

Inflation-linked Financial Markets

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Abstract

Financial instruments with returns that are indexed to inflation allow market participants to hedge against or take positions on future inflation. Inflation-linked bond and swap markets in Australia are small and not very liquid relative to some other advanced economies. Nevertheless, pricing in these markets can provide valuable information about participants' inflation expectations. Market measures of long-term inflation expectations have increased in many advanced economies since the COVID-19 pandemic. In Australia, this has brought expectations into closer alignment with the RBA's inflation target.

Introduction

Inflation-linked financial instruments involve cash flows between market participants (for an inflation-linked bond, from the issuer to the holder) that depend on the rate of inflation. Inflation-linked markets serve two important purposes. First, they can be used for hedging. Market participants with inflation-linked assets, such as governments or infrastructure providers, can issue or enter into inflation-linked financial instruments with participants with inflation-linked liabilities, such as super funds or insurance companies, to reduce risks from future inflation. Second, inflation-linked markets reveal

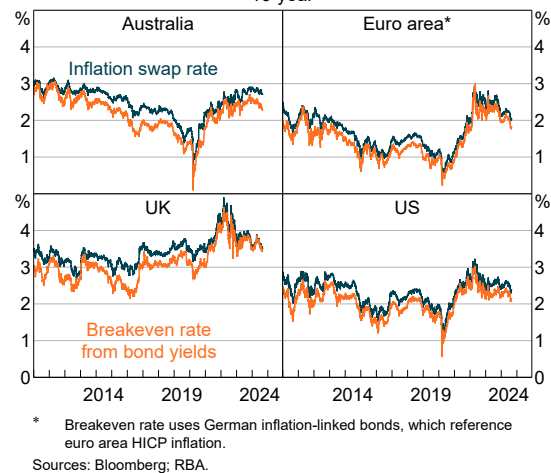
information about participants' inflation expectations. This is because participants can profit by trading in these markets if their forecasts for inflation turn out to be more accurate than those of others.

The two key types of inflation-linked financial instruments are capital indexed bonds ('indexed bonds') and inflation swaps.¹ Pricing in inflation-linked markets provides measures of the compensation that market participants demand for holding an instrument that exposes them to future inflation. This is called 'inflation compensation' and can differ

from market participants' expectations for future inflation, as discussed below. For swaps, inflation compensation can be inferred directly from swap pricing. For bonds, inflation compensation is inferred by comparing the pricing of indexed bonds with nominal bonds that have similar terms to maturity. Most advanced economies, including Australia, have markets for both inflation-linked bonds and swaps. Relative to some other advanced economies, Australia's markets for indexed bonds and inflation swaps are modest in size and somewhat less liquid, particularly for swaps.

Measures of inflation compensation are influenced by risk premia and technical factors, which can cloud their interpretations. This article explains these influences, before presenting estimates that attempt to decompose inflation compensation into components for inflation expectations and risk premia. Understanding how inflation-linked markets function, and decomposing inflation compensation, supports clearer interpretations of how consistent market participants' inflation expectations are with central bank inflation targets. This article investigates market participants' inflation expectations across advanced economies during the most recent inflationary shock – the COVID-19 pandemic. Inflation compensation fell at the onset of the pandemic across advanced economies before rising alongside the surge in inflation (Graph 1). Once estimates of risk premia are removed, pricing in inflation-linked markets suggests that participants' long-term inflation expectations have settled around central bank inflation targets in most advanced economies as inflation has declined. In Australia, participants' long-term inflation expectations are now anchored around the midpoint of the RBA's inflation target (RBA 2024).

Graph 1
Measures of Inflation Compensation
10-year



Inflation-linked financial instruments

What are they?

Indexed bonds are a debt security in which the issuer promises to adjust principal and interest (or coupon) payments in line with a reference inflation index on a pre-determined frequency. The coupon is paid on the inflation-adjusted principal value to maintain the real value of the coupon, so the value of the payments to the holder of the security is constant in real terms because it varies directly with inflation outcomes over the life of the bond. This means the yield on an indexed bond is a real yield. Nominal bonds, in contrast, have fixed face values and coupon payments and therefore they provide a constant nominal cash flow and the yield on these bonds is in nominal terms. The inflation rate that equalises the expected return on equivalent maturity indexed and nominal bonds is known as the 'breakeven' inflation rate and is a measure of the inflation compensation demanded by participants in the bond market. As discussed in 'Risk premia' below, measures of inflation compensation can differ from market participants' inflation expectations, including because participants can demand additional compensation for the risk that inflation turns out to be different from what they had expected.

Inflation swaps are a type of derivative in which two counterparties agree to exchange cash flows for a given notional amount and specified period, where the cash flows in one direction are linked to inflation. One counterparty pays a fixed interest rate, which is agreed at the initiation of the contract, in exchange for a floating interest rate that is based on the change in a reference inflation index. The fixed payment leg of the contract is a measure of the inflation compensation demanded over the term of the swap by participants in the swap market, as that is the rate at which market participants can agree to exchange future fixed and floating cash flows.

Where did they come from?

Indexed bonds

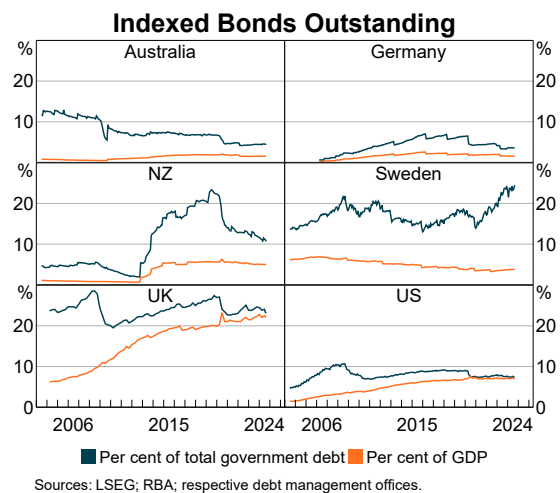
There are several reasons why governments have issued indexed bonds (see, generally, Cole and Schaper 2024). These bonds can reduce the expected cost of debt servicing in so far as investors are willing to pay a premium to reduce their inflation risk (for more detail, see 'Risk premia' below). Indexed bonds may also allow governments to better hedge their net cash flows – at least in the short run – because when inflation is high, nominal tax receipts tend to increase immediately while spending tends to increase with a lag (Bankowski *et al* 2023). Issuing indexed bonds can help to reinforce anchored inflation expectations and monetary policy credibility by reducing the incentive for governments to inflate away the real value of their liabilities. A liquid indexed bond market creates a real risk-free benchmark rate for the economy (i.e. a rate free from both credit and inflation risk). Also, indexed bonds can improve the resilience of sovereign funding by increasing the diversity of the investor base.

The earliest recorded use of indexed bonds was by the Commonwealth of Massachusetts in 1780 (Fisher 1913; Shiller 2003). In 1945, Finland became the first sovereign issuer of indexed bonds. Further sovereign issuance was initially limited to small economies with high inflation that struggled to issue nominal bonds in their own currencies (Garcia and van Rixtel 2007). In 1981, the United Kingdom became the first major advanced economy to issue an indexed bond. Other advanced economies followed later: Australia in 1985; Canada, Sweden, New Zealand and the United States in the 1990s; and Japan and Germany in the 2000s. However, issuance of indexed bonds has often been sporadic. For example, Australia stopped issuing

indexed bonds in 1989–1992 and 2004–2008 (McCray 1997). Over the past few years, Canada and Germany have ceased issuance completely.

Indexed bonds account for a small share of total government debt in most economies (Graph 2). In Australia, Canada and Germany, indexed bonds comprise less than 5 per cent of total debt. These shares have fallen in most advanced economies since the pandemic, in part because governments relied on the more liquid nominal bond market to fund pandemic responses. While less than 10 per cent of US federal debt is in indexed bonds, the market is still large in absolute terms, with around US\$2 trillion outstanding. Indexed bonds make up around a quarter of total government debt in the United Kingdom and Sweden.

Graph 2



Inflation swaps

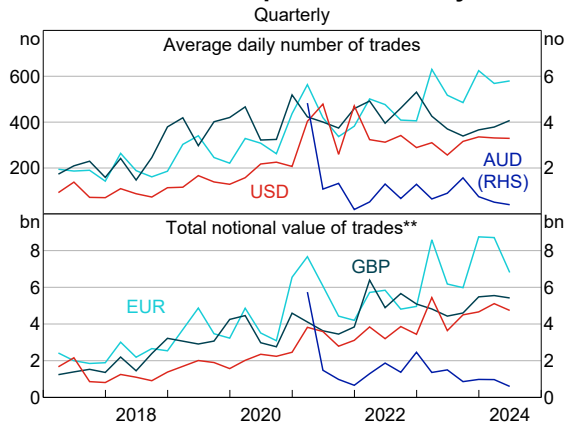
Inflation swap markets emerged in the 1980s and 1990s alongside the issuance of indexed bonds, although they were initially small and non-standardised. The market for inflation swaps in Australia developed during the mid-2000s, as they provided an alternative to indexed bonds, the issuance of which was suspended temporarily by the Australian Government due to budget surpluses. Data on the size of inflation swap markets was, until recently, very limited as inflation swaps are an over-the-counter product. However, central clearing of inflation swaps in a number of overseas markets has increased considerably since 2016 and has been associated with an increase in trade volumes (Graph 3).² By contrast, Australian dollar inflation swaps are not centrally cleared. Activity in the Australian inflation swap market is generally low and sporadic, and the size of the market has declined over recent years in terms of notional value outstanding. It is possible that activity could increase if clearing was offered – for example, if clearing drew in institutions that were either unable or reluctant to participate in an uncleared market.

cash flows in inflation swaps), which they use to hedge their inflation-linked liabilities. Because investors in indexed bonds typically ‘buy and hold’ the asset for hedging purposes, liquidity in indexed bond markets can be significantly lower than in nominal bond markets, which tend to be more actively traded by a diverse range of participants. In Australia, domestic non-bank financial institutions – including super funds, insurance companies and fund managers – make up around half of the turnover in inflation-linked Australian Government securities (AGS; Graph 4).

By contrast, Australian dollar inflation swap activity is dominated by international banks on both sides of the swap, though domestic non-banks are relatively more active on the side that receives inflation-linked cash flows. There are financial market participants, such as hedge funds, that may choose to pay or receive cash flows linked to inflation for speculative or diversification purposes, though this is primarily at shorter horizons. As a result of the interaction of supply and demand dynamics for these instruments, indexed bonds are typically only issued at longer maturities whereas inflation swaps tend to trade at maturities of between one and 30 years.

Graph 3

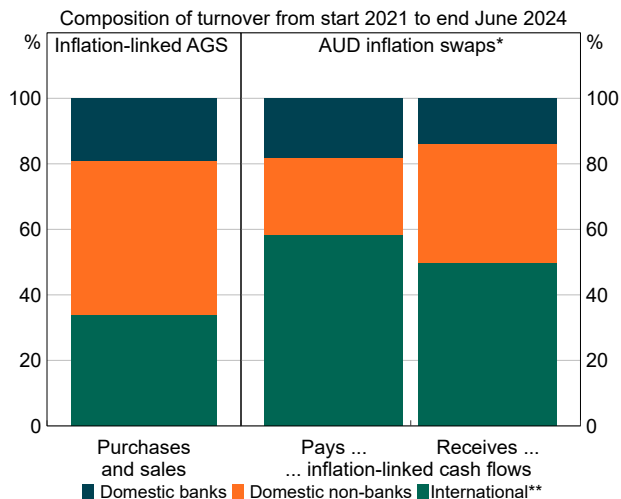
Inflation Swap Market Activity*



* Data cut-off is Q2 2024. For USD, EUR and GBP, trades are those cleared by LCH. For AUD, trades are an upper bound based on reporting to ASIC and exclude swaps between related parties and trade terminations.
 ** Values are reported in the local currency corresponding to each series.
 Sources: ASIC; LCH; RBA.

Graph 4

Inflation-linked Markets in Australia



* Excludes swaps between related parties and trade terminations.
 ** Excludes domestically incorporated entities of international banks for inflation-linked AGS, but includes them for AUD inflation swaps.
 Sources: AOFM; ASIC; RBA.

Who trades them?

The supply of indexed bonds is determined largely by government debt management decisions. Entities with revenues tied to inflation and low variable costs, such as infrastructure providers or utility companies, may also issue indexed bonds to hedge their inflation-linked assets or revenues. Super funds and insurance companies are the key sources of demand for indexed bonds (and for receiving inflation-linked

How do their design features differ across advanced economies?

Indexed bonds and inflation swaps typically reference the same inflation index within an economy, although the index used varies across economies. In most cases, including Australia, the reference index is identical to the central bank inflation target. Where the index is different, measures of inflation compensation can differ from the inflation target (Graph 5). However, index spreads are typically material only in the United States and United Kingdom.³

One difference between Australia and other advanced economies (except New Zealand) is that Australia's reference index, the Consumer Price Index (CPI), is published at a quarterly rather than monthly frequency. The Australian Bureau of Statistics (ABS) plans to transition to a complete monthly CPI in late 2025, though it will continue to publish a quarterly CPI series.⁴ The monthly CPI will not automatically become the new reference index for inflation-linked financial instruments in Australia, given that the pricing formulae for them currently refer to the quarterly CPI.⁵

There are other characteristics that can, at the margin, affect the pricing of inflation-linked financial instruments. First, the frequency of coupon payments can matter.⁶ Second, indexation lags can affect interpretations of inflation compensation, particularly at shorter horizons.⁷ Third, some indexed bond issuers (including the United States, Australia, Germany and Japan) offer deflation floors at maturity, so that if deflation drives the principal amount below par,

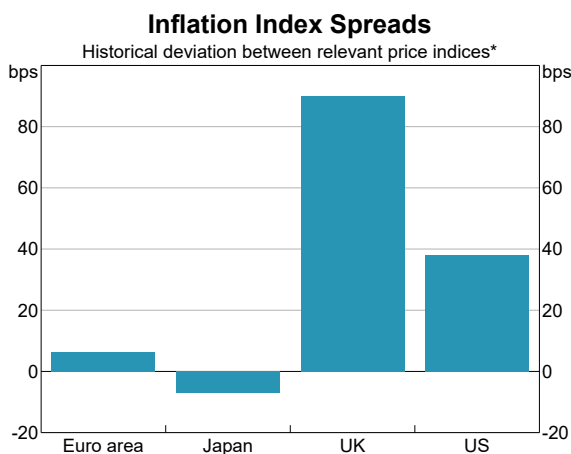
an investor would still receive the full par amount at maturity.⁸ See Appendix A for a comparison of design features of indexed bonds and inflation swaps across selected advanced economies.

Risk premia

Ideally, measures of inflation compensation would provide a direct view of market participants' expectations for inflation. This would be the case if inflation-linked markets were efficient and frictionless and participants were risk-neutral. However, in practice, risk premia and the design features of indexed bonds and inflation swaps can influence measures of inflation compensation such that they do not reflect participants' inflation expectations alone.

Market participants may demand premia for inflation, liquidity and credit risk. These premia are difficult to measure, but models that decompose inflation compensation into inflation expectations and risk premia suggest that they can vary substantially over time. Inflation compensation and risk premia can differ across indexed bond and inflation swap markets due to differences between the two markets. While the spread between inflation swap rates and breakeven inflation rates implied by bond yields varies over time and across advanced economies, swap rates generally tend to be higher than breakeven rates (Graph 6). This spread has averaged around 20–30 basis points in recent years in Australia and some other advanced economies.

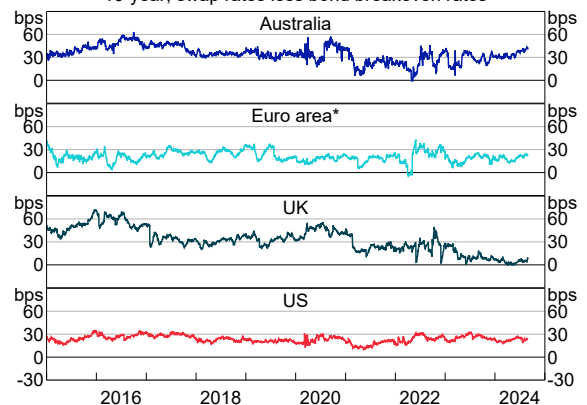
Graph 5



* Over the past 20 years. For the euro area, the spread between CPIH excluding tobacco and CPIH. For Japan, the spread between CPI excluding fresh food and CPI. For the UK, the spread between RPI and CPI. For the US, the spread between CPI-U and PCE deflator.
Sources: Bloomberg; RBA.

Graph 6

Inflation Compensation Spreads
10-year; swap rates less bond breakeven rates



* Using German inflation-linked bonds, which reference euro area HICP inflation.
Sources: Bloomberg; RBA.

Inflation risk

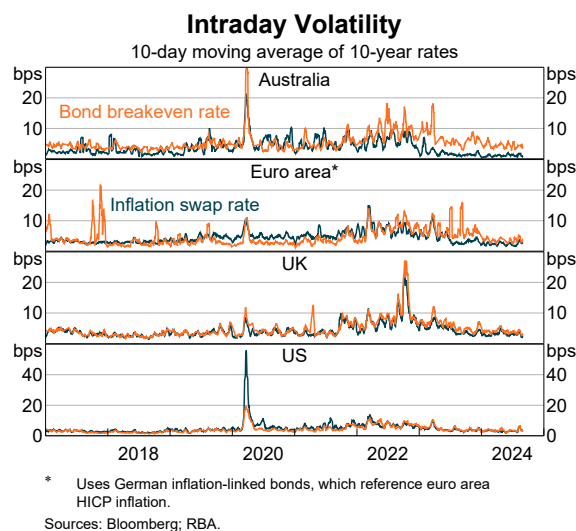
Future inflation is uncertain, so investors may demand compensation for the risk that inflation turns out to be higher or lower than their expectations. In theory, inflation risk premia could be positive or negative depending on the composition of participants in inflation-linked markets and their risk preferences, although estimates tend to be positive on average over time. This is consistent with greater demand for hedging inflation-linked liabilities than inflation-linked assets and may also reflect that unexpected inflation tends to hurt most market participants, so they are willing to pay a premium to insure against it. However, models decomposing inflation compensation into risk premia and inflation expectations should be treated with caution. Term structure models are commonly used, which assume nominal yields, real yields and inflation expectations are linear functions of ‘pricing’ factors, such as in Hambur and Finlay (2018). There are modelling limitations in decomposing market measures, particularly when the policy rate is at its effective lower bound, as it was in many advanced economies during the global financial crisis and the pandemic (Chung, Hui and Li 2017).

Liquidity risk

Measures of inflation compensation can incorporate liquidity premia, which compensates investors for market frictions in transacting in bonds or swaps. Indexed bonds are generally less liquid than nominal bonds, so liquidity premia are generally larger in indexed bond yields, which has the effect of reducing breakeven rates (Moore 2016). For inflation swaps, liquidity premia can be positive or negative depending on which side of the swap is more liquidity constrained. Dealer balance sheet constraints can also push up measures of inflation compensation from inflation swaps (Finlay and Olivan 2012). In the private sector, there is generally greater demand to receive inflation-linked cash flows than pay them, so market participants may require a premium to enter into swaps where they pay inflation-linked cash flows. Dealers may require a smaller premium to enter into swaps where there is a deeper and more liquid indexed bond market, because they can more easily hedge the swaps using the indexed bond market.

Liquidity premia on inflation swaps and indexed bonds cannot be observed directly, but changes in liquidity premia can be inferred from movements in measures of market liquidity. Intraday yield movements – a measure of volatility that can be exacerbated by poor liquidity – tend to be similar in

Graph 7



both indexed bond and swap markets, suggesting liquidity premia have tended to move similarly in the two markets (Graph 7).

Credit risk

Indexed bonds and inflation swaps can incorporate some degree of credit risk. For bonds, this is the risk that the issuer will default on coupon payments or the repayment of principal, while for swaps it is the risk that the counterparties to the swap are unable to meet their obligation to pay the fixed or the floating leg. As indexed bond breakeven rates are derived from the difference between the yield on nominal and indexed bonds, any credit risk is netted out, so credit risk premia are zero in breakeven rates. By contrast, inflation swap rates may incorporate some credit risk premia, with the magnitude varying depending on the credit risk of the counterparties involved. While collateralisation and central clearing can reduce credit risk, it may introduce other costs that affect pricing. Overall, credit risk may be contributing to the spread between inflation swap rates and indexed bond breakeven rates.

Inflation compensation since the pandemic

At the onset of the pandemic, inflation compensation declined considerably below central bank inflation targets, reaching record lows in Australia and the euro area, and the lowest levels since the global financial crisis in the United States (Graph 1). According to model estimates, inflation expectations declined a bit but generally remained closer to targets than inflation compensation, with the latter's large declines driven mostly by risk premia (Graph 8; Burban *et al* 2021). In March 2020, pandemic-related uncertainty caused a sudden increase in liquidity demand (the so-called 'dash for cash') that saw liquidity premia become larger as bond holdings were widely sold off, with larger increases in less liquid markets.⁹ Because inflation-linked bond markets are less liquid than nominal bond markets, the liquidity premia demanded to hold them increased further, contributing to the decline in measures of inflation compensation. In Australia, poor liquidity continued to affect pricing in inflation-linked financial markets through to late 2020, though by 2021 these markets were once again functioning fairly well, as bid-offer spreads for inflation-linked bonds returned to around their pre-pandemic levels. Leaving aside risk premia, the decline in inflation expectations at the onset of the pandemic was consistent with the view that the pandemic would weaken the global economy, which helped prompt expansionary monetary policy (RBA 2020; FOMC 2020; Lagarde 2020).

From mid-2020, short-term inflation compensation increased notably above central bank inflation targets, amid an increase in headline consumer price inflation.

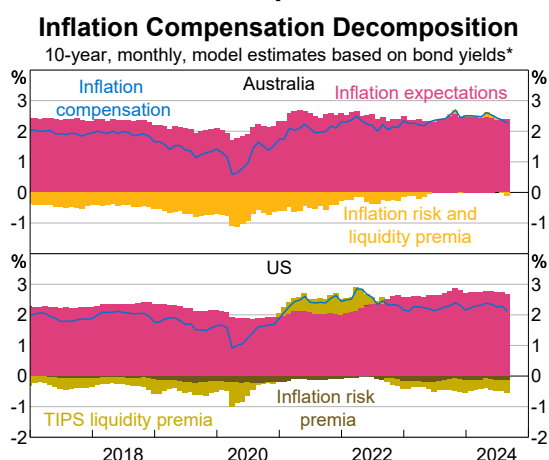
Inflation compensation returned to pre-pandemic levels around early 2021, before surpassing them in late 2021. This was several months before central banks started tightening monetary policy, suggesting market participants were quick to recognise building inflationary pressures. Short-term inflation swap rates reached record highs in many advanced economies in 2022. In Australia, the one-year inflation swap rate peaked at over 6 per cent in mid-2022, which was comparable to the RBA's one-year-ahead forecasts for headline inflation around that time. Longer term rates experienced a smaller increase, indicating market participants did not expect high inflation to persist in the long term, partly because they expected central banks to respond to higher inflation in the near term by increasing their policy rates.

According to model estimates, inflation expectations increased a bit in this period but again remained closer to central bank inflation targets than suggested by some measures of inflation compensation, as rising risk premia influenced these measures. Estimates of inflation risk premia moved higher, consistent with market participants perceiving an increase in uncertainty and upside risks to inflation, likely linked to supply chain pressures and high energy prices at the time (Lowe 2022; Lagarde 2022; Powell 2022). Additionally, in the United States, changes in liquidity premia pushed up inflation compensation as market functioning for indexed bonds improved.

As central banks increased their policy rates quickly in 2022 to return high inflation to target and reduce the risk of above-target inflation becoming embedded in inflation expectations, long-term inflation expectations remained around targets. This suggests market participants expected central banks to set policy rates such that inflation would stay on target over the long term. Short-term measures of inflation expectations moderated from their peak, some of which reflected the unwinding of negative supply shocks in addition to tighter monetary policy settings.

Over the past year, inflation compensation has settled above its pre-pandemic levels and is either consistent with or slightly above central bank inflation targets in the United States, euro area and Australia. Model estimates suggest long-term inflation expectations are generally anchored at targets.¹⁰ Risk premia have moved higher than their pre-pandemic levels in Australia and the euro area, and are little changed in the United States (Burban *et al* 2021; Lane 2024). In Australia, long-term inflation compensation drifted upward by around ½ percentage point

Graph 8



* Estimates in periods when the policy rate is at its effective lower bound, such as during the pandemic, should be interpreted with caution. The term structure models used do not enforce the effective lower bound, which can create biases.

Sources: D'Amico, Kim and Wei (2018); Federal Reserve; Hambur and Finlay (2018); Kim, Walsh and Wei (2019); RBA.

starting from early 2023, reflecting a rise in inflation expectations and inflation risk premia, though more so the latter. This upward drift brought long-term inflation expectations closer in line with the midpoint of the RBA's inflation target, following a long period prior to and during the pandemic where they were below target (RBA 2024).

Overall, the period since the pandemic highlights that inflation compensation in indexed bonds and inflation swaps contains factors beyond market participants' inflation expectations, so caution is needed when interpreting these measures.¹¹

Nevertheless, because indexed bonds and inflation swaps price inflation compensation in real time, they are useful for policymakers as a timely indicator of market participants' inflation expectations, to complement other, less timely, measures of inflation expectations such as surveys.

After abstracting from risk premia, inflation expectations derived from pricing in inflation-linked markets generally support the view that long-term inflation expectations are well-anchored in advanced economies, including Australia.

Appendix A: Design features of inflation-linked instruments in advanced economies

Table A.1: Indexed Bonds

An overview of key features across selected advanced economies

Key features	Australia	Canada	Germany	Japan	New Zealand	Sweden	United Kingdom	United States
Introduction	1985	1991	2006	2004	1995	1994	1981	1997
Reference index	CPI	CPI	HICP ^(a)	CPI ^(b)	CPI	CPI	RPI ^(c)	CPI-U
Indexation lag	~5m	3m	3m	3m	~5m	3m	3m ^(d)	3m
Coupon frequency	Quarterly	Semi-annual	Annual	Semi-annual	Quarterly	Annual ^(e)	Semi-annual	Semi-annual
Share of total debt	4%	2%	4%	N/A	11%	25%	23%	7%
Maturities issued	5–20y	–	–	10y	7, 10, 20y	2–15y	10–30y	5, 10, 30y
Deflation floor	Yes	No	Yes	Yes ^(f)	No	Yes	No	Yes

(a) For the euro area, excluding tobacco.

(b) Excluding fresh food.

(c) Until 2030, after which the CPIH (CPI including housing) will be used for all outstanding and new issuance.

(d) For indexed bonds issued from 2005 only. Prior to 2005, indexed bonds had an eight-month lag. There are still three indexed bonds outstanding that were issued prior to 2005 (the last of which matures in 2035).

(e) Sweden has also issued zero-coupon indexed bonds.

(f) For bonds issued after 2013.

Sources: Bloomberg; debt management offices.

Table A.2: Inflation Swaps

An overview of key features across selected advanced economies

Key features	Australia	Canada	Euro	New Zealand	Sweden	United Kingdom	United States
Introduction	2007	2007	2004	2014	2007	2004	2004
Reference index	CPI	CPI	CPIH ^(a)	CPI	CPI	RPI ^(b)	CPI-U
Indexation lag	3m	3m	3m	3m	3m	2m	3m
Interpolation method	Monthly	Monthly	Monthly	Monthly	Monthly	Monthly	Daily
Coupon frequency^(d)	Zero	Zero	Zero	Zero	Zero	Zero	Zero
Maturities	1–30y	1–30y	1–30y	1–30y	1–30y	1–50y	1–30y

(a) For the euro area, excluding tobacco.

(b) Until 2030, and then the CPIH (CPI including housing) will be used for all outstanding and new issuance. There are some CPI swaps in the market but they are currently much less liquid.

(c) Most common/liquid swap. Coupon swaps are available in some economies, such as the United States.

Source: Bloomberg.

Table A.3: Indexed Bonds

Maturity mismatches across selected advanced economies

Maturity mismatches	Australia	Germany	United Kingdom	United States
Nominal bond lines^(a)	38	84	103	395
Indexed bond lines^(a)	7	4	32	53
Average maturity mismatch (days)^(b)	139	61	96	9
10-year benchmark mismatch (days)	61	59	50	31

(a) Current outstanding bills or bonds, not including non-standard bonds on issue (e.g. green bonds and Treasury STRIPS).

(b) Average difference between current indexed bonds outstanding and the closest maturity nominal bond.

Sources: Bloomberg; debt management offices.

Endnotes

- * The authors are from International Department and Domestic Markets Department. The authors would like to thank: the Derivatives Surveillance team at the Australian Securities and Investments Commission (ASIC) for processing and providing data on AUD inflation swaps; Andrew Barrelle from Barrenjoey for his insights on Australian inflation-linked financial markets; Matthew Wheadon from the Australian Office of Financial Management (AOFM) for clarifications regarding indexed bonds; and Susan Black, Jon Cheshire, Sean Dowling, Rachael Fitzpatrick, Matt Gibson, Jonathan Hambur, Callum Hudson, Christopher Kent, Jeremy Lawson, Gordana Peresin, Benn Robertson, Claudia Seibold and Penny Smith from the RBA for comments that improved the article. The cut-off for data used in this article is end August 2024 unless stated otherwise.
- 1 This article focuses on capital indexed bonds, though there are other, less common types of inflation-indexed bonds, such as indexed annuity bonds. Indexed annuity bonds provide a fixed real stream of regular cash flows over the life of the bond, with no lump-sum principal repayment at the end of the loan period.
- 2 Before the 2016 non-cleared margin rules came into effect, banks were hesitant to clear inflation swaps because this would have created a funding mismatch. The dealer would not have received initial margin from the client (on the non-cleared leg of the trade) but would have been required to post initial margin to the central counterparty. For a discussion of the costs and benefits of central clearing (in the context of bonds), see Cheshire and Embry (2023).
- 3 From 2030, all new and outstanding indexed UK government bonds will be linked to the Consumer Price Index including housing costs (CPIH). The change in reference index is already influencing the pricing of indexed gilts maturing beyond 2030.
- 4 Since September 2022, the ABS has published a monthly CPI indicator, which reflects updated prices for part of the CPI basket, whereas the complete monthly CPI will reflect updated prices for the whole CPI basket.
- 5 For more detail, see AOFM (2023) for indexed bonds and Australian Financial Markets Association (2017) for inflation swaps.
- 6 Inflation swaps are typically zero-coupon so there is only one payment made at maturity. Indexed bonds generally involve coupon payments and the frequency varies across markets. When there is a discrepancy in coupon frequency between the nominal and indexed bond (as in Australia and New Zealand), calculating an undistorted breakeven rate requires an adjustment to account for the compounding effect on yields.
- 7 In most advanced economies, indexed bonds have an indexation lag of up to three months so that bonds traded between coupon dates can include accrued coupon payments from the previous coupon date. However, Australia and New Zealand have lags of up to six months (and sometimes longer) due to the quarterly publication of the CPI. Inflation swaps typically have a two- or three-month lag, so the floating leg payment is based on inflation over the period starting two to three months before the start date of the contract and ending two to three months before the termination date of the swap. There are also differences in how the lag is handled: daily interpolated lag or monthly interpolated lag.
- 8 Without a deflation floor, the price of the indexed bond would decline below par value (and the yield would rise) if deflation occurred over the life of the bond, resulting in a lower implied breakeven rate. As a result, where the outlook is for low or no inflation, indexed bonds with a deflation floor can imply artificially breakeven rates (even if deflation is not the central expectation, as removing the risk of deflation can still imply artificially high breakeven rates). This is most relevant for Japan, where there is evidence the deflation floor has increased breakeven rates over time (Hiraki and Hirata 2020).
- 9 For more detail on dysfunction in the Australian government bond market at the onset of the pandemic, see Finlay, Seibold and Xiang (2020).
- 10 In the United States, this takes into account the average difference between the US Federal Reserve's (Fed) inflation target and the reference rate used in inflation swaps and indexed bonds. US Treasury Inflation-protected Securities (TIPS) and most US dollar inflation swaps reference the Consumer Price Index for All Urban Consumers (CPI-U), whereas the Fed targets the Personal Consumption Expenditures (PCE) index. The CPI-U has averaged 0.4 percentage points more than the PCE deflator over the past two decades.

- 11 This lesson is applicable outside of the post-pandemic period. In some economies, including Australia, the United States and euro area, there is evidence that changes in risk premia are a significant driver of changes in inflation compensation over time, and may be the dominant driver at times (D'Amico, Kim and Wei 2018; Finlay and Wende 2011; Böninghausen, Kidd and de Vincent-Humphreys 2018).

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