Submission to the QCA draft position paper on inflation forecasting

QUEENSLAND TREASURY CORPORATION

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Queensland Treasury Corporation (QTC) welcomes the opportunity to provide comments on the Queensland Competition Authority's (QCA) draft position paper on inflation forecasting[1].

QTC considers the proposed approach to be an improvement on the current inflation forecasting approach. In particular, term matching for the revenue deductions for inflation on the debt-funded portion of the regulated asset base (RAB) is more consistent with the efficient practice of nominal fixed-rate debt issuance by regulated businesses.

Regarding the revenue deductions for inflation on the equity-funded portion of the RAB, the proposed approach does not address the problems arising from an implied inflation risk premium (IRP) being reflected in the 'real' Commonwealth Government Security (CGS) yield in the real return on equity.

As explained in our submission to the inflation forecasting issues paper, the IRP compensates holders of assets with fixed nominal cash flows for systematic inflation risk. By definition, the IRP does not make up part of the true 10-year real (ie, inflation-indexed) CGS yield because inflation-indexed CGS are not exposed to inflation risk. Given that the same indexation approach applies to the real return on equity allowance, it follows that an unbiased estimate of the real return on equity must exclude the IRP.

In QTC's view, the approach in the draft position paper can be improved by adding two cross-checks to assess the plausibility of the QCA's implied real CGS yield in the real return on equity, and the estimate of expected inflation in the final year of the proposed glide-path. Although the cross-checks make use of inflation swap rates, neither cross-check uses these rates as estimates of expected inflation.

1 Inflation risk premium

1.1 The return on equity

- QTC supports a regulatory objective of targeting a real return on equity. For this to be effective, the implied real CGS yield in the real return on equity should not be affected by the IRP, which is[2]:

> *'… **the extra compensation nominal bond investors demand for bearing inflation risks,** and its value depends on the covariance between inflation and real economic activity. This premium is believed to have been positive and sizeable in the 1970s and 1980s, when investors were more worried about stagflation scenarios with higher inflation accompanied by lower growth, but **appears to have declined in recent decades to lower or even negative levels, as investors have become more concerned about outcomes where lower inflation is associated with lower growth.**'*

- This definition makes it clear that the IRP only applies to assets with fixed nominal cash flows, such as fixed-rate nominal bonds and the fixed leg of a zero coupon inflation swap. It also demonstrates that the IRP is compensation for the *systematic* inflation risk exposure of assets with fixed nominal cash flows, because the sign of the IRP depends on the correlation between inflation and real economic activity. For example, a negative IRP means that assets with fixed nominal cash flows are expected to perform strongly in real terms during adverse economic states when equities are expected to perform poorly (ie, the nominal asset is a hedge against equity risk).

[1] QCA (July 2021), *Draft position paper – Inflation forecasting*.

[2] D. Kim, C. Walsh & M. Wei (2021), *Tips from TIPS: Update and Discussions*, FEDS Notes. Board of Governors of the Federal Reserve System.

- The long-term decline in the IRP referred to in the above quote is problematic for the QCA's preliminary proposal to estimate the return on equity by adding a fixed historical market risk premium (MRP) to the prevailing 10-year nominal CGS yield. This issue is explored in more detail in Appendix A.
- The draft position paper also notes that the IRP does not make up part of the yield on assets with inflation-indexed cash flows:[3]

> *'**Nominal bonds carry inflation risk, which indexed bonds do not**. Investors care about their real, not nominal, returns on a bond. Therefore, nominal bonds are risky, because their real return depends on the actual inflation rate that occurs during the relevant period. It is therefore commonly assumed that nominal bonds have an inflation risk premium.'*

- The QCA uses the Capital Asset Pricing Model (CAPM) to estimate the nominal return on equity. Although the nominal return on equity is an input into the revenue building block model, making revenue deductions for inflation on the equity-funded portion of the RAB is equivalent to determining a real return on equity based on QCA expected inflation. As such, the QCA implicitly applies the CAPM in real terms to estimate the real return on equity[4]:

> *'If the discrete-time CAPM applies, it would then apply in real terms, and the risk-free rate would be that on indexed bonds.'*

- Based on the above, the real return on equity based on the CAPM should not include the IRP.

1.2 The cost of debt

- It is efficient practice for regulated businesses to issue nominal fixed-rate debt rather than inflation-indexed debt. This practice is reflected in the QCA's revenue building block model, which assumes the benchmark firm maintains constant gearing by borrowing against the annual indexation of the debt-funded portion of the RAB. The proceeds from these borrowings are used to service part of the efficiently incurred nominal cost of debt.
- If inflation-indexed debt was used, the increase in the benchmark debt balance for inflation would occur automatically via indexation of the principal, and there would be no proceeds raised by the new borrowings.
- As explained in Section 1.1, the IRP is unique to assets with fixed nominal cash flows, including 10-year fixed-rate BBB corporate bonds. Unlike the return on equity, the IRP makes up part of the efficient cost of debt for the benchmark firm, so it should be reflected in the real cost of debt allowance.

2 Proposed cross-checks

- In QTC's view, the approach in the draft position paper can be improved by adding two cross-checks to assess the plausibility of the QCA's implied real CGS yield in the real return on equity, and the estimate of expected inflation in the final year of the proposed glide-path. Although the cross-checks make use of inflation swap rates, neither cross-check uses these rates as estimates of expected inflation.

2.1 First cross-check

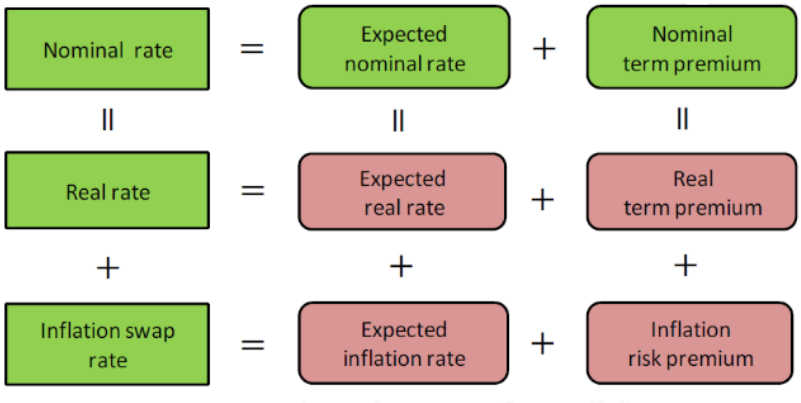
- In our submission to the inflation forecasting issues paper, we outlined a simple, model-free approach for estimating the lower bound for a 10-year inflation-indexed CGS yield that excludes expected inflation, the IRP and the liquidity premium in the observable 10-year inflation-indexed CGS yield.
- The approach is based on the relationships in Figure 1, which show the factors that comprise the nominal yield, real (ie, inflation-indexed) yield, and the inflation swap rate[5]:

[3] Draft position paper, p. 50.

[4] M. Lally (July 2020), *Review of the AER's inflation forecasting methodology*, p. 12.

[5] Imakubo & Nakajima (April 2015), *Estimating inflation risk premia from nominal and real curves using a shadow-rate model*, p. 23.

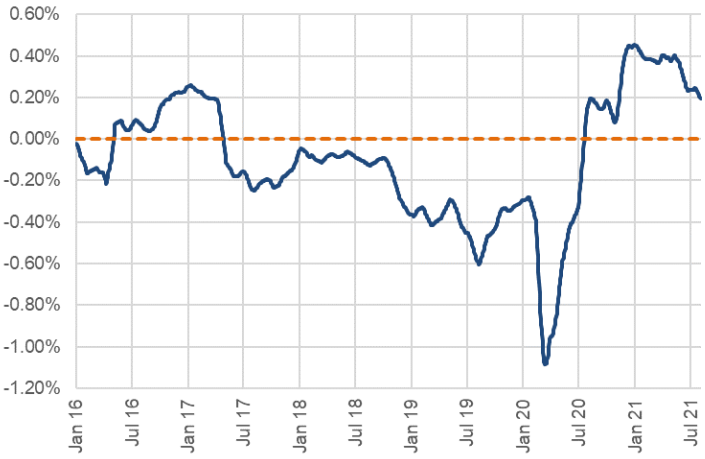
FIGURE 1: BOND YIELD DECOMPOSITION



Source: Imakubo & Nakajima, April 2015

- The Australian inflation swap market is one-sided, with most investors wanting to pay fixed inflation and receive actual inflation. Because there are few natural payers of actual inflation, the swap counterparty will usually require a yield premium to receive a fixed rate of inflation (ie, the other side of the more popular trade). As such, the observable inflation swap rate is likely to be higher than the combined value of expected inflation and the IRP.
- QTC is unaware of any empirical evidence or theoretical reasons that supports the inflation swap rate being lower than the combined value of expected inflation and the IRP. As such, the inflation swap rate is the *upper bound* for the combined value of expected inflation and the IRP.
- The lower bound for the 10-year inflation-indexed CGS yield is calculated by 'deflating' the nominal zero coupon CGS yields with tenors of 1–10 years by the corresponding zero coupon inflation swap rates[6]. The deflated CGS yields do not contain expected inflation or the IRP because both values are common to the zero coupon CGS yields and inflation swap rates.
- The discount factors based on the deflated CGS yields are used to solve for the real coupon rate that, when applied to a real principal of $100, produces real cash flows from 1–10 years (including the real principal at maturity) with a present value equal to $100.
- Figure 2 shows the difference between the implied real CGS yield using the approach in the draft position paper and the lower bound between 2016 and 2021. The differences have mostly been negative, which means the QCA's implied real CGS yield has mostly been *below* the lower bound. This is a strong indication of a negative implied IRP in the 'real' CGS yield and the real return on equity.

FIGURE 2: QCA IMPLIED REAL CGS YIELD MINUS LOWER BOUND



Source: RBA, Bloomberg, QTC calculations. 20-day rolling averages.

[6] This approach produces a lower bound for the inflation-indexed CGS yield because the nominal CGS yields are deflated by an upper bound estimate of the combined value of expected inflation and the IRP.

- The QCA Act requires prices to be sufficient to 'at least' meet the efficient costs of providing a regulated service:[7]

> *'These pricing principles (s. 168A) do not explicitly state that we must have regard to the effect of inflation, but instead require that we have regard for* ***prices at least meeting the efficient costs of providing access to the service*** *(s. 168A(a), referenced in ss. 120(1)(l) and 138(2)(g)).'*

- To be consistent with the above requirement, QTC submits that the implied real CGS in the real return on equity should not be below the lower bound for the 10-year inflation-indexed CGS yield.

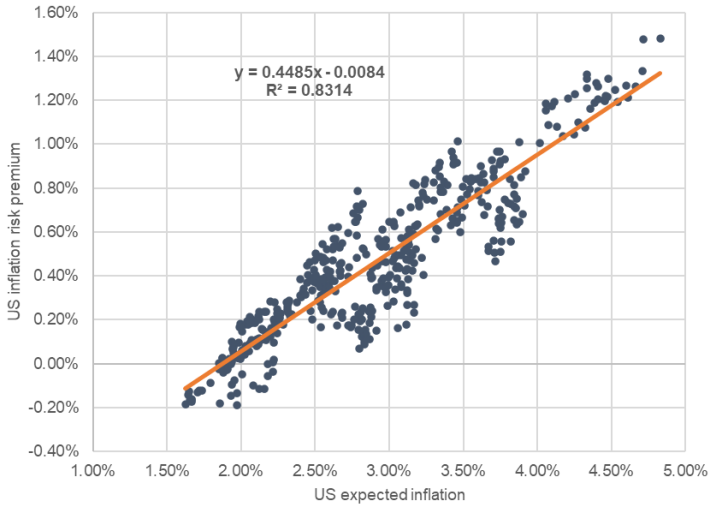
2.2 Second cross-check

- The draft position paper cites the IRP as a key concern with using inflation swaps to estimate *expected* inflation. QTC agrees that the IRP results in inflation swap rates not being a pure estimate of expected inflation. However, this does not mean inflation swaps are of no value to the QCA's inflation forecasting task.
- As explained in Section 2.1, the inflation swap rate equals the combined value of expected inflation and the IRP. Although there are many combinations of expected inflation and the IRP that sum to equal the inflation swap rate, not all combinations are economically plausible. For example:
  - A large negative IRP indicates that investors are concerned about the risk of deflation. It follows that investors must be assigning a meaningful probability to deflation actually occurring, otherwise it would be illogical to accept a negative IRP to own an asset that pays off in real terms if deflation occurs.
  - Therefore, it would not be plausible for expected inflation (ie, the probability weighted average of all possible future inflation outcomes) to be relatively high when the IRP is significantly negative.
- This example is consistent with the expected relationship between expected inflation and the IRP identified in the draft position paper:[8]

> *'In general, we would expect this risk premia to be positively correlated with the level of expected inflation. Therefore, periods of higher-than-average expected inflation would generally be associated with higher positive risk premia, and periods of lower-than-average expected inflation would generally be associated with low or negative risk premia.'*

- Model-based estimates using data from the United States confirm the existence of a strong positive relationship between expected inflation and the IRP (Figure 3).

FIGURE 3: EXPECTED INFLATION VS THE INFLATION RISK PREMIUM (1983–2021)



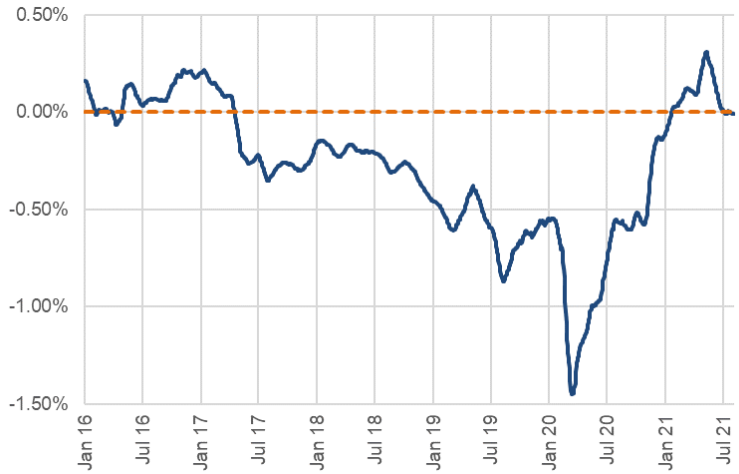
Source: Kim, Walsh and Wei (2021).

[7] Draft position paper, p. 2.

[8] Draft position paper, p. 35.

- For a given estimate of expected inflation, there is an implied IRP such that the combined value equals the observable inflation swap rate. These estimates can be used to assess the plausibility of the QCA's estimate of expected inflation in the final year of the glide-path. For example:
  - In February 2019, expected inflation in year 5 would have been 2.50 per cent based on the approach in the draft position paper. At that time, the implied-forward 1-year inflation swap rate in year 5 was 1.95 per cent, which means the implied IRP in year 5 was **-0.55** per cent.
  - A negative IRP of this size would require a meaningful probability to be given to scenarios where significant deflation occurs. However, this would not be consistent with expected inflation (ie, a probability weighted average of all possible future inflation outcomes) being equal to the 2.50 per cent mid-point of the RBA target band.
  - As such, expected inflation of 2.50 per cent in the final year of the glide-path was not consistent with the positive relationship that should exist between expected inflation and the IRP. This means that the revenue deductions for inflation on the entire RAB were likely to have been too high.
- Figure 4 shows the rolling 20-day average of the implied IRPs between 2016 and 2021. QTC submits that future regulatory determinations should compare the implied IRP with the QCA's estimate of expected inflation in the final year of the glide-path to determine if they are consistent with the positive expected relationship between expected inflation and the IRP.

FIGURE 4: IMPLIED IRP IN YEAR 5 OF THE GLIDE-PATH BASED ON QCA EXPECTED INFLATION



Source: RBA, Bloomberg, QTC calculations. 20-day rolling averages.

3 Perceived biases in inflation swap rates

- The draft position cites a number of perceived biases that may affect the observable inflation swap rate:[9]

> *'Conceptually, inflation expectations incorporated in market data should closely reflect the true level of investors' expected inflation. However, in some of our previous reviews we noted that market-based measures may contain distortions such as risk premia. A more detailed discussion of the potential distortions associated with market-based approaches is provided in Appendix E.'*

- Appendix E of the draft position paper identifies the IRP, liquidity, hedging costs and the inflation indexation lag as issues that make it difficult to infer the level or movements in inflation expectations from inflation swap rates[10]. Similar perceived biases were considered by the Australian Energy Regulator (AER) in its 2017 and 2020 inflation reviews. According to the AER's assessment (Table 1), the perceived biases may be 'minor, potentially small, near zero or negligible'.

[9] Draft position paper, p. 17.

[10] Draft position paper, p. 54–55.

TABLE 1: AER ASSESSMENT OF POTENTIAL BIASES IN INFLATION SWAP RATES

Potential bias	AER's assessment in 2017 and 2020
Hedging costs	*'The ACCC/AER working paper #11 found that* ***academic literature suggests that hedging costs may be minor****, but there are not many studies to support drawing robust conclusions.'*
Inflation indexation lag	*'****This bias is potentially small*** *due to the short lag on indexed CGS and is not likely to be time-varying.'*
Counterparty default risk	*'… the effect of counterparty default risk on zero coupon inflation swap rates* ***may not be significant****. This premia could result in overestimates of expected inflation and is not likely to be time-varying.'*
Liquidity premia	*'****A-priori liquidity premia may be near zero*** *since swaps can be created as required and there is no supply limitation. Observations of Australian data suggest that this* ***liquidity premia may be negligible.****'* *'… the liquidity premium is likely to be greater during periods of uncertainty when investors' appreciation of liquidity risk may have changed.'*

Source: AER Draft Position Paper, October 2020, Table H.1, p. 133–134

- The IRP (as defined in Section 1.1) is not a source of bias in the proposed cross-checks because neither cross-check uses the inflation swap rate to estimate expected inflation:
  - Under the first cross-check, the IRP in the inflation swap rate is useful because it allows the IRP to be removed from the nominal CGS yield to determine the lower bound for the 10-year inflation-indexed CGS yield that is not affected by a relative liquidity premium.
  - Under the second cross-check, the QCA's estimate of expected inflation in the final year of the glide-path is used to determine an *implied* IRP based on the inflation swap rate.
- In our view, the perceived biases in the draft position paper have no implications for the cross-checks in Section 2.

4 Summary of the proposed cross-checks

4.1 First cross-check

- Calculate the lower bound for the 10-year inflation-indexed CGS yield using the approach set out in Section 2.1.
- Convert the 10-year nominal CGS yield to a 'real' yield using the estimate of expected inflation from the approach in the draft position paper.
- The first cross-check is not passed if the 'real' CGS yield is below the lower bound. If it is, this indicates that the revenue deductions for expected inflation on the equity-funded portion of the RAB are excessive relative to the amount of inflation compensation in the 10-year nominal CGS yield in the nominal return on equity.

4.2 Second cross-check

- Calculate the implied-forward 1-year inflation swap rate for the final year of the glide-path.
- Calculate the implied IRP by deducting the QCA's estimate of expected inflation in the final year of the glide-path from the implied-forward inflation swap rate.
- The second cross-check is not passed if expected inflation and the implied IRP are not consistent with the positive relationship identified in the draft position paper. If the estimate of expected inflation is high relative to the implied IRP, this indicates that the revenue deductions for inflation on the RAB are too high.

4.3 Implications of not passing the cross-checks

- The proposed cross-checks do not require any changes to be made to the approach in the draft position paper. However, if one or both cross-checks are not passed at the time of a regulatory determination, consideration should be given to making a top-down adjustment to the nominal or real weighted average cost of capital allowance.

Appendix A: Inflation risk premium analysis

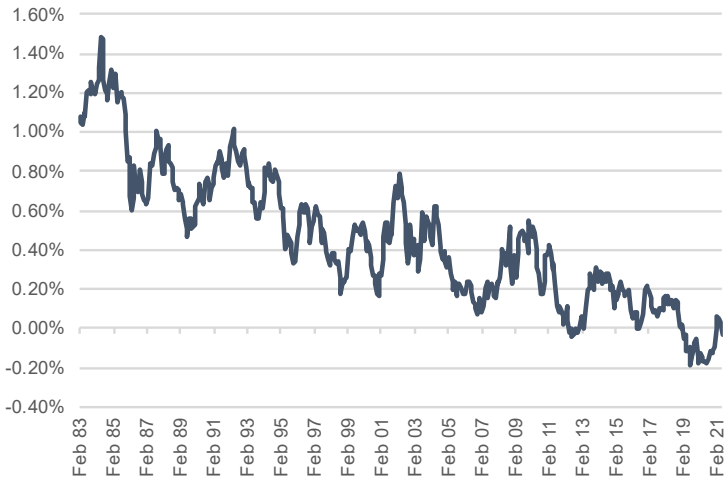
A.1: Background

- The inflation risk premium (IRP) compensates holders of assets with fixed nominal cash flows for systematic inflation risk. The sign and size of the IRP depends on the covariance between inflation and real economic activity:
  - A positive IRP exists when covariance is negative (ie, high inflation coinciding with low real economic activity and vice-versa). A positive premium is required because the real return on assets with fixed nominal cash flows decreases during unfavourable economic states when the marginal utility of consumption is high.
  - A negative IRP exists when the covariance is positive (ie, low inflation coinciding with low real economic activity and vice-versa). Investors are willing to accept a negative premium because the real return on assets with fixed nominal cash flows increases during unfavourable economic states when the marginal utility of consumption is high (ie, the assets act as a hedge against poor equity returns).
- By definition, the IRP in nominal bond yields does not make up part of the real or nominal return on equity.

A.2: Data

- There are no long-term estimates of the Australian IRP. However, Kim, Walsh and Wei (2021) produce model-based estimates using US Treasury bond yields between 1983 and 2021 (Figure 5)[11]:

FIGURE 5: 10-YEAR INFLATION RISK PREMIUM (US DATA)

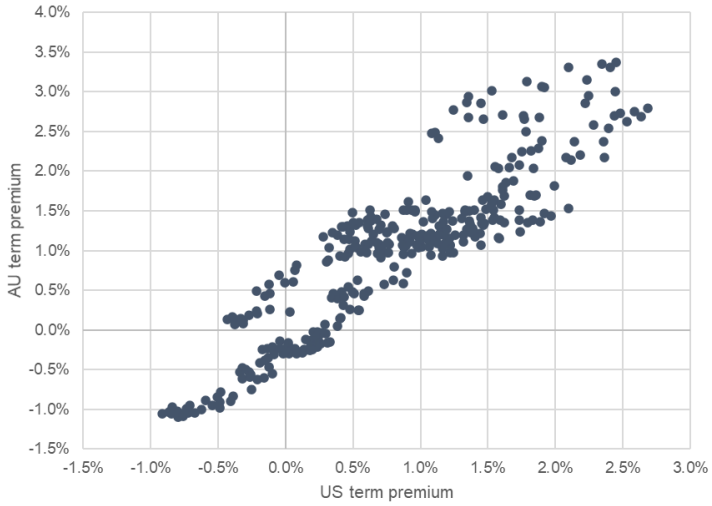


Source: Kim, Walsh and Wei (2021).

- Although the estimates are based on data from the United States, the same trends are likely to be similar for the Australian IRP:
  - The inflation experience in Australia and the United States has been very similar. Actual inflation was very high between the late 70s and mid-80s, and the subsequent success of monetary policy in reducing inflation also resulted in a material reduction in realised inflation volatility in both countries (and the respective IRPs).
  - Australian and United States bond yields and returns are highly correlated, so the components that make up these yields are also likely to be highly correlated. This is confirmed in Figure 6, which shows a strong positive correlation between the estimated 10-year nominal term premium in Australia and the United States. The nominal term premium equals the real term premium plus the IRP.

[11] D. Kim, C. Walsh & M. Wei (2021), *Tips from TIPS: Update and Discussions*, FEDS Notes. Board of Governors of the Federal Reserve System.

FIGURE 6: RELATIONSHIP BETWEEN AUSTRALIAN AND US TERM PREMIA



Source: Kim, Walsh and Wei (2021).

- Although the size of the IRP may differ between the United States and Australia, the analysis that follows is based on the difference between the prevailing IRP and the historical average IRP over time. Therefore, the absolute values of the IRP estimates are less important than the longer-term trend and volatility of the IRP estimates.

A.3: Analysis

- The QCA has proposed to add a fixed historical market risk premium (MRP) to the prevailing 10-year nominal CGS yield to estimate the return on equity. As the IRP is part of the nominal CGS yield:
  - the prevailing IRP is an *addition* to the return on equity
  - the historical average IRP is a *deduction* from the MRP in the return on equity, and
  - for an equity beta equal to 1.0, the net IRP equals the prevailing IRP minus the historical average IRP.
- The IRP is compensation for the systematic inflation risk exposure of assets with fixed nominal cash flows. By this definition, the IRP should not be reflected in any valid estimate of the return on equity. As such, the net IRP is a source of bias in the return on equity estimate.
- If the historical IRP has a stable average (ie, exhibits no significant time trends), the net IRP should average out to zero over time. However, there is a clear long-term downtrend in the IRP, which means that as time passes, the prevailing IRP is more likely to be below the historical average IRP than above it (Figure 7). Therefore, the net IRP is more likely to be negative and will not average out to zero over time.

FIGURE 7: PREVAILING AND CUMULATIVE HISTORICAL AVERAGE INFLATION RISK PREMIUM

Source: Kim, Walsh and Wei (2021).

- Figure 8 shows the monthly net IRP between July 2000 and July 2021. The historical average IRP on July 2000 equals the average IRP between February 1983 and July 2000. Thereafter, an expanding window is used to calculate the historical average IRP, so there is no look-ahead bias in the estimates.

FIGURE 19: NET INFLATION RISK PREMIUM DIFFERENCES (US DATA)

Source: Kim, Walsh and Wei (2021).

- A negative net IRP means that a negative inflation risk premium is reflected in the expected return on equity. However, a valid estimate of the return on equity cannot include the IRP because the IRP only applies to the expected return on assets with fixed nominal cash flows.
- As a consequence, the return on equity has been biased downwards in the last 20 years. The current bias based on United States data is about -0.5 per cent and for the reasons set out in Section A.1, a similar bias is likely to exist in the Australian data.