We do note that the evidence suggests that on balance breakeven inflation approaches may overestimate rather than underestimate inflation. This does reinforce concerns with the current method given breakeven inflation has been significantly below the mid-point of the RBA target for the past two years.

Our ranking, in descending order, for all the approaches is:

1. breakeven inflation;
2. inflation swaps;
3. a glide path approach or the AER's current approach (if the length of inflation persistence can be robustly identified then a glide-path would be preferred to the AER's current approach); and
4. survey based.

The underlying rationale behind our recommendation includes:

- **Use of different criteria to the ACCC/ AER.** We have used criteria that place more weight on the 'congruence with market expectations of inflation' criterion, and treats approaches as either being usable or not usable from a transparency and replicability point of view rather than ranking them.

[44] Although, our case studies showed that there is also some Australian and international precedent for similar non-market approaches like the AER's.

- **Impact of distortions.** While potential distortions are identified, and ideally these would be adjusted for, some of these are also present in other parameter estimates under the AER's regulatory framework, including nominal CGS yields used to estimate the risk-free rate. The biases/risk premia in both inflation swaps and breakeven inflation do vary over time, likely providing an underestimate and overestimate at different times. So long as the approach is consistently applied over a long period then there is an argument that the biases/risk premia will 'average out'. On the basis of the evidence presented in the ACCC/ AER working paper and the independent evidence we have assessed, on balance both measures may overestimate inflation. This reinforces that view that the current approach may be overestimating inflation, but it may also mean that in the long-run market based approaches may result in an overestimate of inflation relative to the 'true' expectation.
- **Inflation expectations from swaps, breakeven and current approach are no longer equivalent.** Previously, the inflation expectations from these measures were very similar. However, this is not the case anymore, especially over the past two years. Breakeven inflation has moved significantly below the AER's current approach, with inflation swaps slightly below the current approach. Breakeven inflation historically, and more so in recent years due to regulatory changes, appears to have overestimated inflation to a lesser extent than inflation swaps relative to the AER's current approach.
- **There are plausible explanations for why breakeven inflation estimates reflect expectations better than the current approach.** This includes: the central banks reduced ability to affect inflation through monetary policy; global forces bringing about a 'lower for longer' scenario as the macroeconomic conditions have fundamentally changed; and the broadening of the RBA's remit which places greater weight on financial stability and may mean the RBA targets the lower part of its band.
- **The issues around breakeven inflation that existed in 2009 are not present.**[45] AOFM has an objective to keep the secondary market for Treasury Bonds and Treasury Indexed Bonds is liquid and efficient. In addition, the overall value of the Commonwealth Bond market has increased substantially.
- **Glide path may be an improvement over current approach.** There are clear indications that inflation over the course of the next price control period could remain below the mid-point of the RBA band and as such a more gradual reversion to this target would better reflect market estimates of expected inflation. Historical movements in CPI support inflation persistence (i.e., long periods where 10-year average inflation is above the mid-point of the RBA's target band). As noted above, this could be an improvement on the AER's current approach.

[45] Our assessment is based on our view that the market for index-linked bonds will remain liquid in future. If new evidence is provided that calls into question this assumption then a different approach may need to be considered in order to avoid 'chopping and changing' approaches which increases regulatory uncertainty.

ANNEX A CASE STUDIES

In this annex, we look at what other regulators have done internationally. This includes examples of regulators who have adopted approaches similar to the current approach (e.g. IPART), approaches that introduce changes to this approach (e.g. NZ CC's glide path concept) and regulators who use market-based approaches (e.g. Ofgem and the ERA).

A.1. Ofgem, UK

	Details
Approach – regulatory framework	Revenues are updated annually in line with RPI. RAV is also indexed to RPI and a real WACC is applied. **RIIO-ED1:** Ofgem recognized a structural change in the level of RPI inflation due to the ONS changing its data collection routines and adjusted its cost of capital and real price effect forecasts accordingly. **RIIO-2:** Ofgem has not specified its approach to CPI/RPI for the next round of RIIO price control reviews.
Approach – use of inflation	**Cost of debt:** Simple 10-year trailing average of iBoxx non-financials 10+ maturity indices with credit ratings of A and BBB[46]. Cost of debt allowance is updated on an annual basis in line with the change changes in 10-year trailing average. Indices are deflated by 10-year RPI breakeven inflation data published by the Bank of England.[47] No adjustment for inflation risk premium is applied. **Cost of equity:** Risk-free rate based on a 10-year average of the yield on index-linked gilts **Allowed revenues:** A mix of inflation forecasts are used. To estimate the base year price level Ofgem use the HM Treasury publication "Forecasts for the UK Economy" which provides an average forecast for the next two years based on independent and City forecasts.[48] For the price control model, Ofgem uses a fixed inflation rate that is based off of the Bank of England 2% CPI target and uplifted for the long-term difference between RPI and CPI. Ofgem apply a true-up adjustment to protect both consumers and network companies against any difference between forecast RPI growth and actual RPI growth.[49] Prior to the RIIO controls, Ofgem set allowed revenues in the prices of the base year. These base allowances were then uplifted by RPI in each charging year during the price control, using a lagged measure of inflation to avoid making an RPI forecast. When RPI followed stable growth, this was not a problem. But in an environment of very low or negative inflation, a change in approach was necessary.

[46] For GD1, for ED1 Ofgem moved to a trailing average period that extends trombone like from a fixed starting point.
[47] Ofgem, *Strategy decision for the RIIO-ED1 electricity distribution price control,* March 2013.
[48] Ofgem, *Decision on the RPI indexation method to apply to allowed revenues in the forthcoming RIIO price controls (T1 and GD1) and the TPCR4 rollover*, July 2011.
[49] Ibid.

	Details
Considerations	Ofgem acknowledges that breakeven inflation rates implicitly include an inflation risk premium. Ofgem considers that the premium does not have a material impact as it is offset by a liquidity risk premium included in the yields of ILGs. The liquidity premium compensates holders of ILGs for the relatively lower levels of liquidity in the ILG market than the conventional (that is nominal) government bond market. Ofgem states that "*a DNO issuing conventional debt would face the cost of an inflation premium in its interest payments. However, the DNO is financing the RAV, which is indexed to RPI. Investors in the RAV, taking both debt and equity investor together, are fully protected from inflation risk. This suggests there should be no inflation premium overall.*[50] Ofgem states that the market inferring a positive inflation risk premium for debt should also infer a negative risk premium for equity and therefore an investor could perfectly hedge against inflation risk by holding proportions of the company's equity. *"It would be unreasonable to allow for a higher overall WACC on account of an inflation risk premium and impose additional costs on consumers for any inflation risk in the financing of an inflation-proofed asset."*

A.2. Ofwat, PR14, UK

Approach – regulatory framework	Ofwat applied RPI inflation Indexation to revenues and the RCV and the WACC is applied in real terms. **PR19**: Ofwat has stated its intention to change the revenue indexation to CPI or CPIH from the start of PR19. It will change the RCV indexation to 50% CPI(H) and 50% RPI and will increase the proportion indexed to CPI through the 2020-25 control period. Ofwat will take a single nominal cost of capital, and separate it as real CPI(H)-based and real RPI-based. This will provide time for existing RPI linked debt to unwind. Ofwat will reconcile the difference between the RPI and CPI(H) forecast for setting price limits and the actual outturn RPI-linked cost of capital that applied to the RPI-linked part of the RCV.
Approach – use of inflation	**Real WACC (nominal cost of debt and cost of equity components):** Consider long-term forward-looking measures of RPI to deflate nominal bond estimates. Use a range of evidence, but predominately breakeven inflation expectation using 10-year bonds and 20-year bonds, adjusted for an inflation risk premium of 0.3% (the average premium on 10 year gilts between 1997 and 2007 as calculated by the

[50] https://www.ofgem.gov.uk/ofgem-publications/89072/riio-ed1draftdeterminationfinancialissues.pdf

	Bank of England).[51, 52] The range generated by the 10-year and 20-year was cross-checked against historical long-run inflation. This is also supported by the BoE inflation target. **Allowed Revenues:** RPI forecasts used for revenue appear to be set equal to Consensus Economics' (a survey) forecasts. A true-up mechanism adjusts for actual inflation annually with a two-year lag. RPI is calculated based on RPI in November the prior year and November of the charging year.
Considerations	Ofwat noted that current RPI estimates from places like the Office for Budget Responsibility was higher over the price control period. However, it considered that the market evidence from the breakeven estimates supported a lower estimate (that it went with). Ofwat also considers that 20 year bonds used to determine breakeven inflation may be more appropriate than 10 years due to the fact that iBoxx 10+ maturity is closer to 20 years. As at March 2015, 48% of water sector debt was index-linked excluding swaps.

A.3. Commerce Commission, New Zealand

Approach – regulatory framework	At the end of the regulatory cycle, the RAB is updated using the actual CPI over the regulatory cycle. NZCC reimburses businesses for 2/3 of the forecast error on opex. Nominal WACC is applied. NZCC seeks to choose an inflation forecast that is consistent with the inflation forecast inherent in the WACC. Use RBNZ CPI forecasts produced at the time closest to the determination window used to estimate the risk-free rate and then trend to the mid-point of the RBNZ inflation target over three years.
Approach – use of inflation	**Cost of debt:** risk-free rate + debt risk premium averaged over a single month close to the beginning of the regulatory period.
Considerations	If inflation forecast is wrong, it can magnify the short-term exposure of equity holders and if it is inconsistent with the inflation forecast inherent in the WACC, it can result in a permanent increase or decrease in the return provided to suppliers. RBNZ have a history of overestimating its-forecasting and de-coupling these with market expectations. However, NZCC does not believe that RBNZ forecasts are biased, even though outturn has been less than RBNZ target; if taking a longer-term average, the outturn inflation is very close to the RBNZ target. If there is an error in the inflation forecast, this still results in a real return to the supplier as long as the same error is included in the

[51] PwC, *Updated evidence on the WACC for PR14*: *A report prepared for Ofwat*, December 2014, page 19.
[52] http://www.bankofengland.co.uk/publications/Documents/quarterlybulletin/qb1203.pdf

	inflation forecast inherent in the WACC. The impact of any potential over-forecasting of inflation is reduced. NZCC point out several key issues with the approach implied from index-linked government bonds: (1) shortest dated NZ inflation-linked bond matures in 2025 therefore any implied inflation would be an average over the period, (2) yields on nominal government bonds can include a premium for bearing inflation risk which can distort the implied inflation forecast, (3) yields on CPI-index government bonds can include a liquidity premium given the relative scarcity of this type of bond. Market forecasts are said to be taken into consideration by the RBNZ in their inflation targets.

A.4. IPART, Australia

Approach – regulatory framework	IPART uses a building blocks methodology to estimate tariffs and revenue requirements. IPART uses a real rate of return to determine the cost of capital allowance of its building blocks model.
Approach – use of inflation	Inflation is used to convert a nominal WACC into a real WACC for use in IPART determinations. The inflation approach used by IPART since March 2015 includes a 10-year geometric average of the one-year RBA inflation forecast and the middle of the RBA's target band of inflation, i.e. 2.5%, for the remaining nine years. A risk-free rate based on a combination of a prevailing forty-day average and a longer ten-year average is used for both the cost of debt and the cost of equity, based on government bond yields.
Considerations	IPART had consulted on use of two year of RBA's inflation forecasts, together with use of the mid-point of the RBA's target band of inflation.[53] Submissions indicated that while the one-year RBA forecast outperforms the mid-point of the target band, the second-year forecast does not. IPART considered this along with additional certainty for utilities and shareholders in revising their approach. Prior to 2009, IPART had used breakeven inflation. However, the changes in bond market conditions led to a move to the use of inflation swaps. Inflation swaps were seen as a market-based estimate that did not require any adjustments for biases/risk premia in the market. IPART noted that breakeven inflation and economists' inflation forecasts would be used as a cross-check. Breakeven inflation was also used for periods where swap data did not exist.

[53] IPART (2015) New approach to forecasting the WACC inflation adjustment

	IPART noted that their view of the appropriate framework was to derive a true real rate that reflects the 'risk manageable' rate. In the choice of using a market derived method in 2009, IPART stated the following: "*If IPART would use the economists' forecast of inflation, regulated utilities would be subject to additional risk as this inflation rate would most likely defer from the inflation rate which can be risk-managed*."[54] IPART further reviewed the choice of inflation in 2014 in light of new evidence and research. The primary approach taken by IPART was to review the accuracy of inflation estimates over the 2009-14 period. Swap implied inflation was 21bps above mean CPI inflation, the furthest away from outturn inflation of the options considered by IPART. The price of inflation swaps was seen as a better predictor of the risk profiles of businesses that purchase inflation swaps rather than economy-wide inflation. IPART note that there are different ways to calculate breakeven inflation and noted that the Australian Government could choose to stop issuing inflation indexed bonds again in future. The breakeven inflation approach was seen as not being as simple as use of forecasts with the RBA target band, while there is passing reference to biases/risk premia in the inflation forecast derived from breakeven inflation.

A.5. ERA, Australia

Approach – regulatory framework	The regulatory framework is similar to that adopted by the AER in that a nominal WACC is used together with an indexed RAB. There is an offsetting adjustment made for expected increases in the RAB due to inflation expectations, using inflation forecasts. Outturn CPI inflation is used to index the RAB. The risk-free rate is used for both the cost of debt and for the cost of equity, based off nominal five-year CGS yields over a forty-day averaging period. The debt premium is updated annually and is based on a sample of comparator bonds. The cost of equity model uses a CAPM approach, following a five-step process in their rate of return guidelines, allowing the ERA to consider a number of models and relevant evidence.

[54] IPART (2009) Adjusting for expected inflation in deriving the cost of capital: Analysis and Policy Development – Final Decision.

Approach – use of inflation	There will be an implied inflation term within the nominal risk-free rate for both the cost of debt and equity. Five-year breakeven is used as the basis for estimating expected inflation. This is taken over the same forty day averaging period as for the risk-free rate. As such, the approach would be equivalent to deriving a real risk-free rate. Linear interpolation on nominal and index-linked yields are used to get the breakeven inflation rate. Outturn CPI inflation is used to index the RAB.
Considerations	The ERA notes their preference for market derived measures of inflation: *"Market prices reflect the aggregation of diverse market participant's expectations. The forecasts of many different market participants is considered to contain more information and be more relevant than any one particular forecast model or limited set of models."*[55] On inflation swaps, the ERA states: "*The Authority considers that the inflation swap approach contains a significant upward bias, which does not accurately reflect investor's inflation expectations…As such, using the implied inflation rate from the swap market is likely to overestimate the expected inflation rate.*"[56] It was noted that there was a small counterparty risk premium included within swap pricing, however they are not considered to have liquidity premia due to the over-the-counter nature of products. The ERA do note that in some circumstances breakeven inflation measures may not be suitable e.g. following the GFC. However, in their view, the liquidity on index-linked bonds had improved and liquidity premia had subsided. Inflation risk premia were considered to be similar to those on CGS.

A.6. ESC, Australia (Victoria)[57]

Approach – regulatory framework	The ESC's standard model for setting regulated charges required a real WACC applied to an indexed RAV. Revenue is also indexed to inflation. Forecast inflation for the purpose of determining the real WACC is based on nominal bond rates using the "paired bond approach" which considers current market evidence.

[55] ERA (2013) Rate of Return guidelines, Explanatory Statement, para 992.
[56] ERA (2013) Rate of Return guidelines, Explanatory Statement, para 994.
[57] http://www.esc.vic.gov.au/wp-content/uploads/2015/04/Consultation-Paper-Review-of-Water-Pricing-Approach.pdf

Approach – use of inflation	**Cost of debt**: As of Melbourne Water's 2016 decision, the ESC calculates the trailing average of nominal cost of debt along with a forecast of inflation, applied by the Fisher transformation to arrive at the implied real cost of debt. The forecast of inflation made at the time of the price review continues to be applied when undertaking annual updating. The inflation risk is thus borne by the regulated business between price reviews. **Real risk-free rate:** Calculated over 40 days using a "paired bonds approach" with Indexed CGS and Nominal CGS. **Allowed revenue and RAV:** Updated for actual inflation.
Considerations	The ESC states that regulated businesses typically finance with nominal debt, thus it is appropriate for a trailing average to be applied to nominal cost of debt including an inflation forecast. According to ESC, this is largely due to the small market size of both inflation swaps and index-linked bonds. Applying a fixed inflation forecast throughout the regulatory period is simple and consistent with the ESC's previous approach.

ANNEX B RESPONSE TO CONSULTATION QUESTIONS

We do not provide specific responses to the AER's consultation questions; however we have provided the Section references for where we address the question, or the premise for the question.

Question 1: *Explain why you agree or disagree that the RBA inflation target method is more likely to provide best estimates of expected inflation than swap-implied estimates and bond breakeven estimates?*

Section 4.3.

Question 2: *Explain why you agree or disagree that inflation swaps are a more robust and congruent market-based estimate of expected inflation than bond breakeven estimates?*

Section 4.1.2 and 4.3.

Question 3: *Do you agree that we should not rely on swap-implied estimates or bond breakeven estimates? Should we place some weight on estimates from each of the four methods?*

Section 4.3.

Question 4: *Do you consider that monetary policy has (or is perceived to have) lost its effectiveness in influencing economic activity and as a result inflation expectations?*

Section 4.1.2.

Question 5: *In light of potential anchoring of long-term inflation expectations to the RBA's target band, explain whether you consider we should simply estimate expected inflation based solely on the RBA target band, without adjusting for the RBA's short-term (2-year) inflation forecasts?*

N/A.

Question 6: *Provide reasons as to whether or not you agree that the RBA's short-term (2-year) forecasts are likely to outperform private-entity forecasts? If our approach is to continue to combine short-term inflation forecasts with the RBA target band, should we use the RBA's 2-year forecasts or use other survey estimates instead and why?*

N/A.

Question 7: *Do you consider that swap-implied estimates are materially affected by various risk premia and biases? If so, do you consider that those biases and premia can be estimated robustly and removed from the swap-implied estimates?*

Section 4.1.

Question 8: *Do you consider the limited tenors of indexed CGS are likely to result in the swap-implied forward inflation curve better reflecting the decomposition of market-implied forward inflation rates than the bond breakeven-implied forward inflation curve?*

Section 4.1.

Question 9: *Do you consider that bond breakeven estimates are materially affected by various risk premia and biases? If so, do you consider that those biases and premia can be estimated robustly and removed from the bond breakeven estimates?*

Section 4.1.

Question 10: *Should we consider survey-based estimates of 10-year inflation, even if the data cannot be publicly reported?*

Section 4.2.

Question 11: *Is there an adjustment to the PTRM that could be made to remove the incentive to insert bias in to the inflation expectation? Does this adjustment still achieve the same inflation compensation outcomes?*

Not part of the scope of this paper.

Question 12: *Should inflation compensation be set in real or nominal terms? Should inflation compensation be set in real or nominal terms at the regulatory asset base level or at the equity and debt level? Explain why your selection is preferable.*

Not part of the scope of this paper.

Question 13: *Are there preferable changes to achieve the appropriate inflation compensation that have regard to the relevant items in the NER, minimise impact to other building blocks and do not reduce regulatory stability and certainty?*

Not part of the scope of this paper.

Question 14: *Are there changes to the inflation lag approaches that can be made that ensure appropriate matching of inflation periods? If so, how are they materially better?*

Not part of the scope of this paper.

Question 15: *If changes are made to reduce inflation risk, should the median credit rating or the equity beta be adjusted in the short term? Are there other parameters that also should be adjusted?*

Not part of the scope of this paper.