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Estimating Inflation Expectations for Regulatory Decisions

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Executive Summary

The Essential Services Commission of South Australia is preparing a regulatory determination that will set SA Water's maximum allowable revenues for the period July 2020 to June 2024. One issue that arises in the Commission's deliberations is the need to choose a deflation factor for the purpose of determining the real weighted average cost of capital (WACC) allowed to SA Water. This paper addresses that issue.

The Commission presently calculates the real rate of return by deducting an assumed inflation expectation from the nominal interest rate on a 10-year Commonwealth Government Security. It asks what the best measure of inflation expectations is, and considers four alternatives:

- the geometric average of the Reserve Bank's (RBA) one-year inflation forecast and nine years of the midpoint of the RBA medium-term inflation forecast which currently is 2.5 per cent ("the RBA-based method" hereafter; it is the method presently used by the Commission);
- the long-term bond breakeven rate;
- the fixed rate on long-term inflation swaps; and
- survey-based estimates of expected inflation.

The Commission has prepared a useful summary of the pros and cons of these options. However, there are some issues that should be given more weight in the Commission's deliberations.

Firstly, the midpoint of the RBA's target range is not necessarily a good indicator of inflation expectations. The RBA has pointed out that, at any particular time, the RBA inflation expectation may lie elsewhere. If, say, the Bank held the expectation that inflation would average 2¼ over 10 years, this would not be picked up by a method which mechanically takes the midpoint of the target range for inflation.

This point is particularly relevant in the current inflation environment. The RBA is forecasting inflation of 1.9 per cent through the year to the December quarter 2020 and then 1.9 per cent through the year to the December quarter 2021, and there is no indication of an acceleration of inflation in that forecast window. The RBA does not publish forecasts beyond 2021.

Secondly, the revenue model for SA Water provides near-full insurance against inflation risk. Consequently, the real WACC should be calculated with a deflator that excludes both inflation expectations *and* the inflation risk premium from the nominal bond rate. However, the Commission describes the process of deriving a real WACC as one in which the nominal WACC is deflated by inflation expectations, without mention of the need to remove the inflation risk premium as well.

If one has the objective of removing only inflation expectations, then it is a relative strength of the RBA-based method that it strips out only inflation expectations. And from that perspective it is a relative weakness of the bond breakeven rate that it removes the inflation risk premium.

If one takes the view that the inflation risk premium should be removed, then it is a relative weakness of the RBA-based method that it does not strip out the risk premium. In this case it is an advantage of the bond breakeven rate that it covers the risk premium. But it is a disadvantage of the breakeven rate that it includes the net differential in liquidity premia. The swap rate encompasses both inflation expectations and the inflation risk premium but is unlikely to include any liquidity premia and from this perspective is the ideal measure to deflate for both inflation expectations and the inflation risk premium.

Thirdly, it is well recognised that there is a potential for error in the parameter assumptions that the Commission adopts. One approach to minimising errors in the parameter assumptions is to avoid or reduce the risk of "outlier" values in estimates of the parameter values. The RBA-based method effectively suppresses outliers in the inflation expectations series by omitting from consideration the evidence on fluctuations in inflation expectations in the last 9 years of the 10-year averaging period. But the consequence of this is in fact to accentuate the magnitude of the real WACC cycle, because low nominal interest rates and WACCs are correlated with low inflation expectations. The RBA-based method gravitates to the average in its estimates of inflation expectations but amplifies the real WACC cycle and also amplifies the outliers in that series.

Arguably the Commission should be more concerned about outlier values in the real WACC and thus the cost of capital building block than in its inflation expectations assumptions.

Fourthly, this paper presents some rough numerical calculations for alternatives to the RBA-based methodology. The RBA-based methodology suggests deflating the WACC by about 2.4 per cent. Another alternative is to use the bond breakeven rate which indicates a deflation factor of about 1.3 per cent at the end of September. Another alternative is to deflate the nominal bond yield by an inflation swap rate which presently is about 1.7 per cent. Another method, which avoids the use of any current data on expectations, inflation risk premia, etc. but instead predicts the breakeven rate from the nominal bond rate produces a deflation factor of about 1.5 per cent (but this would be better replaced with a model based on the swap rate). The estimate based on the inflation swap rate is probably the most pure conceptually, but one would want to assess data availability before proceeding to implement it.

Fifthly, fluctuations in the real rate of return on capital can create substantial volatility in water prices from one regulatory period to the next. From a political perspective this may be problematic, because it is difficult for a government to impose price increases well ahead of CPI even if they have, a few years before, had sub-CPI price changes of offsetting magnitude. The real WACC that would arise from the RBA-based method at present would seem to be the lowest at least since the beginning of the inflation targeting era. It is likely that it will be higher at the next regulatory decision, requiring a potentially sharp uplift in prices. There is a good economic case for prices that are genuinely cost reflective. But the cost recovery concept at hand is of a long-run nature and it is not clear that short run volatility in these prices provides useful price signals to water customers. The Commission should be wary of allowing “outlier” pricing observations to be built into the maximum allowable revenue calculation.

The Commission has raised the possibility of annual updating of the WACC within the regulatory period, with the objective of smoothing prices from one determination to another. The WACC would be updated for latest data on nominal interest rates, cost of debt and 1-year inflation expectations. While this would probably do no harm, it seems likely that there are some longer cycles in the key parameters of the WACC that could not be smoothed-out by such a method.

1. Introduction

The Essential Services Commission of South Australia (the Commission) is preparing its SA Water Regulatory Determination 2020 (SAW RD20). Inter alia this regulatory determination will set the maximum amount of revenue that SA Water may raise from the provision of services covered by SAW RD20.

This paper considers the approach that the Commission takes in SAW RD20 with respect to inflation expectations—both the way in which it affects the maximum revenue and also the assumption about what level of inflation expectations is held in financial markets.

2. Background

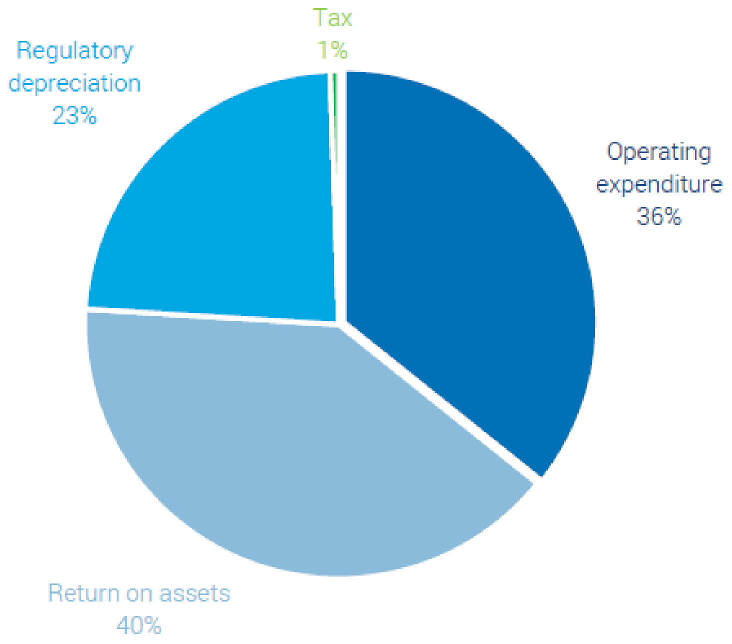
The Commission sets the maximum allowable revenue over the 4 years of the determination in real terms. It tests for compliance at the end of the regulatory period by (a) deflating the nominal value revenues earned by SA Water in each year by the CPI for that year to generate actual revenue in real terms and (b) adding them up to obtain total real revenue for the regulatory period. And in the transition from one regulatory period to the next, the Commission inflates the regulatory asset base in line with actual inflation.

This approach allows SA Water some flexibility in the price path that it implements. If it were to raise prices in line with the actual CPI outcome in each year, then it would achieve constant real prices through the regulatory period. But SA Water has flexibility to set other price paths so long as they are consistent with the maximum allowable revenue.

The Commission uses a ‘building blocks’ approach to set the maximum allowable revenue. Figure 1 shows the building blocks in the calculation and their contribution to maximum allowable revenue under the current Determination (SAW RD16).

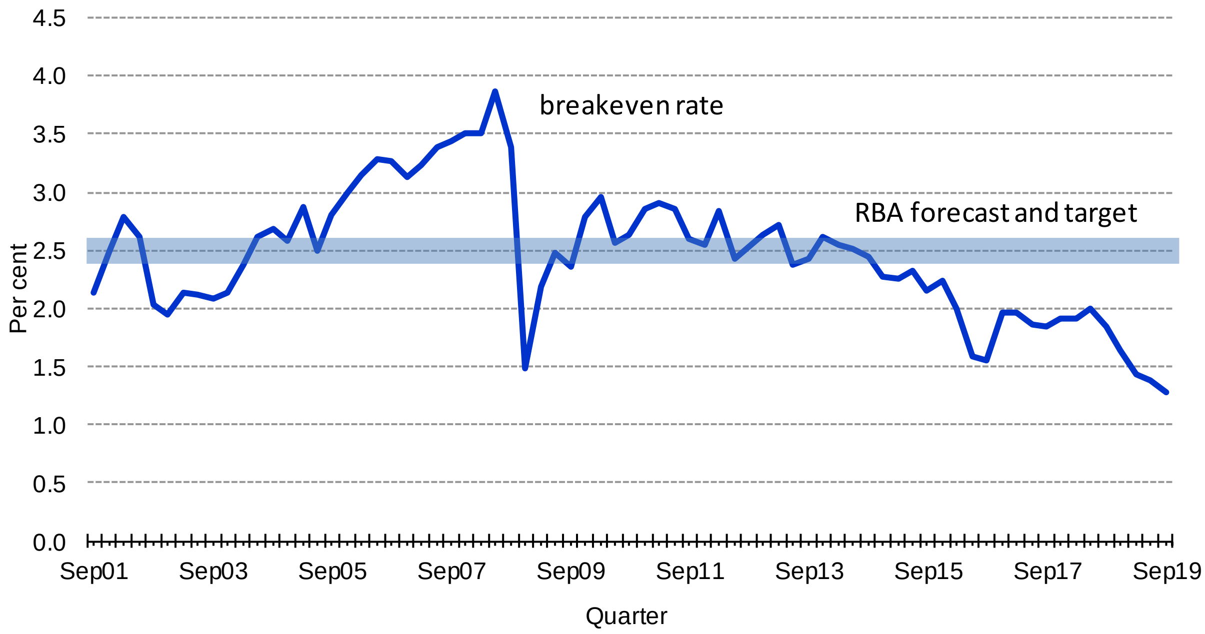
The largest single building block is “return on capital”. This component is determined by identifying SA Water’s capital needs and a required real rate of return on that capital. There is a general assumption that the real rate of return is calculated by removing an estimate of 10-year expected inflation from a 10-year nominal rate of return. This means that the Commission must make an assumption regarding the 10-year expected rate of inflation so that it can deflate the nominal interest rate.

Figure 1 Building blocks’ contribution to maximum allowable revenue in SAW RD16



Source: ESCOSA ()

Figure 2 Indicators of expected inflation: RBA-based and bond breakeven rate



Source: SACES calculations using RBA data.

By "expected inflation" we mean the inflation expectation that lies behind the prices that are transacted in financial markets. This expected rate of inflation cannot be directly observed and must instead be inferred from other indicators. The Commission identifies four approaches to estimating expected inflation (ESCOSA 2019), these being:

- the geometric average of the Reserve Bank's (RBA) one-year inflation forecast and nine years of the midpoint of the RBA medium-term inflation forecast which currently is 2.5 per cent ("the RBA-based method" hereafter; it is the method presently used by the Commission);
- the long-term bond breakeven rate;
- the fixed rate on long-term inflation swaps; and
- survey-based estimates of expected inflation.

These are also the approaches that were identified and considered by the Australian Energy Regulator (2017) when it last considered this issue in depth.[1] In correspondence with the AER at the time of that review, the RBA (2017) said that *"To summarise our response, none of these measures is perfect* [as a measure of expected inflation]*".*

The Commission at present puts its weight entirely on the RBA-based method. In correspondence with the AER, in respect to a similar inflation expectations construct, the RBA says that this approach *"appears to be congruous with the AER's aim for a transparent, replicable and simple measure"* but that

> *"it has some limitations. Firstly, the mid-points of the published forecast ranges are not necessarily the RBA's central forecasts. Secondly, if actual long-term inflation expectations were to move notably for a sustained period, it would not be valid to use the Bank's target as a proxy."*

Even if the Reserve Bank's own inflation expectation were to move within its target, say down to 2¼ per cent or to 2 per cent, this would not immediately lead to a change of the target range. The RBA-based method would not pick it up. This is not a problem for the target range given that its role is to set a policy for inflation targeting, but it is a problem when predicting expected inflation.

3. The bond breakeven rate and the swap rate

The bond breakeven rate—sometimes referred to as the "inflation yield"—is the difference between the yield on a nominal bond and the yield on an inflation-indexed bond of the same duration. To understand the structure of the bond breakeven rate we need to understand the structure of nominal and real yields.

[1] AER uses two years of forecasts and eight years of the midpoint.

We can conceive the yield on a nominal bond y_{nom} as compensating investors in the nominal bond for four factors, these being the rate of time preference r which is paid to compensate the bond holder for deferring consumption, the inflation expectation π_e which compensates for the anticipated erosion by inflation of the purchasing power of the payments to the bondholder, a risk premium β which compensates the bondholder for non-diversifiable risks associated with her inflation exposure, and a liquidity premium λ_{nom} which compensates her for the inherent illiquidity of the bond and the likely size of the loss that she incurs from liquidating her holding. Thus

$$y_{nom} = r + \pi_e + \beta + \lambda_{nom}. \quad (1)$$

We can conceive of the yield on an indexed bond $y_{indexed}$ as compensating an investor for two factors, these being the rate of time preference and the appropriate liquidity premium on the indexed security so that

$$y_{indexed} = r + \lambda_{indexed}. \quad (2)$$

It follows that the bond breakeven rate is given by

$$y_{breakeven} = y_{nom} - y_{indexed} = \pi_e + \beta + (\lambda_{nom} - \lambda_{indexed}). \quad (3)$$

The swap rate is not stapled to an underlying security so we assume that no significant liquidity issues arise. Under the swap contract, one party is assured of a payment which is indexed to inflation and the other party is assured of a payment which is fixed in nominal terms and thus inflation-exposed. The party accepting the inflation-exposed payment requires compensation y_{swap} covering both expected inflation and the inflation risk inherent in its payment stream so that

$$y_{swap} = \pi_e + \beta. \quad (4)$$

Figure 2 shows that the breakeven rate has fallen quite substantially over the last few years, meaning that some of all of the inflation expectation, the inflation risk premium and the net liquidity premium component have fallen. For instance, between September 2013 and September 2019 the breakeven rate has fallen by about 1¼ percentage points. Data from the swaps market indicate a fall of similar magnitude over the same period, suggesting that the fall in the bond breakeven rate is not due to movements in liquidity but is due to movements in inflation expectations and the inflation risk premium.

4. Choice of an appropriate deflation factor

ESCOSA's methodology for calculating SA Water's regulatory WACC seeks to deflate the nominal WACC for inflation expectations. But on conceptual grounds the Commission should actually deflate for inflation expectations and the inflation risk premium.

The real risk free WACC for SA Water should be calculated in a way that excludes not just inflation expectations but also the inflation risk premium because SA Water is effectively insured against inflation risk. This insurance comes in two forms. Firstly, within a regulatory period its revenue cap is adjusted in nominal terms in line with actual inflation. Secondly, across regulatory periods the regulatory asset base is escalated in line with actual inflation (not expected inflation) and other costs are reviewed in light of prevailing market conditions including actual inflation outcomes. These mechanisms mean that SA Water is able to adjust its nominal revenues to cover actual inflation, and accordingly its returns do not have an inflation risk

If one accepts that the appropriate deflator should encompass inflation expectations and the inflation risk premium then a number of implications follow:

- firstly, the Commission suggests that it is an advantage of the RBA-based method that it is a pure inflation expectations measure, but in fact this is a disadvantage because what is needed is a deflator that includes inflation expectations and the inflation risk premium;
- the case against the bond breakeven rate is overstated, because the fact that the bond breakeven rate includes an inflation risk premium should be regarded as a strength and not a weakness; and
- the swap rate is a conceptually identical indicator because it covers both inflation expectations and an inflation risk premium without any confounding influences from liquidity premia.

These considerations cast doubt on the validity of the Commission's current approach of using 'an estimate of long-term inflation expectations to deflate the nominal WACC' [p. 4]. The Commission should also be stripping out the inflation risk premium. If one accepts this view, then the fact that the bond breakeven rate includes the inflation risk premium is a strength, not a deficiency.

The discrepancy is of particular concern because data from the swap markets suggests that there is a substantial downward break in the appropriate deflation factor but the RBA-based method does not capture it. The point is illustrated by considering Figure 2. The Commission's deflation factor should be showing a move similar to that shown by the bond breakeven rate but the RBA-based method does not do this.

The deflation factor from the RBA-based method presently is about 2.4 per cent. The bond breakeven rate is about 1.3 per cent and it would therefore produce a real WACC estimate about 1.1 percentage points higher than what would be produced with the RBA-based method. 10-year inflation swap rates are currently trading at about 1.7 per cent and they would thus produce a real WACC about 0.7 percentage points higher than what would be produced with the RBA-based method.

5. Predicting a deflator from nominal interest rates

Mainstream economic theory suggests that there is a positive correlation between inflation expectations and the nominal bond yield. The RBA-based method is likely to suppress that correlation and thus as an indicator it will exaggerate the highs and lows of the real interest rate cycle.

We do not have a pure inflation expectations series that can be used to investigate correlation with the nominal bond rate. But there is a strong positive correlation between the bond breakeven rate and the nominal interest rate. This means that when the nominal interest rate is low then the breakeven rate is likely to be low and in turn some or all of the components in it—see (3)—are likely to be low. The same is true for the swap rate. A further implication of this relationship is that is that the real interest rate tends not to move as much as the nominal interest rate.[2]

The RBA-based method ignores all of the information that is available from contemporary bond yields about contemporary inflation expectations, the inflation risk premium and liquidity premia. This increases the risks of errors in the estimated risk free rate and increases the risk of "outlier" estimates of the cost of capital. We can predict that the RBA method will tend to exaggerate the cycle of risk free real rates.

Even if the Commission is reluctant to take point-in-time estimates of components in the bond breakeven rate, it could make allowance for the correlation that they have with nominal interest rates, and thus produce estimates of the real risk free rate that are appropriately dampened. Essentially this dampening allows for the fact that movements in the nominal bond rate cannot be expected to have a one-for-one impact on the real interest rate.

At the time of writing we do not have the data to investigate the correlation between nominal interest rates and the swap rate. As an alternative we investigate the correlation with the breakeven rate. The econometric analysis here is rough and gives an indication of how to proceed; further refinements should be considered.

A basic regression of the breakeven rate on nominal yields produces a regression coefficient of 0.31, which means that a 1 percentage point reduction in the nominal yield is associated on average with a 0.31 percentage point reduction in the breakeven rate.[3] The correlation appears to be quite robust. This model produces a predicted breakeven of 1.5 per cent for September 2019, which compares with an actual breakeven of 1.3 per cent. Perhaps this specification could be improved on, but we will work with this number for the present. (It might be better to model the swap rate.)

The advantage of using a prediction is that it avoids exposing the estimate of a deflation factor to an observation on the bond breakeven rate which might be affected by temporary, anomalous factors. Instead, the estimate of the deflation factor is driven by a prediction based on more robust nominal interest rate data.

2 Over the period June 2013 to November 2019 the simple correlation coefficient is 0.96. The standard deviation of nominal yields over June 2013 to November 2019 is 0.76 whereas the standard deviation of yields on indexed bonds is 0.48.

3 We do not need to make any assumptions about causation for the purposes of this discussion.

If the predicted breakeven were used for deflation, it would imply a WACC about 0.9 percentage points lower than with the RBA-based method.

6. Practice in other jurisdictions

This raises the question of how other jurisdictions that use a real WACC model go about setting a real rate. The Commission's (2019b) Appendix B indicates that IPART and ERA use real WACC concepts.

In its 2018 review of it WACC method, IPART (2018) considered the issue of what deflator to apply to nominal rates of return to produce a real rate of return. Inter alia it considered an RBA-based method the same as South Australia's, which is its current approach, and the bond breakeven rate. It received submissions in support of both. It decided to retain its existing method, but reconsider changing to a method employing the bond breakeven rate in its next review.

ERAWA uses a real WACC in some but not all of its decisions. In its 2018 final decision on the Western Power Network it calculated a real WACC by deflating with a "forecast inflation rate" which it calculated as the breakeven rate on five-year CGS (ERAWA 2018). ERA's discussion of the issue suggests that it regards the breakeven rate as a satisfactory measure of inflation expectations; it did not address the issue of inflation and liquidity premia in the breakeven rate.

The AER uses a nominal rate of return with an indexed regulatory asset base and a negative revenue adjustment. It says that its "approach produces an identical revenue outcome to the real rate of return approach". This would seem to hold *ex ante* but may not hold *ex post.*

8. Smoothing prices

The building blocks model has as its goal ensuring that the regulated entity can recover efficient costs but not more. If some of the building block components are volatile this may lead to sharp jumps up or down in prices from one regulatory period to the next. In some markets, such as stock markets, petrol, fruit, etc. there is probably a quite high degree of customer acceptance of prices that bounce up and down. But this is arguably not the case with utilities prices, especially when they are government-owned and the pricing decision is seen by the public as a policy choice. Whereas there may be general acceptance of government charges that rise broadly in line with inflation, there is likely to be a more hostile reaction to a pricing model that raises the same revenue but with prices that move up and down markedly from one period to another.

Changes in the real WACC cause the cost-of-capital building block to increase and decrease in real terms and are potentially a significant source of price volatility. With cost of capital accounting for roughly 40 per cent of SA Water's maximum allowable revenue, then changing the WACC from say 5 per cent to 4½ per cent or vice versa has the potential to push prices up or down by about 4 per cent when the WACC changes. Smoothing the real WACC can contribute tangibly to smoothing the trajectory of water prices.

This point is important because regulators tend to smooth parameters when they are uncertain as to their true values. In the current context there is uncertainty about both inflation expectations and real rates of return. The RBA-based method does a good job of smoothing the inflation expectations parameter but the problem is that this means that volatility in the nominal bond rate is all passed on into the regulatory real rate of return. It would assist with implementing a smoother price trajectory if the smoothing were applied to the real rate rather than the expected rate of inflation.

Smoothing of this type is unlikely to be materially at odds with the objective of efficient resource allocation. Efficient resource allocation relies on having a cost-reflective set of prices for firms and households that make decisions about how to use water, how to make efficiencies, and so on. But it is average prices over a period of time that are likely to determine consumer behaviour, for instance because water efficiencies will often involve long-term investments.

9. Annual updates

The Commission has released a Guidance Paper canvassing annual updates of the regulatory rate of return. The use of annual updating would effectively calculate the WACC as an average of four annual observations and this would serve as "a mechanism to help to avoid the risk of large movements in the regulatory rate of return at each determination" [p. 3].

In considering the annual updating approach it is worthwhile to consider two perspectives on annual updating. Firstly, we consider it from the perspective that the annual WACC calculations are correct, i.e. not subject to measurement error, and we consider the efficacy of annual updates as a smoothing mechanism. Secondly, we consider annual updating from the perspective that the WACC is not exactly observed and is in fact estimated subject to measurement error. We consider the potential for annual updating to diminish measurement error.

Smoothing efficacy

The Commission's proposed method will produce some smoothing of prices. It is likely to dampen high-frequency cycles in the WACC but it cannot do much to suppress low-frequency cycles. The method effectively sets up a filter with a 4-year window (albeit not moving). As such it can be expected to smooth out cycles with periods of up to four years. However, it is unlikely to dampen cycles with a longer period.

To illustrate the point, consider Figure 3. It shows annual WACC values drawn from two distinctly different distributions. The two distributions both have a mean (average) of 4.0 and a variance of approximately 0.5 but they have very different time series properties. The "cycling" series follows a cyclical pattern through time whereas the "noisy" series has no cycle at all and is purely random.

Figure 4 shows 4-year moving averages of these series. It shows that the "damping" is a lot more effective on the noisy series than on the cycling series. The variance of the noisy series is halved but the variance of the cycling series is virtually unchanged.

Yields (both nominal and indexed) and inflation expectations likely have substantial long-period cyclical components, and the Commission's proposed method will not deal with these. To the extent that there is a cycle in these costs, the annual updating method will not be effective in dampening it, and it will leave a cycle in water prices. To the extent that there is a cycle in water prices it will lead to potentially large movements in prices in the transition from one determination to another.

Error suppression

The Commission does not suggest that annual updating will protect against measurement error. But it is worth being clear that it will not address the main potential source of error in the measurement of WACC. This is because the Commission proposes to confine revisions to parameters that can be "objectively estimated" [p. 9], and these are not the source of errors. Specifically:

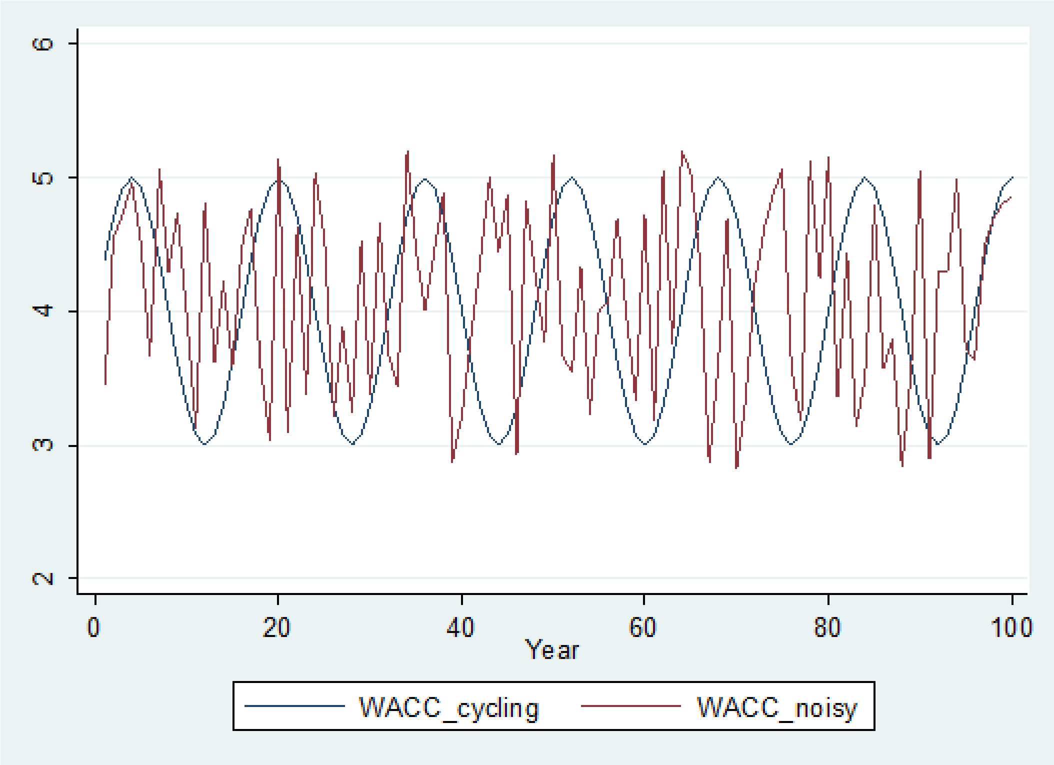
a. the (contemporaneous) nominal risk free rate is readily observed (from RBA);

b. the cost of debt is readily observed; and

c. the RBA 1-year forecast is readily observed.

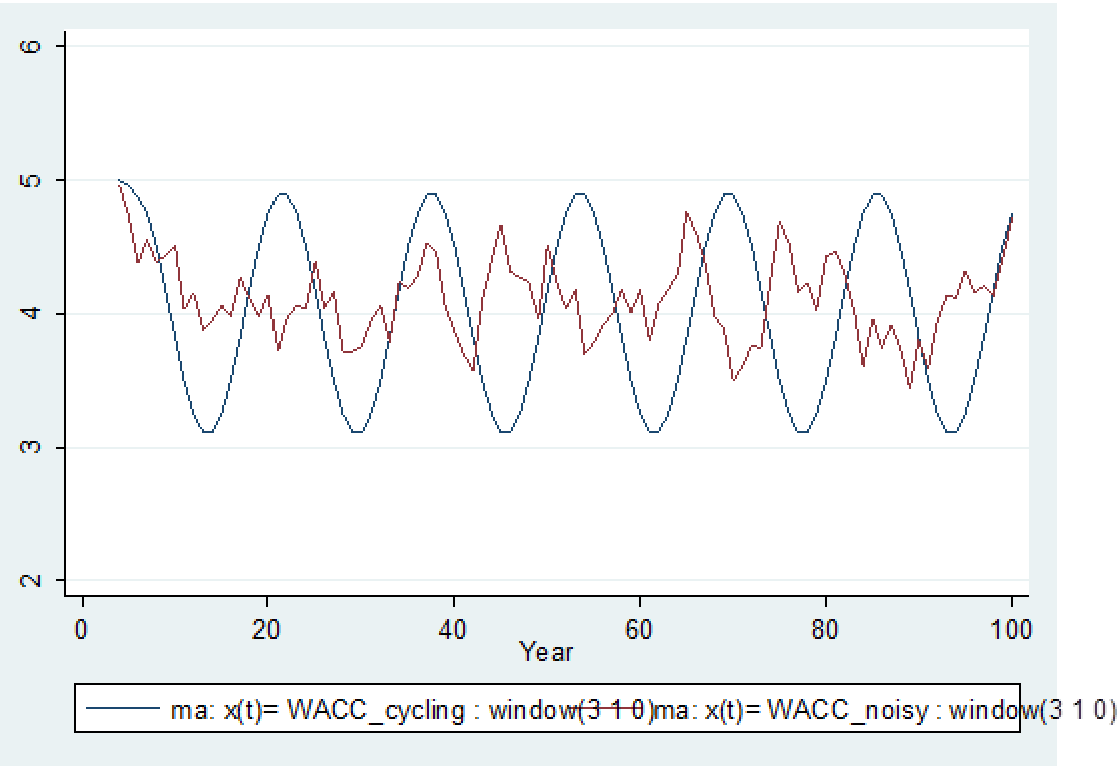
The potential for error in the real WACC estimate arises from possible errors in the market risk premium, beta and the method used to calculate the 10-year inflation expectation. None of these factors would be subject to annual update. The Commission's reasoning for not updating them—basically the absence of any objective annual data—is convincing in the context of its existing method. However, as discussed previously, there is a case for considering adjustments to the method to take into account the correlation between inflation expectations and nominal interest rates. Annual updating will not do this.

Figure 3 Annual WACC values (hypothetical)



Source: SACES calculations.

Figure 4 4-year moving average of annual WACC values (hypothetical)



Source: SACES calculations.

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