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Back to the Futures: Liquidity in Australian Bond Futures amid Market-moving Events since COVID-19

By Richard Finlay, Ben Jackman and Dmitry Titkov

Research Discussion Paper 2025-07

Enquiries

Phone : +612 9551 8111

Email : rbainfo@rba.gov.au

Website : https://www.rba.gov.au

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Richard Finlay*, Ben Jackman** and Dmitry Titkov***

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*Markets Group, Federal Reserve Bank of New York
**Domestic Markets Department, Reserve Bank of Australia
***Monetary Policy Strategy Department, Reserve Bank of Australia

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Corresponding Author: titkovd at domain rba.gov.au

External Communications: rbainfo@rba.gov.au

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Abstract

The market for futures on Australian Government Securities (AGS) is one of Australia's key markets for trading interest rate risk, and turnover in AGS futures is substantially greater than turnover in AGS themselves. We examine liquidity in the market for futures on AGS using granular 'tick-level' data that capture trades and changes at the top of the order book from October 2019 to June 2025. We find liquidity deteriorated at the onset of COVID-19 and around the end of the RBA's yield target. Nevertheless, the market for AGS futures functioned well in the period, with market participants always able to transact (albeit sometimes at higher transaction costs). For 'news' events in the period – such as monetary policy decisions and economic data releases, which are inherently uncertain – we find liquidity tended to deteriorate briefly following these events but recovered before day's end. By contrast, for 'flow' events – such as pre-announced purchases and sales of AGS, including syndicated issuance – we find liquidity improved in anticipation of these events and smooth trading conditions were maintained. A better understanding of how liquidity in AGS futures changes in response to market-moving events should assist AGS market participants – including the RBA – to extract and interpret information from market data, and to design any AGS market transactions to maximise effectiveness while minimising side effects.

JEL Classification Numbers: G13, G14

Keywords: bond futures, liquidity, COVID-19

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1. Introduction

This paper uses tick-level data from the Australian Government Securities (AGS) futures market between 2019 and 2025 to develop a better understanding of that market.[1] In particular, we study the liquidity of the AGS futures market and the impact of market-moving events on its liquidity. These events include: the introduction and the removal of the RBA's yield target; the RBA's regular monetary policy decisions; bond purchases by the RBA as part of its bond purchase program; bond issuance by the Australian Office of Financial Management (AOFM); major economic data releases by the Australian Bureau of Statistics (ABS); futures 'rolls', which occur leading up to the quarterly expiry dates for futures contracts; and changes in the minimum price increment that futures can trade in.

Understanding the AGS futures market and how it reacts to major market-moving events is important because AGS – that is, bonds issued by the Australian Government – constitute a critical fixed income securities market in Australia. AGS are considered to be free of credit risk and the AGS market is deep and liquid, and reflecting this the yields on AGS act as a benchmark for the pricing of other fixed income securities in Australia. AGS also play a key role in monetary policy transmission, both in terms of how the RBA implements monetary policy (which involves the purchase of AGS, either outright or under repurchase agreement) and in terms of transmitting changes in the RBA's operational target – the cash rate – to longer-term interest rates, broader financial conditions, and ultimately economic activity and inflation.

AGS futures provide a convenient way to gain exposure to AGS, without having to either fund and hold the underlying bond (for a long position) or borrow and then short sell the underlying bond (for a short position). As is the case with many types of derivatives, turnover in AGS futures contracts, at the equivalent of around $20–40 billion face value per day, is many times higher than turnover in the underlying bonds themselves, at around $5 billion per day (Figure 1).[2] Reflecting this, price discovery for AGS often occurs in the futures market rather than the underlying AGS market, and as such AGS futures are a key instrument for taking on, or hedging, interest rate risk in Australia.[3]

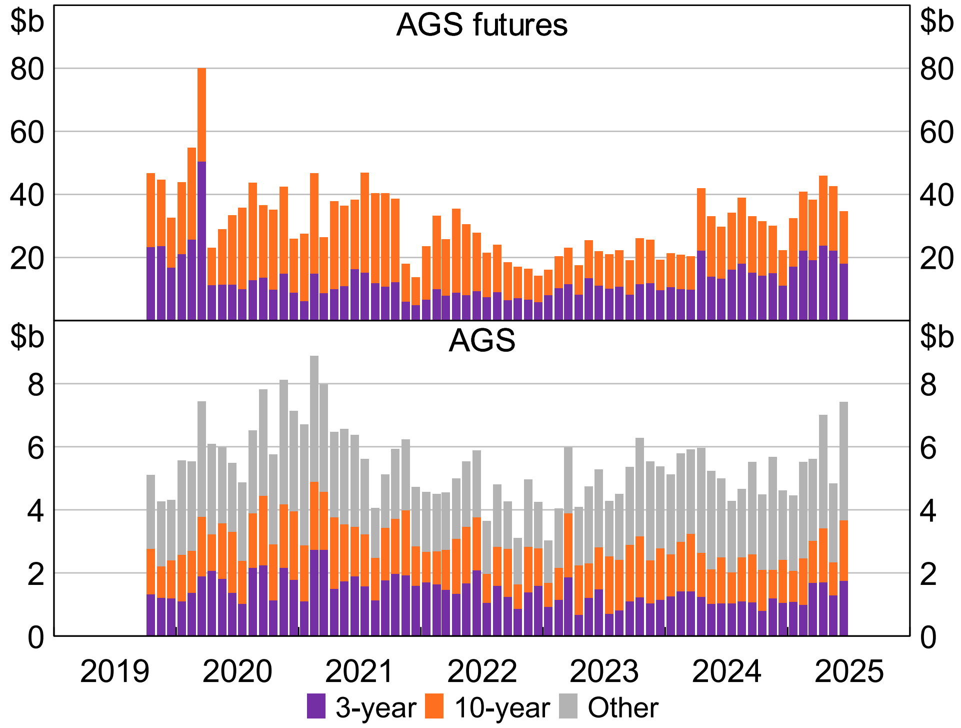
1 Market participants sometimes use the term 'Treasury bond futures' rather than 'AGS futures'; we use the latter term in this paper to make explicit that we are discussing futures for *Australian* government bonds, since many countries issue 'Treasury bonds'.

2 Turnover in AGS futures is much higher still where trades associated with futures roll activity are included. We exclude these trades because they have limited economic significance but inflate turnover substantially. For more detail, see Section 3.

3 For earlier discussions of price discovery for AGS, see Cheshire (2016) and Debelle (2016).

Figure 1: Average Daily Turnover in Markets for Australian Government Securities

Face value, monthly



Notes: For AGS futures, turnover excludes trades associated with futures roll activity and includes trades in the night session; turnover for 5-year and 20-year futures is not shown. For AGS, '3-year' shows turnover in AGS with 2–5 years to maturity, '10-year' shows turnover in AGS with 9–12 years to maturity, and 'Other' shows turnover in other nominal AGS.

Sources: AOFM; Authors' calculations; Bloomberg.

Futures prices and AGS yields are closely linked by arbitrage relationships. Futures contracts expire on a three-month cycle, and at expiry the futures contract pays 100 *minus* the average yield on the basket of AGS that the futures contract references (typically three to five bonds of similar maturity). AGS futures contracts are settled via a transfer of cash, rather than the transfer of an underlying bond. This cash settlement of futures contracts is different to many other countries, most notably the United States, where futures are settled via the delivery of a bond. Before expiry, deviations of futures prices from AGS yields (adjusted for the cost of transacting in and funding any outright bond positions) represent an arbitrage opportunity, since investors know that at expiry the futures contract will pay out (100 minus) the average bond yield. Given this, investors trade on, and so minimise, price deviations between futures and bonds. The most liquid futures contracts in Australia are the 3-year and 10-year contracts, which reference AGS with residual maturity of close to 3 years and 10 years, respectively. There are also 5-year and 20-year futures contracts, but they are less widely traded than the 3-year and 10-year contracts and we do not consider them in our analysis.

In the remainder of this paper we review relevant literature (Section 2); describe our data in more detail and perform some preliminary analysis (Section 3); review some periods of interest since COVID-19 through the prism of futures market liquidity (Section 4); and estimate the impact on futures market liquidity of various events including RBA policy announcements and bond purchases, data releases, AOFM bond sales, the futures roll period, and changes in the minimum price increment that futures contracts can trade in (Section 5). Section 6 concludes.

To preview our results briefly, we find that:

- Liquidity in the AGS futures market deteriorated at the onset of COVID-19 and around the end of the RBA's yield target. Market depth and price impact seem to be more informative as measures of liquidity for AGS futures than bid-offer spreads, which can be unresponsive to poor liquidity, and turnover, which responds ambiguously to poor liquidity.

- Regular news events, including RBA policy decisions and major ABS data releases, tend to lead to higher turnover but somewhat worse liquidity conditions. As these events contain an element of uncertainty, market participants actively trade on the news and adjust their portfolios. However, during these events, market participants are less willing to be providers of liquidity to others by offering to buy or sell futures at the current prevailing price, which results in a decrease in the number of buy and sell orders at the best bid and ask (that is, depth falls at the top of the order book), and executed trades seem to move futures prices by more than otherwise.

- Large flow events such as AOFM bond syndications, which are known in advance and typically involve the sale of $10 to $15 billion worth of a bond, improve liquidity by serving as a focal point that brings investors to the market. Smaller flow events such as RBA bond purchases and AOFM bond tenders, which are also known in advance and are typically in the order of around $1 billion in size, also improve liquidity.

- Conversely, the futures roll periods that occur at quarterly expiry dates see liquidity deteriorate, as focus and resources shift away from the outright futures market to the roll market, though the recent delinking of the outright and roll markets seems to have reduced the extent of the deterioration.

- Finally, an increase in the minimum price increment for the 3-year contract, implemented in October 2022 by the Australian Securities Exchange (ASX) to try to improve liquidity conditions, seems to have been successful, with various liquidity metrics improving after the change.

2. Literature Review

Studies looking at AGS futures typically find the market to be liquid and efficient, with prices incorporating information from major data releases within 30 seconds, and no evidence of information leakage in the form of prerelease price movements (e.g. Kim and Sheen 2001; Smales 2012; Heng *et al* 2020). This paper builds on the previous literature by expanding on the number of liquidity metrics and event types studied, and also updates the analysis to cover the 2019–2025 period, which encompasses a number of major economic events (Finlay, Titkov and Xiang 2023).

Major economic data releases and monetary policy announcements are typically associated with higher trading volumes but a deterioration in other measures of market liquidity. For example, Tsuchida, Watanabe and Yoshiba (2016) find that trading volumes in Japanese Government bond futures tend to rise around such events, but that other measures of liquidity such as market depth fall. Focusing on Australian studies, Kim and Sheen (2001) find that economic surprises lead to elevated AGS bond futures trading volumes, while Lu, In and Kou (2009) and Lu, Qu and Zhou (2015) find that monetary policy surprises lead to increased AGS futures volatility, and Frino and Hill (2001) find that bid-ask spreads tend to widen ahead of major data releases and remain wider for a period after the release. International studies find qualitatively similar results, namely that liquidity is generally worse at times of high volatility (e.g. Chorida, Sarkar and Subrahmanyam 2005; Nguyen *et al* 2020; Meldrum and Sokolinskiy 2025). One international study suggests that some of the Bank of England's gilt purchases had no discernible effect on liquidity in gilt futures (Fullwood and Massacci 2018).

The impact of central bank yield target policies on futures liquidity appears to depend on how aligned the yield target is with underlying market pricing. For example, Fukuma *et al* (2024) find that bid-ask spreads in the Japanese Government bond futures market fell and transaction volumes rose (i.e. the market became more liquid) over a period when the Bank of Japan's yield curve control (YCC) policy was well aligned with underlying market pricing, but that these trends reversed during a period in which the YCC policy deviated from market pricing. Similarly, Finlay *et al* (2023) find that market depth (i.e. the quantity of buy and sell orders at different price levels) in the 3-year AGS futures contract rose over a period when the RBA's yield target was well aligned with fundamentals, but fell to very low levels once market participants came to expect the policy to be removed and yields to rise above the target level.

Studies looking at top-of-book order imbalance – that is, the number of buy orders at the best available price less the number of sell orders at the best available price – find that positive order imbalance (more buy than sell orders) is contemporaneously associated with an increase in price, as one might expect. Conversely, past increases in price tend to have an opposing effect on order imbalance and result in fewer buy orders relative to sell orders (e.g. Chorida, Roll and Subrahmanyam 2002; Smales 2012).

Finally, studies looking at the effect of tick size changes – that is, the minimum yield or price increment that it is possible to trade in – tend to find that smaller tick sizes lead to narrower bid-ask spreads (although some studies find no impact), either unchanged or higher trading volumes, and lower depth. For example, see Ahn, Cao and Choe (1996), Bourghelle and Declerck (2004), Pavabutr and Prangwattananon (2009) and Werner *et al* (2023), who examine equity exchanges. However, Fleming, Nguyen and Ruela (2024), who study 2-year US Treasury bonds and futures, find that depth is little changed after appropriately adjusting for the mechanical effect of the change – that is, if tick sizes are halved, there may be less depth available at the best price, but depth available at the best *two* prices, which together encompass what would previously have been the best price, is little changed. A non-peer-reviewed study looking at the increase in the tick size for 3-year AGS futures in October 2022 found that it diminished liquidity (Li and Narayanan 2023).

We find qualitatively similar results to those discussed above, with the partial exception of the effect of a tick size change, where, different from Fleming *et al* (2024), we find that an increase in the minimum price increment that the 3-year futures contract could trade in led to an improvement in liquidity conditions. This difference likely relates to the relative underlying liquidity of AGS versus US Treasury bonds, as discussed in Section 5, consistent with the model and empirical evidence presented in Werner *et al* (2023).

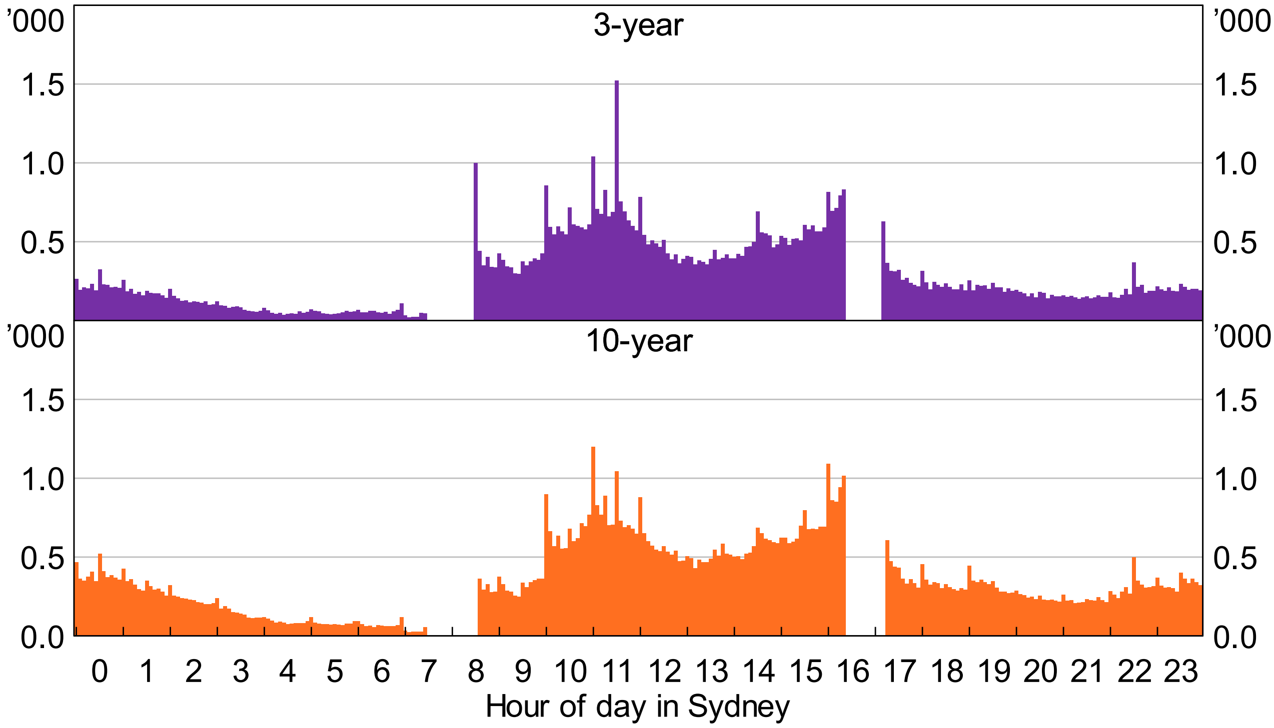
3. Data and Some Descriptive Statistics

We use tick-level data on 3-year and 10-year AGS futures contracts, including trades, and bids or asks at the top of the order book (i.e. at the current best price). Each data point includes price, volume, date-time information, and other metadata. The tick-level data are updated any time a trade is executed or the volume or price at the best bid or ask changes. Volume and/or price changes for bids and asks are much more common than trades, at around 90 per cent of data points, with trades making up the remaining 10 per cent. Our dataset runs from October 2019 to June 2025.

AGS futures trade almost 24 hours a day. Very early in the Sydney morning is the least liquid time of the day, while activity picks up from 08.30 as the Sydney trading day begins, and increases further mid-morning as Asian markets open. There is a notable drop in liquidity around the Sydney lunchtime, before activity picks up again over the afternoon, with the opening of European markets towards the end of the Sydney trading day providing a further boost. We focus on the Australian day session (08.30 to 16.30) as this is the most liquid time period and also the period in which major Australian events such as data releases, monetary policy decisions, and central bank bond purchases occur (Figure 2).

Figure 2: Average Intraday Turnover in 3-year and 10-year Futures

Turnover in thousands of contracts, 5-minute intervals



Notes: Turnover excludes trades associated with futures roll activity, and turnover is not shown for: the open auctions of both the day and night sessions; and the close of the day session. For 3-year futures, this means that the 5-minute intervals starting 08:20, 08:25, 16:25, 17:00 and 17:05 are not shown. For 10-year futures, in addition to these intervals, the 5-minute intervals starting 08:30 and 17:10 are also not shown, because the day and night sessions start 2 minutes later for 10-year futures.

Sources: Authors’ calculations; Bloomberg.

We remove trades associated with futures roll activity, since such trades inflate turnover volumes without being associated with liquidity or affecting the price.[4] We also remove cross trades (that is, trades where the buyer and seller are one and the same) and trades with prices and sizes of zero. This leaves us with 29 million data points for the 3-year contract and 68 million data points for the 10-year contract.

To conduct the main analysis, we transform the tick-level data into 5-minute buckets, with the main variables of interest being:[5]

- Last price, defined as the midpoint of the last bid and ask recorded in the 5-minute bucket.

- Change in price, defined as the last price of the given bucket, minus the last price from the previous bucket.

- Bid-ask spread, defined as the average bid-ask spread across all observations that occur within the 5-minute bucket.

- Best depth, defined as the average volume available to trade at the top of the order book across all observations that occur within the bucket; we calculate bid depth (i.e. average volume available to trade at the best bid) and ask depth (i.e. average volume available to trade at the best ask), and best depth is the average of bid depth and ask depth. Similar to Adrian, Fleming and Vogt (2017), we find that the natural logarithm of depth has a more stable relationship with the other variables of interest than the level of depth, so we use the log of depth in the analysis that follows.

- Turnover, defined as the sum of trading volume occurring within the bucket; we calculate seller-initiated turnover (i.e. trades that occur at the bid price), buyer-initiated turnover (i.e. trades that occur at the ask price), and total turnover (i.e. the sum of any trades that occur).

- Price impact, which we define as the impact on price from buying 10,000 contracts (equivalent to $1 billion face value of bonds). Price impact must be estimated, rather than simply calculated from the data as for the previous indicators. We do this by regressing the change in price, in basis points, on net buyer-initiated trades (i.e. buyer-initiated turnover less seller-initiated turnover). These regressions are estimated over a trailing 90-minute window using tick-level data aggregated into 30-second buckets, for a total of 180 observations per regression window.

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4 The futures roll occurs in the week leading up to a contract's expiry, when investors with a position in the expiring contract 'roll' their position into the next contract. They do this by closing out their position in the expiring contract and opening an equivalent position in the next contract. For example, if an investor has an existing position of 100 expiring contracts, they may transact to sell 100 expiring contracts (leaving their net position at zero) and purchase 100 of the next contracts (re-establishing their original position). There is a separate market for roll trades, in which offsetting trades in the expiring and next contract are agreed as a single package. The separate roll market was previously linked to the outright futures market, such that the minimum price increment was the same across the two, but they were delinked starting from the March 2025 futures roll.

5 Except for the first bucket of the trading day, an observation is counted as within a bucket if it occurs *after* the beginning of the bucket, and at or before the end of the bucket. So, for example, the 09.00 to 09.05 bucket contains data from 09:00:01 to 09:05:00. The first bucket of the trading day also includes observations at the start of the bucket (i.e. it runs from 08:30:00 to 08:35:00).

Our estimate of price impact will be valid to the extent that prices only move due to order flow (which in turn may evolve due to various factors). While this will often be a reasonable assumption, it is unlikely to hold while the market is absorbing the implications of material new information, when prices can shift independent of actual trades. If any independent change in price is associated with a concurrent change in order flow, the price impact regression will suffer from endogeneity issues and be biased. To reduce the likelihood of this occurring, we exclude data 5 minutes either side of 11:30 and 14:30 from our price impact regressions; this gives a window for prices to adjust to key news events – specifically, ABS data releases and RBA policy announcements – without affecting estimated price impact. See, for example, Kyle (1985), Fleming (2003, 2024), Bouchaud (2010) or Adrian *et al* (2017) for further discussion of price impact and its estimation.

The median estimated price impact across the 3- and 10-year futures contracts is 3 and 6 basis points, respectively. That is, 10,000 net buyer-initiated trades, equivalent to a bond purchase of $1 billion face value, are associated with an increase in futures price, or decrease in the futures-implied yield, of 3 or 6 basis points. Low price impact – where large trades in either direction have only a modest impact on price – is indicative of a liquid market.

The final four metrics – bid-ask spread, depth, turnover, and price impact – are commonly used as measures of liquidity. In general, one might expect higher liquidity to be indicated with higher depth, higher turnover, lower bid-ask spreads, and lower price impact.

Price impact is conceptually appealing as it is close to what most market participants mean when they discuss liquidity: the ability to trade in large size without adversely moving the price. Conversely, it must be estimated, and the estimate may be biased in some circumstances, whereas the other measures can simply be calculated from the data. Depth is also a measure of the ability to trade in size without moving the market, since one can always transact the volume shown at the top of the order book at the current best bid/ask. Bid-ask spreads on the other hand measure transaction costs, rather than the ability to trade in size, while turnover measures the volume of trading but is agnostic on transaction costs or whether that trading moves prices.

In practice, depth and price impact seem to respond similarly to the events studied, which we take as supporting the case for both as good measures of liquidity. On the other hand, our findings suggest that bid-ask spreads and turnover are less informative as measures of liquidity for the AGS futures market. For bid-ask spreads, this is because they can be unresponsive to periods of poor liquidity as long as the minimum price increment remains binding. For turnover, this is because the response to periods of poor liquidity can be ambiguous (conceptually, turnover is more of a measure of disagreement than liquidity).

Figures 3 and 4 display our four liquidity metrics from October 2019 to June 2025, aggregated to the daily total for turnover and daily averages for other measures, for the 3-year and 10-year futures contracts respectively. A few points immediately stand out:

- The quarterly futures roll period – that is, the week leading up to the expiry of the current futures contract – is a major event in the futures market, with bid-ask spreads consistently falling to close to the new minimum price increment when this is in effect, best market depth falling significantly, and to a lesser extent price impact increasing.[6] The roll period is explored further in Section 5.

- For the 3-year contract, there is a step up in bid-ask spreads in October 2022, when the ASX increased the minimum price increment for the contract outside of roll periods, with price impact and best depth seeming to improve from around when the change was implemented. The effects of this change on liquidity are also explored further in Section 5.

- Outside of roll periods, March 2020 stands out as a period of reduced liquidity, with bid-ask spreads and price impact higher, and depth lower. This period is explored further in Section 4.

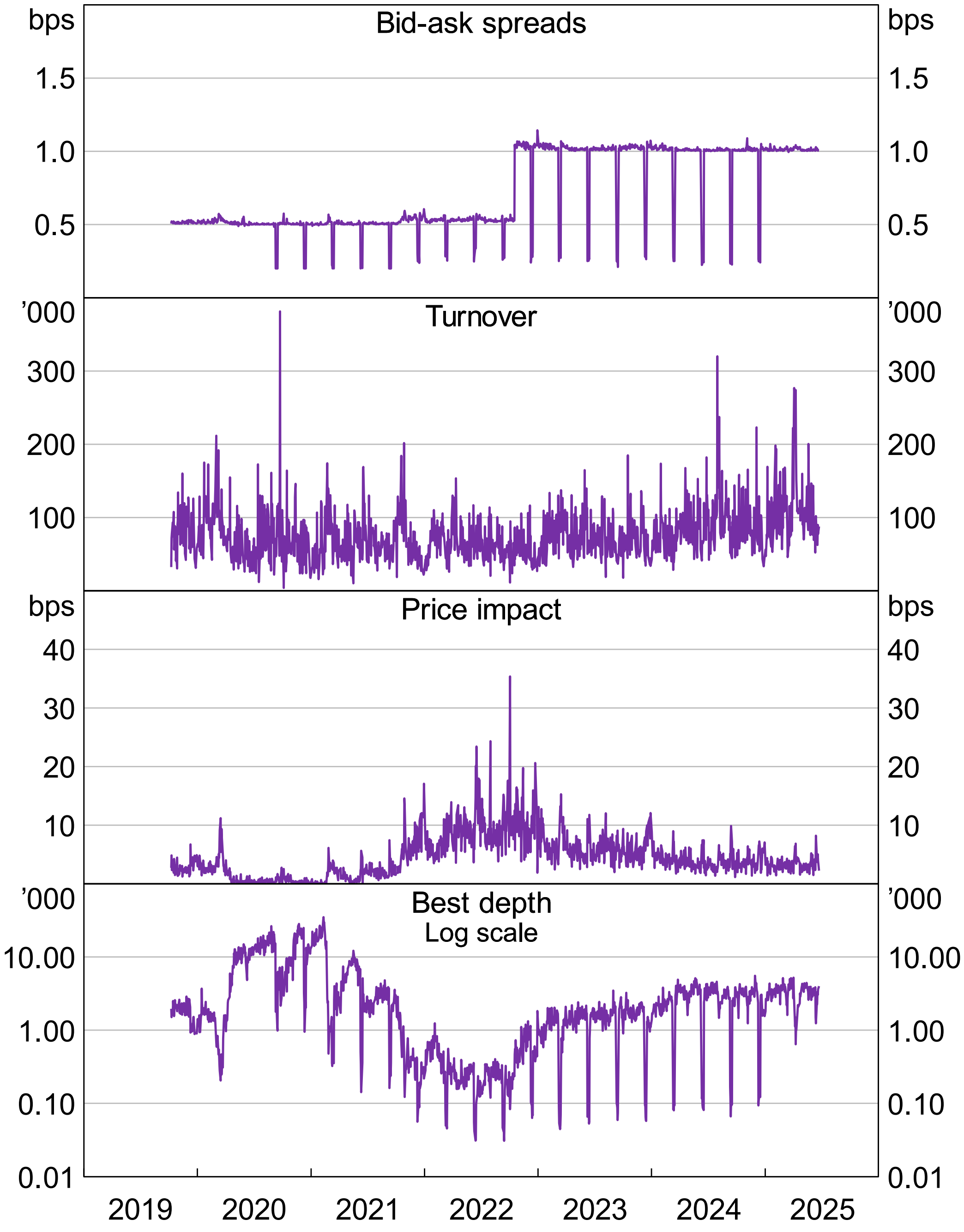
- From late 2021 and through 2022, depth is consistently low, price impact is consistently elevated, and bid-ask spreads are higher than usual. This likely reflects, in the first instance, some disruption to the market caused by the removal of the yield target, and more broadly an increase in uncertainty and volatility associated with a period of rising inflation and interest rates. This period is also explored further in Section 4.

- Conversely, apart from spiking higher during certain stress events such as around March 2020, turnover exhibits no clear pattern through time.

6 For the 3-year contract the minimum price increment, and therefore the minimum possible bid-ask spread, is 0.5 basis points outside of roll periods from the start of our sample until October 2022, and 1 basis point thereafter; during roll periods the minimum price increment is 0.5 basis points for the December 2019, March 2020, and June 2020 rolls, and 0.2 basis points from September 2020 until December 2024. From March 2025 the roll and outright market are delinked, so that the roll market trades in 0.2 basis point increments while the outright market trades in 1 basis point increments. For the 10-year contract the minimum price increment is 0.5 basis points outside of roll periods for the entire sample; during roll periods the minimum price increment is 0.25 basis points for the December 2019, March 2020, and June 2020 rolls, and 0.1 basis point from September 2020 until December 2024. As with the 3-year contract, the roll and outright futures markets are delinked from March 2025.

Figure 3: Measures of Liquidity for 3-year Futures

Total for turnover and averages for other measures, daily

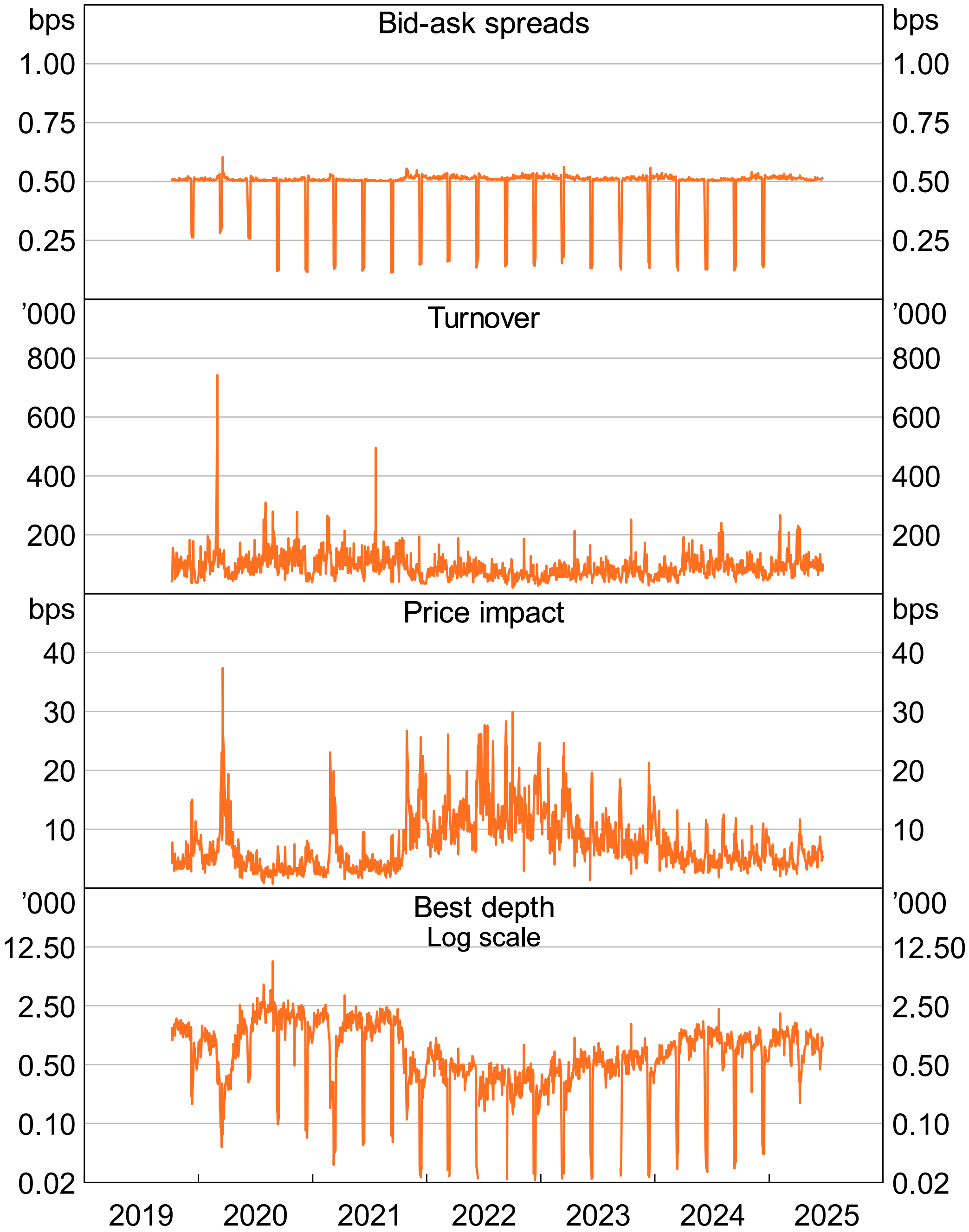


Notes: Best depth and turnover are shown in thousands of contracts. Price impact is shown in basis points per $1 billion of net flow.

Sources: Authors' calculations; Bloomberg.

Figure 4: Measures of Liquidity for 10-year Futures

Total for turnover and averages for other measures, daily



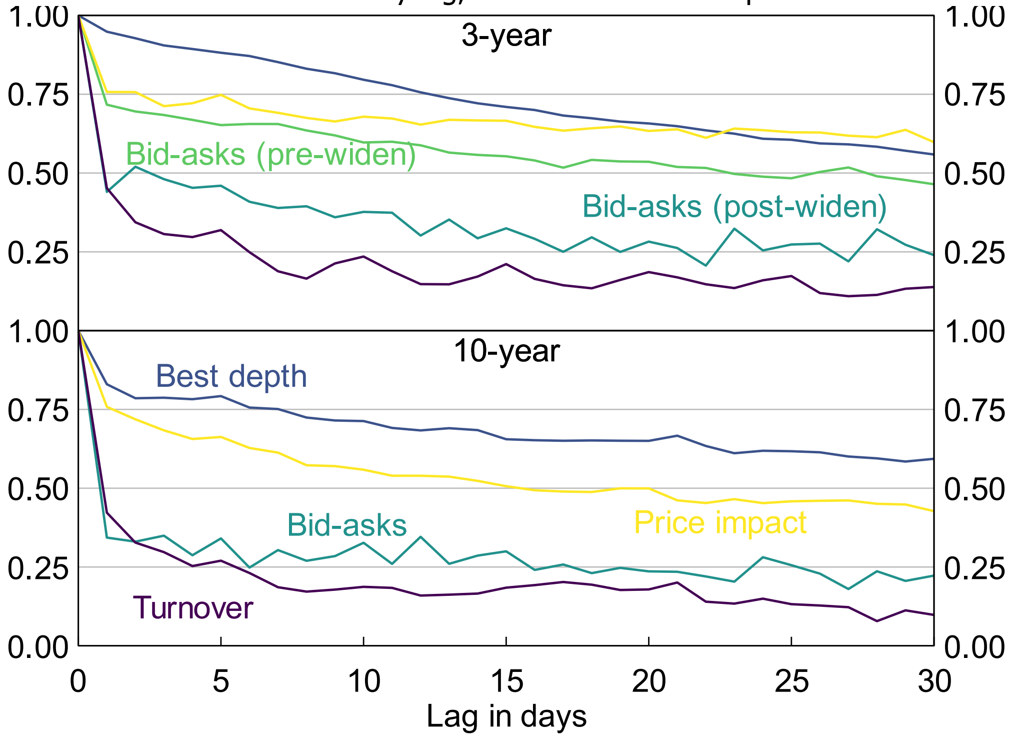
Notes: Best depth and turnover are shown in thousands of contracts. Price impact is shown in basis points per $1 billion of net flow.

Sources: Authors' calculations; Bloomberg.

The autocorrelation function of each liquidity metric on a daily basis is shown in Figure 5. We see that market depth is the most persistent variable, implying that it can take considerable time for depth to recover following a shock. Price impact is also relatively persistent, while bid-ask spreads and turnover are generally less persistent. These results accord with Meldrum and Sokolinskiy (2025; see, for example, their Figure 2) and Aronovich, Dobrev and Meldrum (2021), and also align with traders' perceptions, which are that depth often takes considerable time to recover following a shock, whereas bid-ask spreads and turnover return toward normal levels much more quickly.[7]

Figure 5: Autocorrelations of Measures of Liquidity for 3- and 10-year Futures

Autocorrelation by lag, excludes futures roll periods



Note: For 3-year futures, the sample for autocorrelations of bid-ask spreads is split into those prior to the widening of spreads with the increase in the minimum increment for 3-year futures on 18 October 2022 ('pre-widen') and those after it ('post-widen').

Sources: Authors' calculations; Bloomberg.

As discussed in Section 2, the literature typically finds that periods of market volatility are associated with higher turnover but a deterioration in other measures of liquidity, and we find similar results. Returning to 5-minute data and taking the analysis a little further, we find that:[8]

- Bid-ask spreads are sensitive to price volatility, as one might expect, although the effect size is small. For the 3-year and 10-year contracts, average bid-ask spreads in a 5-minute window widen by around 0.02 and 0.01 basis points, respectively, for each 1 basis point change in price that occurs over the window, both significant at the 1 per cent level. For comparison, outside of roll periods and considering the period when the minimum price increment was 0.5 basis points, the median bid-ask spread for the 3-year contract is 0.51 basis points, and for the 10-year contract it is 0.50 basis points. That is, the bid-ask spread is typically equal to the minimum price increment allowed by the exchange, which is also 0.5 basis points over most of the sample.

7 Focusing on just the second half of the sample, and therefore excluding the period over 2021 when depth was particularly elevated, gives qualitatively similar conclusions.

8 Note that in the regressions below we remove the highest and lowest 0.5 per cent of observations. We also include dummies for the roll period and for the period when the minimum increment size for the 3-year contract increases from 0.5 basis points to 1 basis point. All regressions are univariate OLS regressions.

- Order book depth is also sensitive to price volatility. For both the 3-year and 10-year contracts, best depth in a 5-minute window falls by around 10 per cent for each 1 basis point change in price, significant at the 1 per cent level.

- Conversely, turnover increases with price volatility. For the 3-year contract each 1 basis point change in price over a 5-minute window is associated with 1,200 more contracts trading, while for the 10-year contract each 1 basis point change in price is associated with 1,270 more contracts trading (median turnover in a 5-minute window is 280 and 420 for the 3-year and 10-year contracts respectively). Unsurprisingly, the direction of price change has an impact on whether trades tend to occur at the prevailing bid or ask price, with a 1 basis point *increase* in price associated with around 530 more trades executed at the prevailing ask price rather than bid price for the 3-year contract, and 590 more trades executed at the prevailing ask price rather than bid price for the 10-year contract. That is, when the price is going up, more trades occur at the top of the bid-ask spread, and when the price is going down more trades occur at the bottom of the bid-ask spread.

- Price impact is lower – that is, liquidity is higher – when top-of-book order depth is higher, again as one might expect.[9] For the 3-year contract, a doubling of depth in a 5-minute window is associated with the price impact of trading 10,000 contracts being 0.3 basis points lower, while for the 10-year contract the price impact is 1 basis point lower, both significant at the 1 per cent level. As noted above, the median price impact from trading 10,000 contracts is 3 and 6 basis points, respectively, for the 3-year and 10-year contract.

- While we do not focus on order imbalance in our analysis, we find – similar to some other studies – a small positive contemporaneous relationship between order imbalance and changes in price, and a negative relationship between past price changes and order imbalance. That is, greater order imbalance is associated with a higher price contemporaneously (although the size of the effect is small), while an increase in price is associated with a fall in the number of bids to purchase compared with the number of offers to sell.[10]

4. Review of Liquidity in Periods of Interest

4.1 March 2020: the onset of COVID-19 and introduction of the RBA's yield target

In late February 2020, pandemic concerns were escalating sharply, with government bond yields and risky asset prices both falling. In March 2020, government bond yields began unexpectedly rising: increased volatility meant that investors needed to raise cash to reduce leverage, meet margin calls, and meet redemptions. Many investors chose to sell government bonds because they are liquid. AGS market makers initially absorbed sales, but their capacity to undertake further trades and

9 Meldrum and Sokolinskiy (2025) find a similar result for US Treasuries, namely that lower depth increases the likelihood of a deterioration in price impact.

10 Specifically, we find that 10,000 net additional contracts on the bid side of the order book in a 5-minute window is associated with a 0.01 and 0.1 basis point increase in price in that window for the 3-year and 10-year contract respectively. Additionally, a 1 basis point increase in price in the previous period is associated with an 890 contract decrease in bid versus ask depth for the 3-year contract, and a 340 contract decrease for the 10-year contract. All four of these effects are significant at the 1 per cent level. For reference, for the 3-year contract the median bid depth is 1,650 contracts, the median ask depth is 1,680 contracts, and the median order imbalance is –10 contracts; for the 10-year contract the equivalent figures are 640, 650, and –5 contracts.

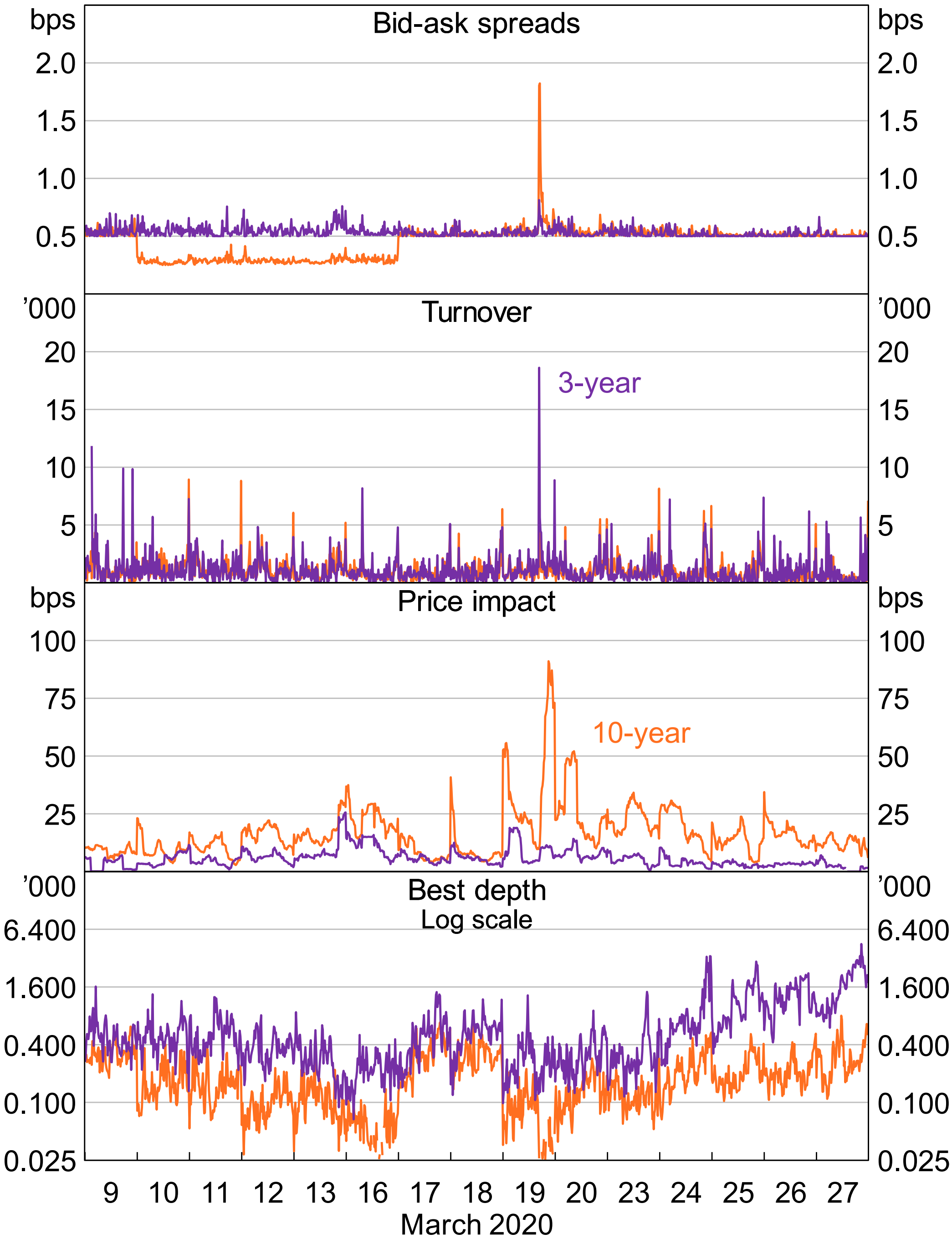
to assist price discovery deteriorated as dealer intermediation capacity began to run up against internal and regulatory risk limits, contributing to further volatility and impaired function in both the AGS and AGS futures markets (Finlay, Seibold and Xiang 2020). As the deterioration in financial market function became more serious, the RBA responded by: releasing a statement on 16 March stating that the Bank stands ready to support the smooth functioning of the government bond market; then, on 19 March, announcing a package of policy measures following an out-of-cycle Board meeting, including the RBA's intention to purchase government bonds to address market dislocations, with purchases beginning the following day (for more information, see Finlay *et al* (2023)).

Focusing on the futures market, Figure 6 shows bid-ask spreads, best depth, turnover, and price impact for the 3-year and 10-year contracts from 9 to 27 March 2020. The period of 10 to 16 March coincided with the futures roll, during which the minimum price increment (and so the minimum possible bid-ask spread) was lower than usual for the 10-year contract. For bid-ask spreads and price impact, higher values imply worse liquidity; for best depth and turnover, lower values imply worse liquidity.

Using the month of November 2019 as a control for the non-roll period of the sample (being 9 March 2020 and 17 to 27 March 2020), and 10 to 16 December 2019 as a control for the roll period of the sample (10 to 16 March 2020), we find that average bid-ask spreads rose modestly. For the non-roll period, they rose from 0.51 to 0.54 basis points for the 3-year contract and from 0.51 to 0.53 basis points for the 10-year contract. For the roll period, they rose from 0.52 to 0.56 basis points for the 3-year contract and from 0.27 to 0.29 basis points for the 10-year contract. The single period that stands out from a visual inspection was between 14.30 and 14.45 on Thursday, 19 March 2020, when bid-ask spreads for the 10-year contract widened to almost 2 basis points, that is, four times the minimum price increment. As noted in Finlay *et al* (2023), this corresponded to some initial confusion in the market around the nature of RBA bond purchases to restore market function, which were at first interpreted as being directed only to shorter maturity bonds around the 3-year tenor; once it became clear that the RBA would purchase bonds with up to 10 years to maturity, bid-ask spreads for the 10-year contract fell back to close to the minimum increment.

Figure 6: Measures of Liquidity for 3- and 10-year Futures at the Onset of COVID-19

Total for turnover and averages for other measures, 5-minute intervals



Notes: Best depth and turnover are shown in thousands of contracts. Price impact is shown in basis points per $1 billion of net flow.

Sources: Authors' calculations; Bloomberg.

The tumult of March 2020 for the AGS futures market was more evident in other liquidity metrics. For the 3-year contract, average market depth fell from 1,000 to 370 contracts in the roll period and from 2,040 to 680 contracts in the non-roll period; average price impact rose by 67 per cent in the roll period and by 113 per cent in the non-roll period. Conversely average turnover increased, from 710 to 1,030 contracts per 5-minute interval in the roll period and from 970 to 1,020 contracts per 5-minute interval in the non-roll period. For the 10-year contract, average market depth fell from 270 to 110 contracts in the roll period and from 1,330 to 210 contracts in the non-roll period; average price impact rose by 56 per cent in the roll period and by 348 per cent in the non-roll period; while again turnover increased, from 770 to 1,190 contracts per 5-minute interval in the roll period and from 980 to 1,110 contracts per 5-minute interval in the non-roll period.[11]

Taking as a given that March 2020 was a particularly stressed and illiquid period, a few points stand out:

- Apart from a truly acute period of stress between 14.30 to 14.45 on 19 March 2020, where market function for the 10-year contract deteriorated sharply, bid-ask spreads are not particularly responsive to stress and so do not appear to be the most useful gauge of liquidity conditions for AGS futures. That is, bid-ask spreads are usually at the minimum price increment, or very occasionally at two increments, largely irrespective of circumstances.

  This finding is in contrast to physical AGS, where bid-ask spreads are responsive to market conditions and widen meaningfully during periods of stress (see Finlay *et al* (2023)). Physical AGS are typically quoted in standard parcel sizes of $10 or $20 million depending on the tenor, whereas there is no equivalent standard number of futures contracts that dealers quote. This in turn reflects the types of entities that dominate market making in each market: in physical AGS, it is traditional dealers, which adhere to market conventions and trading platform guidelines regarding standard sizes; in futures, algorithmic market makers tend to dominate, and there is no standard parcel size to adhere to. Given that size is relatively fixed for physical AGS, dealers adjust to stress by widening bid-ask spreads; in futures the adjustment occurs via size (i.e. market depth).

- Market depth and price impact *are* responsive, and both deteriorated markedly during the acute phase of stress. By contrast, turnover was higher than usual during the period of stress, and for the 10-year contract was elevated during the acute phase of stress between 14.30 and 14.45 on 19 March 2020, at 9,880 contracts over that 15-minute period (whereas average turnover between 9 and 27 March 2020, excluding the open and close when turnover can sometimes be very high, was 2,620 per 15-minute period).

To sum up, it is almost always possible to trade some number of AGS futures contracts without having to cross a large bid-ask spread and without overly moving the price. During stress episodes, that number of contracts can fall considerably, but that does not necessarily stop investors from trading (albeit incurring higher transaction costs). These dynamics suggest that during stress, market participants have low conviction around the current price (hence low depth), and adjust their views quickly as buy/sell flows come in (hence high price impact).

11 Note that a *t*-test of the null hypothesis that the control period sample and March 2020 sample have the same mean is rejected for all statistics mentioned above. That is, differences between the control period and March 2020 are statistically significant. Expanding the control period to cover the four months to mid-February 2020 delivers very similar results. For comparison, the full sample medians for the 3-year contract are: bid-ask (excluding roll periods and the period of 1 basis point minimum price increments) of 0.51 basis points, depth of 1,790 contracts, and turnover of 280 contracts; the increase in price impact relative to the median is 41 per cent. For the 10-year contract, the full sample medians are: bid-ask (excluding roll periods) of 0.50 basis points, depth of 670 contracts, and turnover of 420 contracts; the increase in price impact relative to the median is 239 per cent. For reference, the full sample median for the daily absolute price change is 1 basis point for both the 3-year contract and the 10-year contract.

4.2 October and November 2021: the end of the yield target

In late 2021, domestic activity and inflation showed signs of picking up, and markets started to revise their previously held view of ongoing subdued economic activity. This saw market participants begin to view the RBA's yield target – around 10 basis points for the 3-year AGS – as inconsistent with the revised outlook, and the target came under increasing pressure as the yield on the 3-year AGS rose. This pressure increased on 27 October 2021, when stronger-than-expected September quarter CPI data was released, and the pressure rose further in the days following when, counter to some market participants' expectations, the RBA did not enter the market to purchase bonds in support of the target. The target was officially discontinued by the Reserve Bank Board on 2 November 2021.

Considering the week to 2 November 2021, and taking the final week of September 2021 as a control, average bid-ask spreads for the 3-year contract rose modestly, from 0.50 to 0.57 basis points; average turnover also rose, from 870 to 1,450 contracts per 5-minute interval; average depth fell by 90 per cent, from 2,820 to 280 contracts; and average price impact rose by 395 per cent (see Figure 7). Similarly, for the 10-year contract, average bid-ask spreads rose from 0.50 to 0.55 basis points; average turnover fell from 1,540 to 1,040 contracts per 5-minute interval; average depth fell around 90 per cent, from 1,690 to 190 contracts; and average price impact rose by 429 per cent.[12]

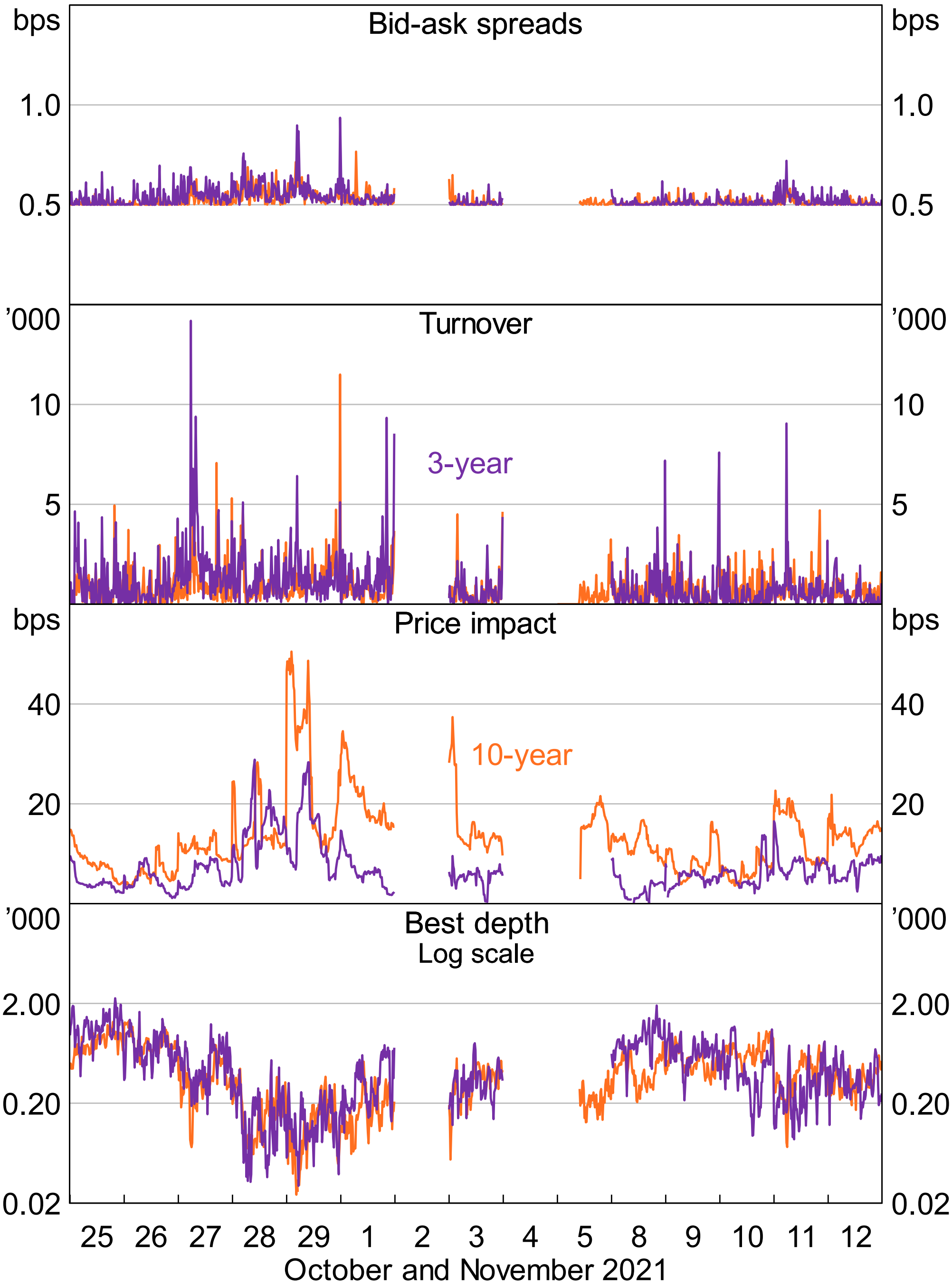
Similar to the experience of March 2020, bid-ask spreads were affected by the period of market stress, but less so than other measures of liquidity, while depth and price impact saw very large effects, particularly in the days following 27 October as it became increasingly clear that the RBA was not going to intervene. Turnover was mixed, being a little higher on average for the 3-year contract and a little lower on average for the 10-year over the period considered. Again, the results suggest that even during acute stress it was possible to trade a small number of contracts without having to cross a large bid-ask spread, but that moderately to larger-sized trades move prices, thereby incurring significant transaction costs.

Liquidity conditions recovered a little over 2022 but remained materially poorer than had been the case prior to the end of the yield target (see Figures 3 and 4). For the 3-year contract excluding roll periods and the period of higher minimum price increments starting from October 2022, bid-ask spreads averaged 0.54 basis points over 2022, retracing half the widening seen at the end of the yield target, average depth increased just 10 per cent to 310 contracts, price impact fell around 10 per cent, and average turnover per 5-minute increment halved to 700 contracts, all relative to the end of the yield target period. For the 10-year contract, again excluding roll periods, bid-ask spreads retraced a little more than half their widening to average 0.52 basis points over 2022, depth doubled to 410 contracts, price impact fell 36 per cent, and turnover fell 20 per cent to 800 contracts.

12 As above, all changes between periods are statistically significant. For comparison, the full sample medians for the 3-year contract are: bid-ask (excluding roll periods and the period of 1 basis point minimum price increments) of 0.51 basis points, depth of 1,790 contracts, and turnover of 280 contracts; the increase in price impact relative to the median is 191 per cent. For the 10-year contract the full sample medians are: bid-ask (excluding roll periods) of 0.50 basis points, depth of 670 contracts, and turnover of 420 contracts; the increase in price impact relative to the median is 207 per cent.

Figure 7: Measures of Liquidity for 3- and 10-year Futures around End of Yield Target

Total for turnover and averages for other measures, 5-minute intervals



Notes: Best depth and turnover are shown in thousands of contracts. Price impact is shown in basis points per $1 billion of net flow. Intraday measures of liquidity could not be calculated for 2, 4 and 5 November (except for the second half of 5 November for 10-year futures). Daily measures from an alternative dataset suggest that liquidity on the missing days was similar to or worse than liquidity on surrounding days.

Sources: Authors' calculations; Bloomberg.

Evidence suggests that international factors played a part in the persistence of poor liquidity in the AGS futures market through 2022, following the sharp deterioration in liquidity conditions caused by the end of the yield target. For example, liquidity conditions in the US Treasury market also deteriorated materially over late 2021 and through 2022, and remained worse than usual for a prolonged period (Fleming and Nelson 2022; Fleming 2024). It is very unlikely that events in Australia would impact US Treasury market liquidity; rather, a common global factor is likely to have contributed, namely heightened economic and policy uncertainty as inflation and interest rates rose globally over 2022, which caused worse liquidity in government bond markets around the world, including Australia.

4.3 January 2021: a particularly calm period in markets

In juxtaposition to March 2020 and November 2021, January 2021 was a particularly calm period in markets when the outlook for monetary policy appeared relatively certain: low rates for a prolonged period. The 3-year yield target was seen as credible, and the RBA had not had to conduct any purchases to support the target for some time.

Given this backdrop, we see essentially the opposite market dynamics to March 2020 and November 2021: bid-ask spreads were again largely stable at the minimum increment of 0.5 basis points, while turnover was in line with or lower than the control period, again taken as November 2019 (470 contracts on average per 5-minute window for the 3-year, versus 970 in the control period; and 1,060 contracts on average per 5-minute window for the 10-year, versus 980 in the control period). Conversely, market depth was higher than in November 2019 (19,120 contracts on average for the 3-year, versus 2,040 in the control period; and 1,770 contracts on average for the 10-year, versus 1,330 in the control period) and average price impact was lower (91 per cent lower than in the control period for the 3-year, and 27 per cent lower for the 10-year).[13]

The results for the 3-year contract in particular stand out – depth is almost 10 times higher than in the control period, average price impact is over 10 times lower, but turnover is also lower. These results accord with the messages heard in market outreach at the time, which suggested that market participants were very confident that 3-year yields would be stable at their current level, hence a willingness to offer to transact large volumes at the current price, and minimal price impact from trades, but relatively little actual trading.

4.4 March, May and October 2021: changes to the RBA's securities lending fees

The RBA adjusted the fee it charged to lend out the yield target bond – the April 2024 AGS as at the time of the adjustments – to market participations on three occasions: at around midday on 9 March 2021 when it was raised from 25 to 100 basis points in an effort to discourage short-selling of the bond and so bring the bond's yield more into line with the target (largely successfully); at around midday on 7 May 2021 when the fee was lowered from 100 to 25 basis points given no current pressure on the yield target; and at 16.30 on 19 October 2021 when it was again raised from 25 to 100 basis points in an effort to defend the yield target (initially successfully, but only for a short period).

A higher fee to borrow a bond might be expected to reduce market liquidity in that bond (since market makers would find it more expensive to make a market, which often involves borrowing

13 As above, all changes between periods are statistically significant. Expanding the control group to cover the four months to mid-February 2020 does not change the results. For comparison and as noted previously, the full sample medians for the 3-year contract are: bid-ask (excluding roll periods and the period of 1 basis point minimum price increments) of 0.51 basis points, depth of 1,790 contracts, and turnover of 280 contracts; the decrease in price impact relative to the median is 94 per cent. For the 10-year contract, the full sample medians are: bid-ask (excluding roll periods) of 0.50 basis points, depth of 670 contracts, and turnover of 420 contracts; the decrease in price impact relative to the median is 45 per cent.

bonds), and a lower fee might have the opposite effect. But this does not appear to have been the case in the futures market, or at least any initial impact was relatively small.[14] Considering the period from 30 minutes to 2½ hours after a fee change, versus the period from 2½ hours to 30 minutes before the change, the various metrics show no statistically significant changes in average liquidity.

4.5 April 2025: announcements of tariff changes by the United States and others

On the afternoon of 2 April 2025 Eastern Time in the United States ('Liberation Day', which was the morning of 3 April 2025 Sydney time), US President Trump announced baseline tariffs of 10 per cent on almost all goods imported into the United States, and additional tariffs on imports from countries that had a goods trade surplus with the United States. These tariffs were much larger than most market participants had been expecting, and over the following days resulted in significant falls in US equity prices, higher US Treasury yields, some strains in US Treasury markets, and a depreciation of the US dollar (see Perli (2025) for a discussion of the impact of the tariff announcements on the US Treasury market). These effects spilled over to other markets, including in Australia.

Similar to the United States, liquidity in the Australian government bond market deteriorated, with strains peaking around 9 April (Jacobs 2025). Liquidity in AGS futures deteriorated too, though this was somewhat less pronounced than for AGS themselves. As shown in Figure 8, bid-ask spreads for the 3-year futures contract were modestly higher (averaging 1.04 basis points on 9 April, versus 1.01 over the 5 days to 31 March), while depth fell materially (from an average of 4,460 contracts over the 5 days to 31 March, to 640 contracts on 9 April) and price impact rose to 2.3 times its end-March level. Turnover on 9 April was over twice its end-March average. Similar dynamics were observed in the 10-year futures (bid-ask spreads not much changed; depth falling by almost 90 per cent; price impact increasing by a factor of 3; and turnover almost doubling). As with other stress episodes, bid-ask spreads were only modestly affected, depth and price impact deteriorated meaningfully, and turnover rose.

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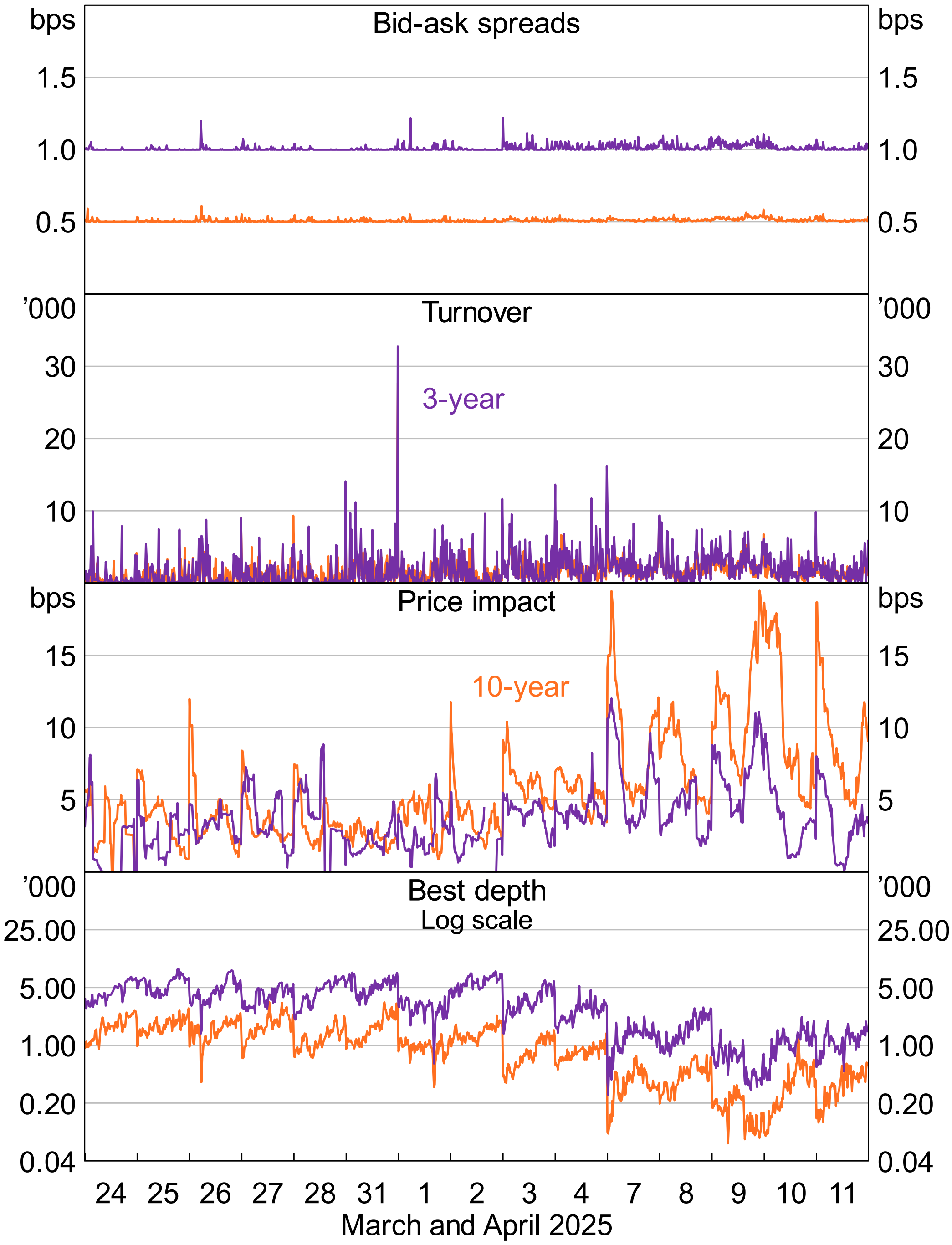
14 Other considerations beyond the strict cost to borrow the bond that may have influenced outcomes include any signals that the fee change may have sent to the market, including that the RBA was committed to the yield target policy, or conversely that the policy was coming under increasing market pressure.

Figure 8: Measures of Liquidity for 3- and 10-year Futures around 'Liberation Day'

Total for turnover and averages for other measures, 5-minute intervals



Notes: Best depth and turnover are shown in thousands of contracts. Price impact is shown in basis points per $1 billion of net flow.

Sources: Authors' calculations; Bloomberg.

5. Effects of Regular Events on Liquidity

We now turn to the effects of market-moving events that occur fairly regularly in our sample – specifically, RBA policy decisions, major economic data releases from the ABS, RBA bond purchases, AOFM bond sales and changes in minimum price increments, in particular in futures roll periods – on our measures of futures market liquidity. For regular events, we can estimate their effects with greater confidence than we can for one-off periods of interest. To do this, we compare liquidity on event days with uneventful 'control' days throughout our sample. We use our full sample from

October 2019 to June 2025 for our estimations throughout Section 5, though a sample that excludes 2020, thereby excluding the period most affected by COVID-19, produces qualitatively similar results.

5.1 News events: RBA policy decisions and ABS data releases[15]

First, we estimate the effects of the RBA's monetary policy decisions and major ABS data releases. For each liquidity measure and futures tenor, we use an ordinary least squares regression (OLS) to estimate the following equation for the two types of news event separately:

$$y_{d,t} = \alpha_d d + \beta_t t + \sum_{d,t \neq t_0} \gamma_t x_d t + \varepsilon_{d,t}$$

where $y_{d,t}$ is the measure at time t on date d and x_d is a binary treatment variable, indicating whether the news event occurred on that date (= 1) or not (= 0). We include fixed effects for dates (α_d) and times of day (β_t). We cluster errors ($\varepsilon_{d,t}$) by date and time of day. Our sample consists of dates where that type of news event occurred and control dates, and excludes dates where other types of events occurred. Our control dates are Tuesdays where no market-moving events occurred. Given this, our coefficients of interest are γ_t, which can be interpreted as the average time-of-day effects for that type of news event relative to control dates and an arbitrary time (t_0) prior to when the news event occurs.

Figures 9 to 12 show model results in graphical form, where for each 5-minute increment the dot represents the mean effect of the news event on the given measure of liquidity in that 5-minute period and the whiskers show the 90 per cent confidence interval around that mean. Qualitatively, the results follow the same patterns as some of the events discussed in the previous section – bid-ask spreads increase, market depth falls, and price impact tends to rise, all indicative of a worsening in liquidity. Also similar to above, turnover rises despite the worse liquidity conditions, as investors adjust their portfolios following the news.

Beginning with bid-ask spreads in Figure 9, news events see a widening in the minutes leading up to the release, with spreads increasing by around 0.05 to 0.15 basis points, compared with a median bid-ask spread of 0.5 basis points. Liaison with market participants suggests that many liquidity providers, particularly those that utilise algorithms to make the market, pull back ahead of information releases, which may explain this pattern; this is also relevant for depth and price impact, as discussed below.[16] The effect is generally small and short-lived, however; for both the 3-year and 10-year contracts, spreads return to typical levels within around half an hour after the news event for RBA decisions, and within a few minutes for ABS data releases. The more rapid normalisation following ABS data releases, versus RBA decisions, is also apparent in the other liquidity metrics, and may indicate that the market is able to interpret ABS releases quickly, whereas it takes longer

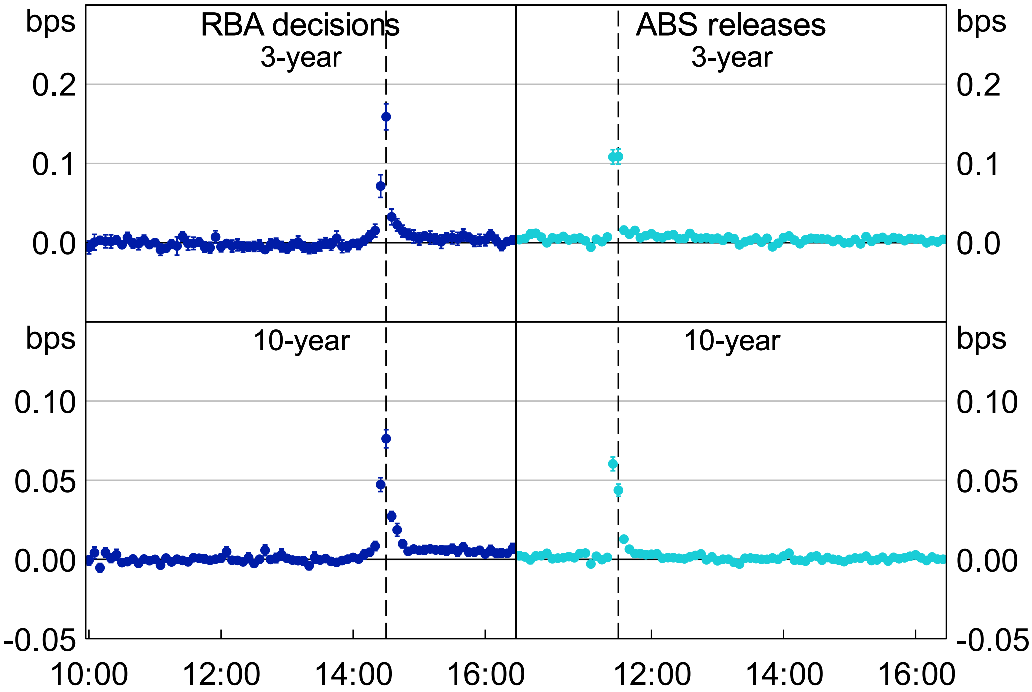
15 In the regressions for this section, we drop the time-of-day fixed effect for 11:00 for RBA policy decisions, and 15:00 for ABS data releases. This allows us to include a date fixed effect and means that the measured effect at the relevant time (chosen to be several hours away from the event time) is zero. The ABS data releases we consider are: the quarterly consumer price index, national accounts and wage price index; and the monthly labour force survey and retail trade survey.

16 Rapid price changes may also lead to wider bid-ask spreads, although this is more likely to be a factor after the data has been released, rather than before.

to fully interpret and price the new information contained in RBA decisions (including because RBA decisions are followed by a press conference for part of our sample).

Figure 9: Effects of News Events on Bid-ask Spreads

Intraday effects, 5-minute intervals, dashed line = event time



Notes: Whiskers show 90 per cent confidence intervals. X-axis shows the time of day in Sydney, from 10:00 to 16:25.

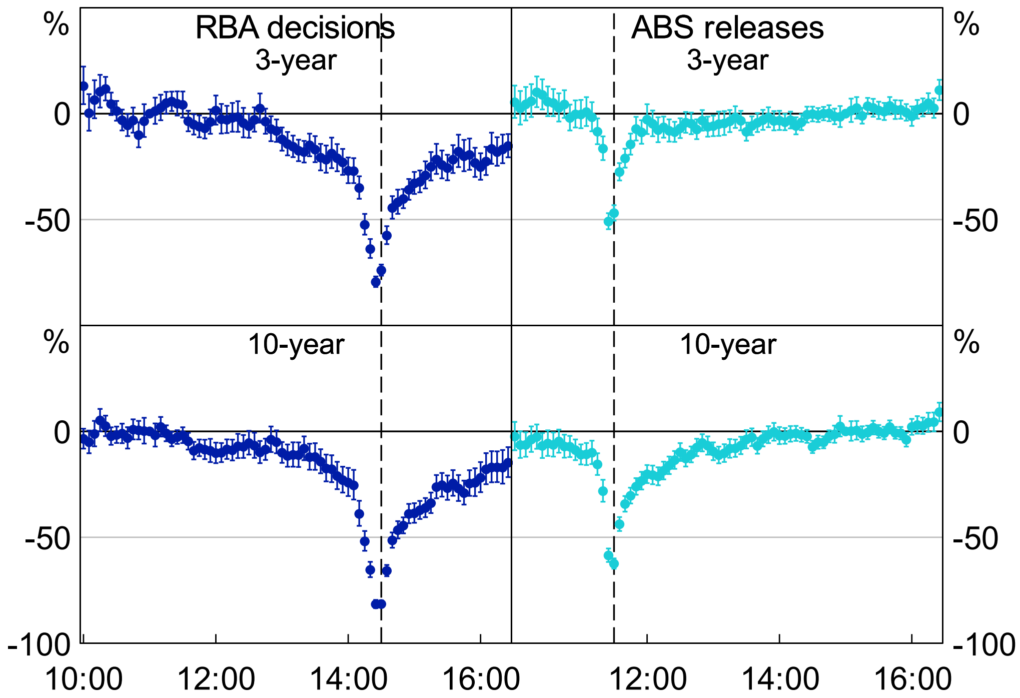
Sources: Authors' calculations; Bloomberg.

Market depth in Figure 10 displays a pronounced and relatively longer-lived reaction to news events, and especially to RBA policy decisions. Depth falls by around 75 per cent at peak for RBA policy decisions for both the 3-year and 10-year contracts, and is materially lower than is typical for around 30 minutes either side of the event. For ABS data releases the response is similar but less pronounced, with depth falling by around 50 per cent for both the 3-year and 10-year contracts and remaining materially lower for 10 to 20 minutes either side of the event.

Conversely, turnover as shown in Figure 11 increases disproportionately *after* the event (versus before for the other measures), and it increases despite the less favourable liquidity conditions, as market participants observe and then trade on the news to rebalance their portfolios. For RBA policy decisions, turnover increases by around 7,000 and 3,500 contracts respectively for the 3-year and 10-year contracts – to a level around eight and five times typical turnover, respectively – and remains elevated through to the close of the day session. Again, for ABS data releases the response is similar but a little less pronounced.

Figure 10: Effects of News Events on Best Depth

Intraday effects, 5-minute intervals, dashed line = event time

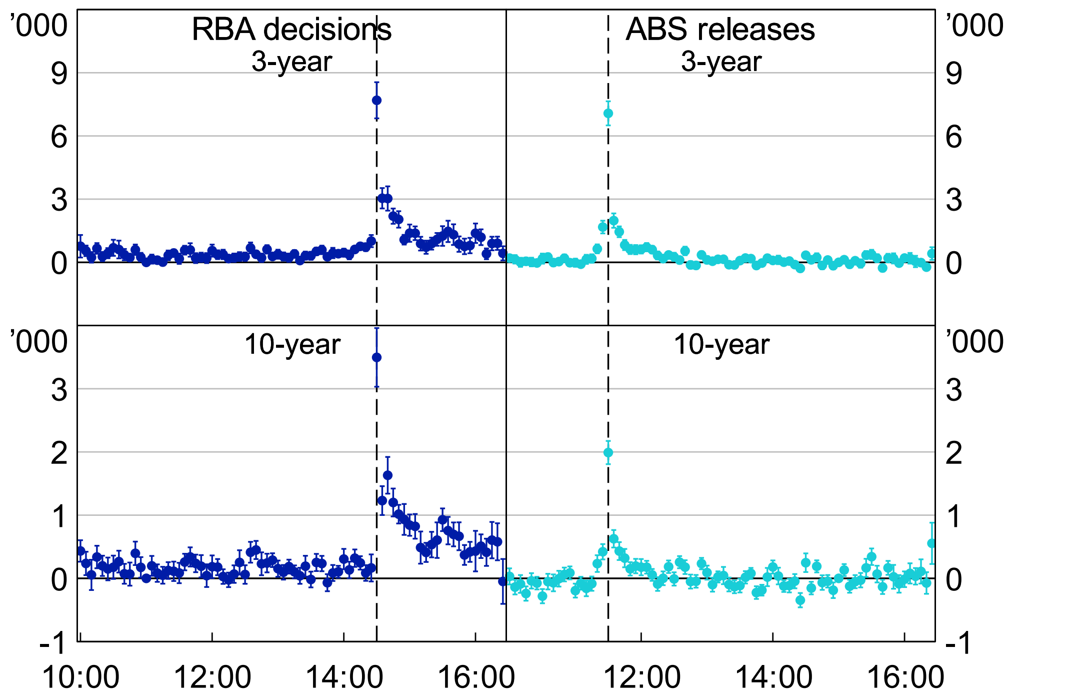


Notes: Whiskers show 90 per cent confidence intervals. X-axis shows the time of day in Sydney, from 10:00 to 16:25.

Sources: Authors' calculations; Bloomberg.

Figure 11: Effects of News Events on Turnover

Intraday effects in thousands of contracts, 5-minute intervals, dashed line = event time



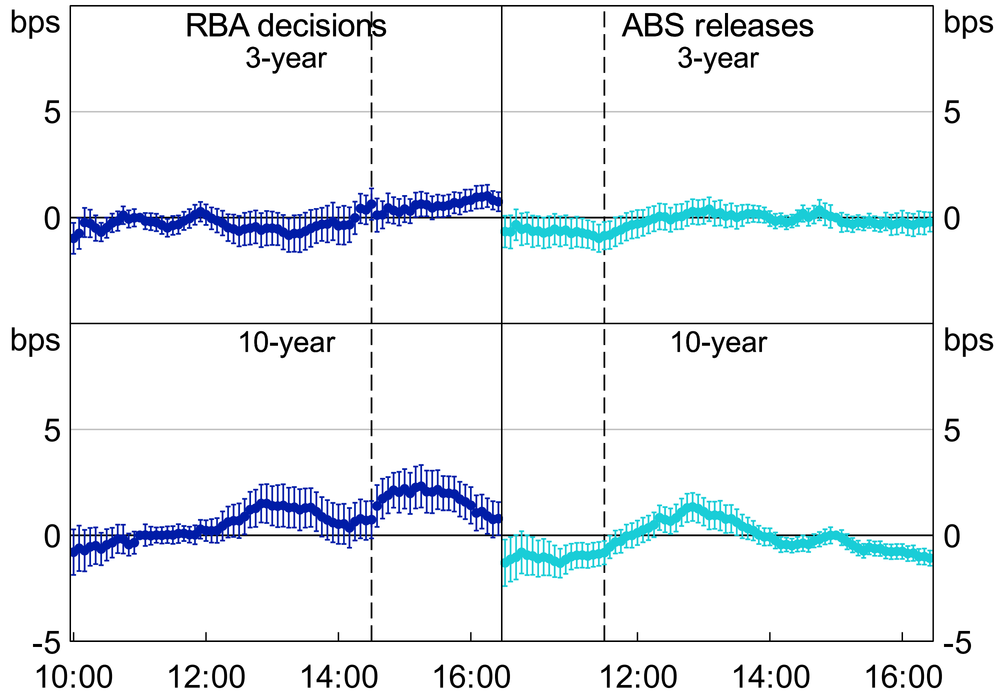
Notes: Whiskers show 90 per cent confidence intervals. X-axis shows the time of day in Sydney, from 10:00 to 16:25.

Sources: Authors' calculations; Bloomberg.

Finally, price impact as shown in Figure 12 tends to increase following news events, particularly for the 10-year contract, which is indicative of worse liquidity conditions. Recall that the price impact measure is estimated over a trailing 90-minute window excluding data 5 minutes either side of the news event; this means that by construction it has a high degree of persistence.

Figure 12: Effects of News Events on Price Impact

Intraday effects per $1 billion of net flow, 5-minute intervals, dashed line = event time



Notes: Whiskers show 90 per cent confidence intervals. X-axis shows the time of day in Sydney, from 10:00 to 16:25.

Sources: Authors' calculations; Bloomberg.

5.2 Flow events: RBA purchases and AOFM tenders[17]

Large scheduled flow events – bond sales by the AOFM or purchases by the RBA – serve as a focal point for market participants, bringing investor attention, and therefore liquidity, to the market. We analyse flow events similarly to news events, but we replace the binary treatment variable with a continuous treatment variable representing the size of the flow, adjusted to apportion it between the 3- and 10-year futures contracts.[18] For example, for a tender of $1 billion of a 6.5-year bond, the continuous treatment variable would be $0.5 billion in each of the 3- and 10-year regressions. If the bond had 3 years to maturity instead, then the treatment variable would be $1 billion in the 3-year regression and zero in the 10-year regression (effectively, it would count as a control day in the latter regression). This approach approximates how market participants use a combination of

17 In the regressions for this section, we drop the time-of-day fixed effect for 12:00 for RBA purchase days, and 14:30 for AOFM tender days. This allows us to include a day fixed effect and means that the measured effect at the relevant time (chosen to be several hours away from the event time) is zero. The RBA purchases we consider are purchases of AGS under the RBA's bond purchase program. For more information about the RBA's bond purchase program, see Finlay *et al* (2023).

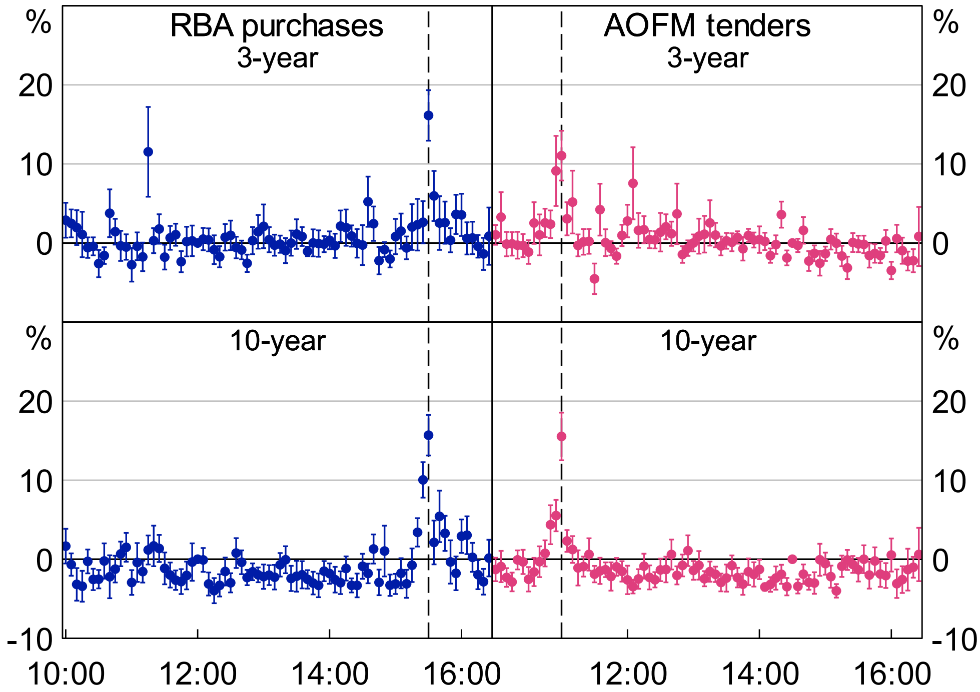
18 Other approaches to dealing with differences between the tenors of futures contracts and bonds bought or sold – for example, grouping bonds by the closest futures contract tenor rather than apportioning them between the contracts – produce qualitatively similar results.

3-year and 10-year futures positions to hedge bond purchases. We do not report bid-ask spreads as they display minimal reaction to flow events.

Figure 13 shows the effect on turnover from RBA purchases and AOFM tenders, expressed as a share of the adjusted flow amount. So, for example, if the purchase or tender flow apportioned to the 3-year contract was $1 billion, a 10 per cent effect size would mean that turnover in the 3-year contract rose by 1,000 contracts, equivalent to $100 million face value of bonds (i.e. 10 per cent of $1 billion) relative to control days in the relevant 5-minute window. As might be expected, turnover is elevated in the event window, with the magnitude of the increase around 10 to 20 per cent of the adjusted flow level; turnover is also elevated, but to a lesser extent, for 5 to 10 minutes either side of the event.[19] Flows are fairly evenly balanced between the buyer-initiated and seller-initiated sides for both event types.

Figure 13: Effects of Flow Events on Turnover

Intraday effects as a share of adjusted flow, 5-minute intervals, dashed line = event time



Notes: Whiskers show 90 per cent confidence intervals. X-axis shows the time of day in Sydney, from 10:00 to 16:25.

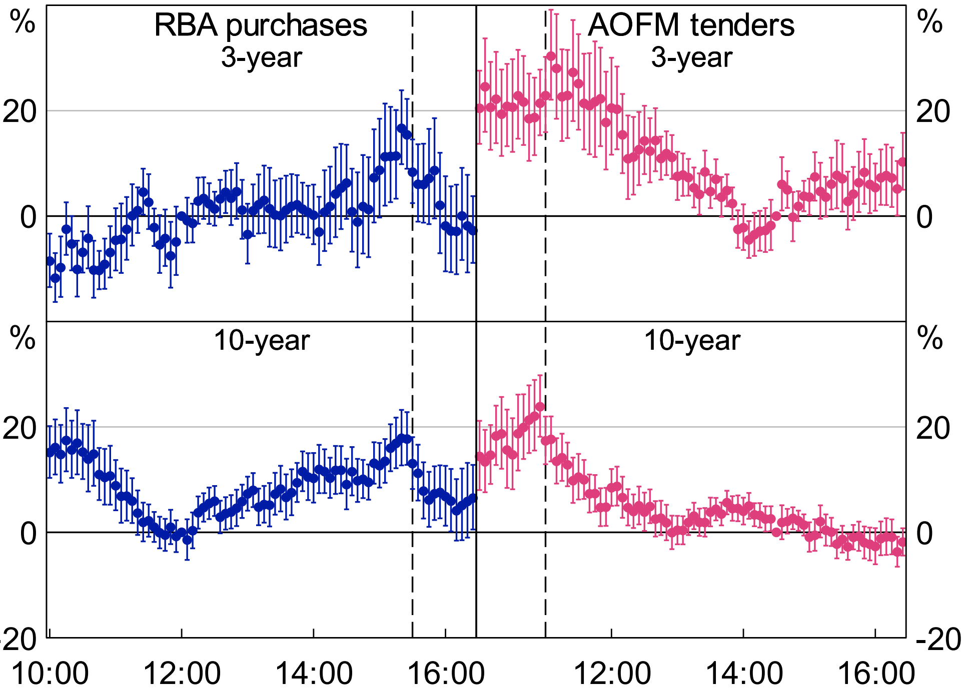
Sources: Authors' calculations; Bloomberg.

19 Notably, turnover is elevated for 3-year futures on RBA purchase days at 11:15, which is when the RBA would announce the bonds that would be eligible for purchase on those days, including any purchases of 3-year bonds to support the RBA's yield target. Turnover for 3-year futures at 11:15 was especially high on a number of days in September 2020 and February, March and October 2021, when participants expected the RBA to announce purchases of 3-year bonds to defend the target. For more information about the RBA's yield target purchases, see Finlay *et al* (2023).

Figure 14 shows the effect on depth from RBA purchases and AOFM tenders. RBA bond purchases and AOFM bond tenders both result in modestly increased market depth for the hour or so leading up to the event, in the order of around 10 to 30 per cent per $1 billion of adjusted flow. The increase in depth around RBA purchases occurs on the bid side of the order book, whereas the increase around AOFM tenders is on the ask side; this is consistent with participants laying orders to hedge expected flows pre-emptively.

Figure 14: Effects of Flow Events on Best Depth

Intraday effects per $1 billion of adjusted flow, 5-minute intervals, dashed line = event time



Notes: Whiskers show 90 per cent confidence intervals. X-axis shows the time of day in Sydney, from 10:00 to 16:25.
Sources: Authors' calculations; Bloomberg.

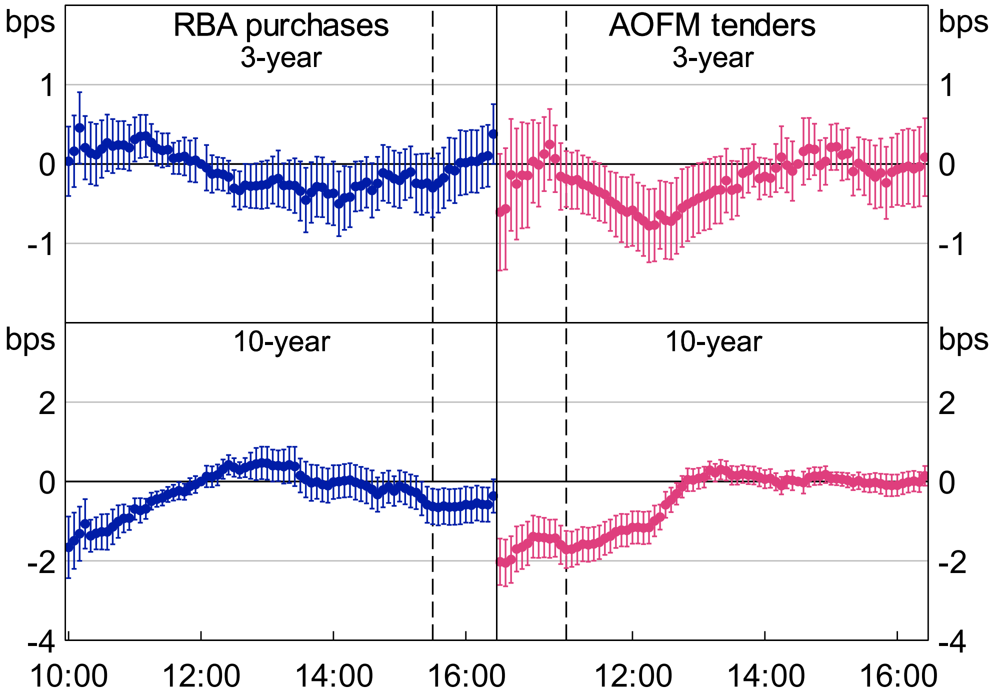
Consistent with greater depth, price impact is typically little changed to modestly lower around these events (Figure 15).

Taken together, the above results suggest that RBA bond purchase and AOFM bond tender events improved liquidity conditions somewhat. These flow events – which are announced in advance – serve as a focal point and draw participants into the market, where they meet and transfer risk, which appears to improve liquidity for a short period. Each of the events represents a significant transfer of interest rate risk between the public and private sectors; if investors found it difficult to smoothly absorb that transfer, then this could result in worse or little changed liquidity conditions, though our findings suggest that this is not what occurs in the AGS futures market typically.[20]

20 For comparison, Fullwood and Massacci (2018) find no discernible effect on liquidity dynamics around Bank of England asset purchase facility purchases in 2016; see their Figures 11 and 12, where higher numbers denote worse liquidity.

Figure 15: Effects of Flow Events on Price Impact

Intraday effects per $1 billion of adjusted flow, 5-minute intervals, dashed line = event time



Notes: Whiskers show 90 per cent confidence intervals. X-axis shows the time of day in Sydney, from 10:00 to 16:25.

Sources: Authors' calculations; Bloomberg.

5.3 Syndication events

AOFM syndications are the largest flows that the Australian Government bond market needs to absorb.[21] They are typically more than $10 billion in size, equivalent to 100,000 futures contracts. While issuance is on an outright basis from the AOFM's perspective (unlike other issuers that sometimes issue on a hedged basis using futures), AOFM syndications nevertheless involve a substantial volume of futures trades and have a major effect on the AGS futures market. First, around one-half of investors in a syndication typically submit orders for hedged bond purchases (known as 'exchange for physical', or EFP, in the market). These orders involve the hedge risk manager – one of the commercial banks that is involved in organising the syndication – executing short futures trades that hedge the interest rate risk of the bonds for the investor. The investor then receives the long bond position, plus an offsetting short futures position, when they take delivery of the bonds. The hedge risk manager will typically execute most, but not all, of the short futures trades ahead of syndication pricing, with the remainder executed over the course of the day. While the hedge risk manager bears the risk of moves in futures prices between execution and the pricing of the syndication, they spread out the flow to reduce the volume of short futures trades that must be absorbed by the market in a short period of time, as a concentrated flow close to the time of the syndication pricing could itself move futures prices. Second, some investors who purchase bonds outright (rather than EFP) will hedge the interest rate risk themselves, rather than via the hedge risk manager.

21 Unlike tenders, where the AOFM 'taps' an existing bond line through an auction process, AOFM syndications typically involve the issuance of a new bond line, which is placed directly with investors with the support of a panel of commercial banks that organise the syndication. For more information, see AOFM (2019).

AOFM syndications tend to occur at longer tenors of 10 years or more (although there were three syndications for bonds with tenors of around 5 years in 2020), so we focus on 10-year futures in our discussion of estimated effects. For each liquidity measure and futures tenor, we use OLS to estimate the following equation:

$$y_{s,d} = \alpha_s s + \sum_{e,s,d} \beta_e c_{e,s,d} + \sum_{s,d \neq d_0} \gamma_d x_s d + \varepsilon_{s,d}$$

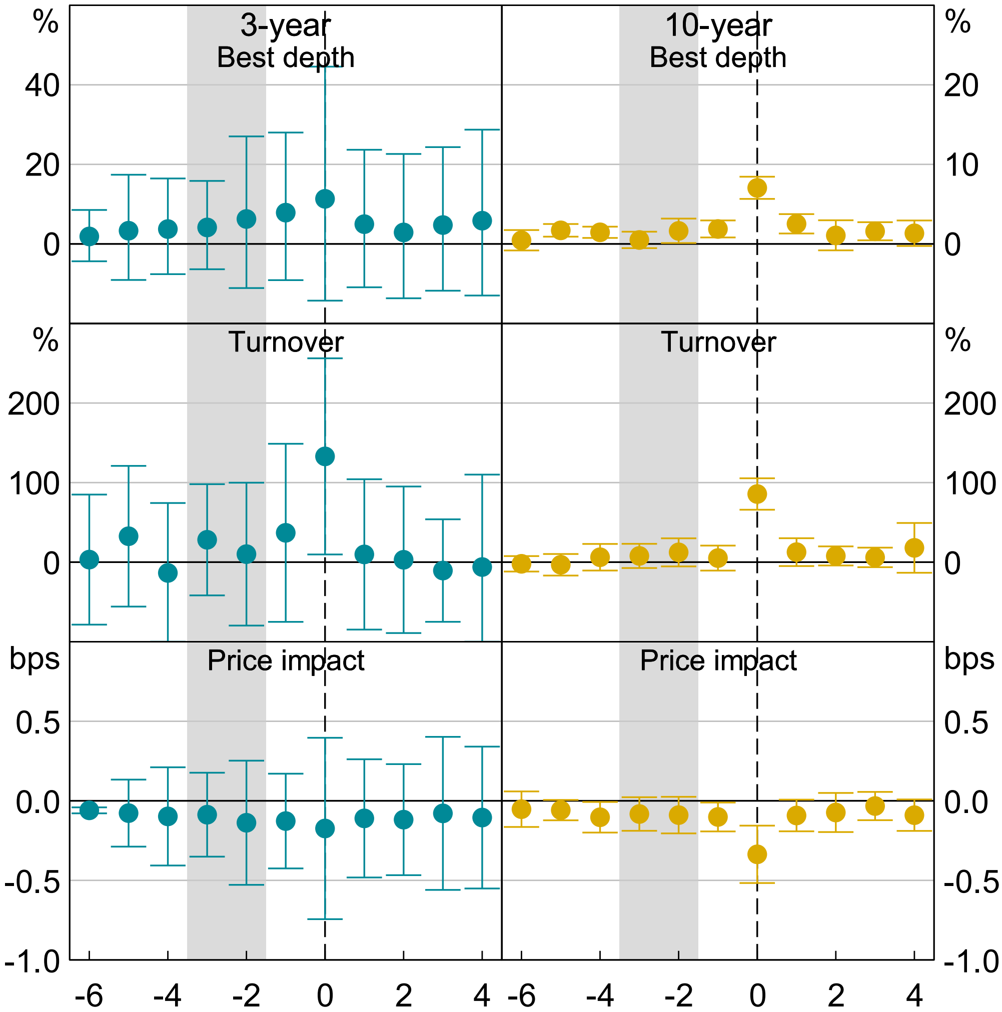
where $y_{s,d}$ is the average measure for syndication s on day d, where d measures days relative to when that syndication was priced taking integer values between –7 and 4. We include fixed effects for each syndication (α_s) and control for event types e occurring in the syndication period through binary variables $c_{e,s,d}$, which cover the news and flow events analysed above, the futures contract roll periods analysed below, and the releases of RBA minutes and Reserve Bank of New Zealand (RBNZ) policy decisions, which take place during the Australian trading day and can move pricing for AGS futures. Errors ($\varepsilon_{s,d}$) are clustered by syndication. We scale the effects by the syndication amount, adjusted for the tenor of the syndication similarly to how we analyse the other flow events, through the continuous treatment variable x_s. Our coefficients of interest are γ_d, which can be interpreted as the average day effects for syndications relative to an arbitrary day (d_0) prior to the syndication period, set to be seven days before the pricing date. There are relatively few data points in general, and even fewer that are relevant for 3-year futures, because syndications occur infrequently.

Consistent with our analysis of smaller flows above, syndications tend to improve liquidity conditions on the day that they occur (Figure 16). Focusing on the 10-year contract, market depth rises by close to 10 per cent per $1 billion of adjusted flow (so a $10 billion 10-year syndication leads to a near doubling in depth). Turnover rises by roughly the same magnitude as the size of the syndication. The increases in depth and turnover occur on both sides of the order book, though for depth the increase on the ask side is somewhat more pronounced, in line with our finding for AOFM tenders. Price impact is substantially lower, by around 0.3 basis points per $1 billion of adjusted flow (so a $10 billion 10-year syndication would reduce price impact by around 3 basis points). We find broadly similar effects for the 3-year contract, but as there were only three syndications of shorter-dated bonds in our sample confidence intervals are wide and we do not focus on them.

Again, in theory large syndications could worsen liquidity, which would be the case if investors had trouble smoothly absorbing the additional interest rate risk sold to the market. That this is not the case suggests that the AGS futures market is deep and liquid enough to be able to smoothly absorb even very large flows. Indeed, large flow events serve as a focal point, bringing investors to the market to such an extent that liquidity is improved.

Figure 16: Effects in Syndication Periods on Measures of Liquidity

Multiday effects relative to adjusted flow, dashed line = pricing, shading = most announcements



Notes: Whiskers show 90 per cent confidence intervals. X-axis shows days relative to the pricing day. Effects on turnover are shown as a share of adjusted flow. Effects on best depth and price impact are shown in per cent and basis points per $1 billion of net flow, respectively, with each expressed per $1 billion of adjusted flow.

Sources: Authors' calculations; Bloomberg.

5.3.1 Announcements[22]

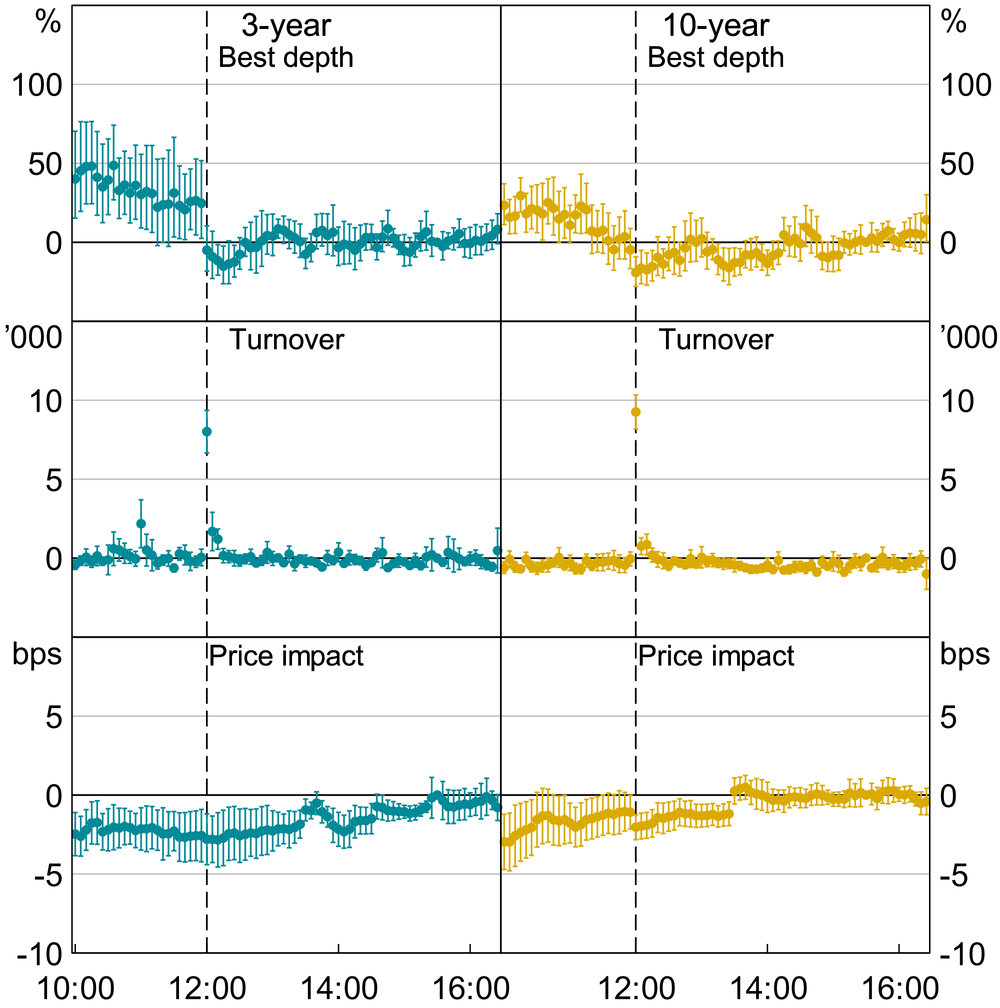
Syndications are officially announced a few days before they are priced, though the announcements are to some extent anticipated by market participants. For example, market participants may be fairly certain that a syndication will occur in a given month, most likely on one of a handful of days, but still be uncertain as to the exact day. We analyse announcement day effects similarly to other intraday effects. However, as the sample is substantially smaller for syndications, we do not filter out days where they clash with other events, whereas for our analysis of other events we do filter out these clashes. Most syndication announcements in our sample occurred on AOFM tender days. For reference, most announcements occurred on days –2 and –3 of the regressions displayed in Figure 16.

22 In the regressions for this section, we drop the time-of-day fixed effect for 15:30. This allows us to include a day fixed effect and means that the measured effect at the relevant time (chosen to be several hours away from the event time) is zero.

We find that intraday depth is elevated ahead of syndication announcements – likely due to announcements falling on AOFM tender days, which tend to be associated with greater depth – but that depth falls following the announcement, before returning to normal levels by the end of the day, as shown in Figure 17. Turnover spikes higher on the announcement, but the effect is very short-lived and turnover returns to pre-announcement levels within 5 to 10 minutes. And price impact is a little lower through most of the day, again most likely due to announcements falling on tender days. On net, and similar to news events, it seems that syndication *announcements* temporarily worsen liquidity conditions.

Figure 17: Effects of Syndication Announcements on Measures of Liquidity

Intraday effects, absolute (not relative to adjusted flow), dashed line = announcement time



Notes: Whiskers show 90 per cent confidence intervals. X-axis shows the time of day in Sydney, from 10:00 to 16:25. Effects on turnover are shown in thousands of contracts. Effects on price impact are shown in basis points per $1 billion of net flow.

Sources: Authors' calculations; Bloomberg.

5.3.2 *Pricing days*[23]

We cannot analyse pricing day effects exactly like other intraday effects since syndications are priced at different times in the afternoon on pricing days, ranging from around 13:45 to 15:15. Instead, for each liquidity measure and futures tenor, we use OLS to estimate the following equation:

$$y_{d,t,r} = \alpha_d d + \beta_t t + \sum_{d,r \neq r_0} \gamma_r x_d r + \varepsilon_{d,t,r}$$

where $y_{d,t,r}$ is the measure on date d at time t, and r is the time relative to the pricing time on syndication dates (on other dates r is irrelevant, as it is multiplied by the treatment variable x_d, which is zero on other dates). For x_d, we use either a binary variable (as we used for news events) or a continuous variable representing the adjusted flow from the syndication for each futures tenor (as we used for flow events). We include fixed effects for dates (α_d) and times of day (β_t), and cluster errors ($\varepsilon_{d,t,r}$) by date and time of day. Our sample consists of syndication pricing dates and control dates but, just as for analysing syndication announcements, we do *not* exclude syndication pricing dates where other types of events occurred. Given this, our coefficients of interest are γ_r, which can be interpreted as the average relative-time-of-day effects for syndication pricings compared to our control dates and an arbitrary time relative to the pricing time (r_0). For reference, pricing occurs on day 0 of the regressions displayed in Figure 16.

Figure 18 shows the results for market depth, with the top panels coming from a regression where the treatment variable is binary (pricing day or not), and the bottom panels coming from a regression where the treatment variable is continuous (being the dollar amount of syndication flow apportioned to the 3-year or 10-year contract). For both regressions and both contracts, depth rises in the few hours leading up to the pricing time. The effect size is large – peak depth is double the typical level for the 10-year contract, and around 50 per cent higher than typical for the 3-year contract. Similar to our finding for the increase in depth on the pricing day, the increase *within* the pricing day is also fairly balanced between the bid and ask sides of the order book, though slightly larger on the ask side. Depth returns toward more typical values soon after pricing.

Turnover also rises significantly around pricing, and for the 10-year contract is elevated for a short period before pricing, as shown in Figure 19. Focusing on the top-right panel, turnover in the 10-year contract rises by around 10,000 contracts in the 5-minute window containing the pricing time, versus median turnover of around 420 contracts per 5-minute window. This is unsurprising given that the hedge risk manager will be executing futures trades in the lead-up to and around the pricing time.

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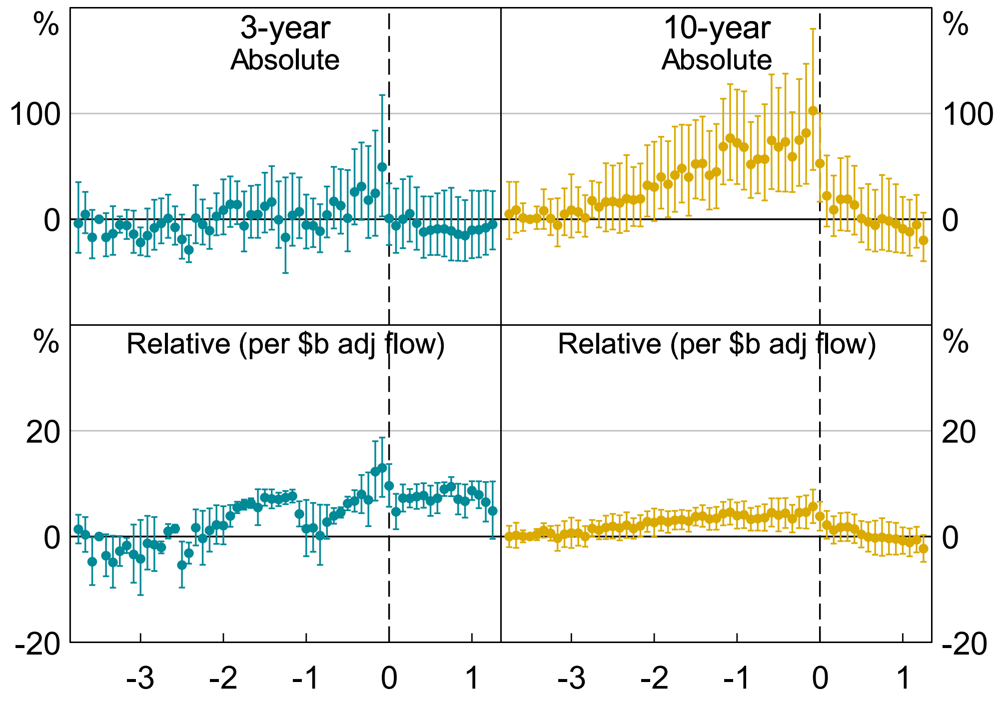
23 In the regressions for this section, we drop the fixed effect for the 5-minute interval that is 3.5 hours prior to the pricing time. This allows us to include a day fixed effect and means that the measured effect at the relevant time (chosen to be several hours away from the event time) is zero.

Figure 18: Effects of Syndication Pricings on Best Depth

Intraday effects, 5-minute intervals, dashed line = pricing time

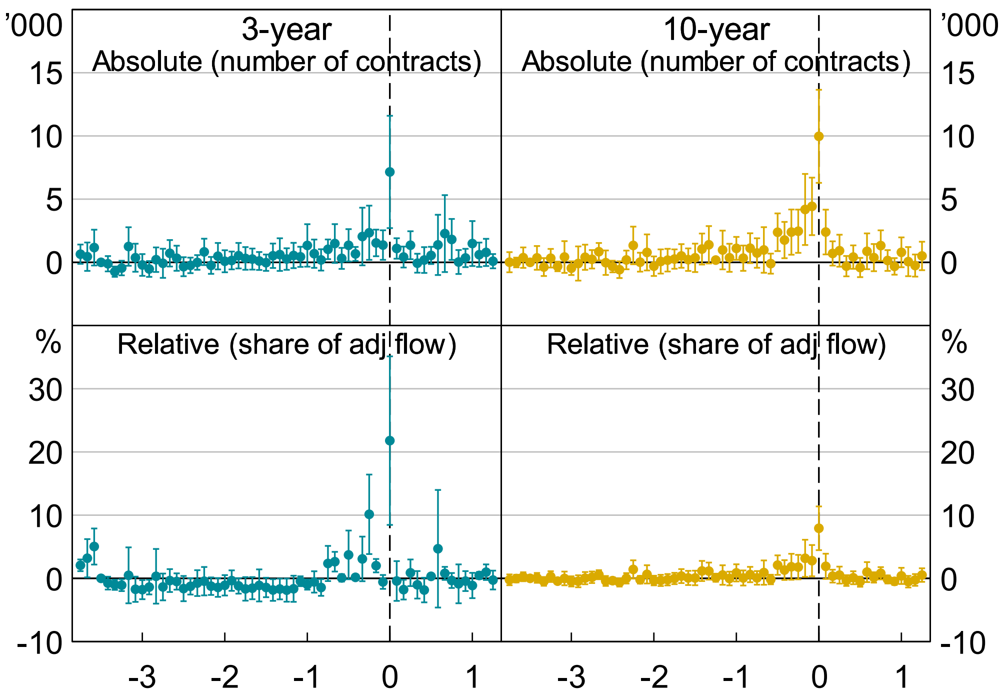


Notes: Whiskers show 90 per cent confidence intervals. X-axis shows time in hours relative to the pricing time, from –3:45 to 1:15.

Sources: Authors' calculations; Bloomberg.

Figure 19: Effects of Syndication Pricings on Turnover

Intraday effects, 5-minute intervals, dashed line = pricing time



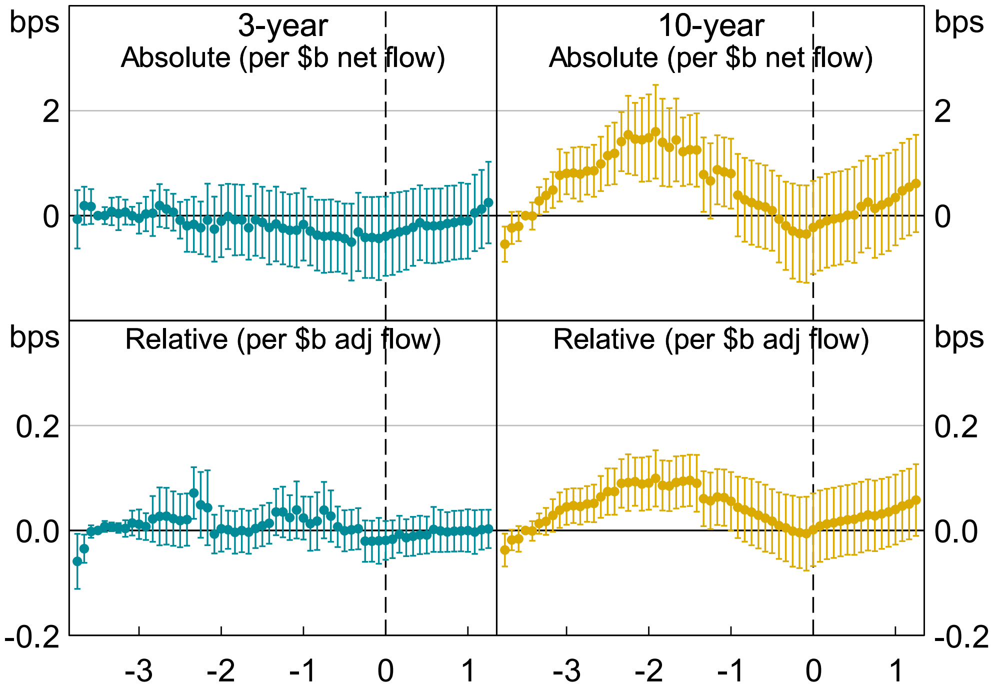
Notes: Whiskers show 90 per cent confidence intervals. X-axis shows time in hours relative to the pricing time, from –3:45 to 1:15.

Sources: Authors' calculations; Bloomberg.

Figure 20 shows price impact on pricing days, with the top panels again coming from a regression where the treatment variable is binary (pricing day or not), and the bottom panels coming from a regression where the treatment variable is continuous (being the dollar amount of syndication flow apportioned to the 3-year or 10-year contract). For 10-year futures, the magnitude of the effects in the top panel are around 10 times the size of those in the bottom panel since syndications are typically around $10 billion in size and tend to be at longer tenors (i.e. the treatment variable is '1' in the top panel regressions, and around '10' in the bottom panel regressions). Despite higher depth, price impact tends to increase ahead of pricing, indicative of worse liquidity conditions. This is a period when the AOFM's hedge risk manager may be expected to be active in the futures market. Other market participants, knowing that the hedge risk manager is likely to need to transact a substantial quantity of futures contracts, may speculate around this activity, contributing to a more one-sided market and increasing price impact. Market contacts have also confirmed some deterioration in liquidity ahead of pricing. Recall, however, that these are intraday effects, controlling for the fact that the day is a syndication day. As discussed above and shown in Figure 16, price impact falls overall on syndication days, and the results of this section suggest that that fall is most pronounced at the time of pricing itself, which serves as a focal point for market participants to transact and transfer risk.

Figure 20: Effects of Syndication Pricings on Price Impact

Intraday effects in absolute and relative terms, 5-minute intervals, dashed line = pricing time



Notes: Whiskers show 90 per cent confidence intervals. X-axis shows time in hours relative to the pricing time, from –3:45 to 1:15.

Sources: Authors' calculations; Bloomberg.

5.4 Increment events

Futures rolls are a major event in the futures market. Futures contracts expire on the 15th day of March, June, September, and December, or on the following business day if the 15th is a weekend or other non-trading day. Outside of roll periods, the overwhelming majority of trading activity occurs in the so-called front futures contract, that is, the contract closest to expiry. But the front contract expires every three months, and investors who wish to maintain their futures position post-expiry have to 'roll' from the expiring contract to the next contract. They do this by closing out their position in the expiring contract (e.g. selling futures if they are long) and entering a new position in the next contract (e.g. purchasing futures if they were long), usually in a single linked trade. Roll activity is concentrated in the five days leading up to expiry, and over this period the ASX typically narrows the minimum price increment that the futures contract can trade in, in order to make rolling positions less costly. Outside of the roll period, in October 2022 the ASX widened the minimum price increment for the 3-year contract, to try to improve liquidity in that contract.

A priori it is unclear what the net liquidity effect of changes in minimum price increments should be. On the one hand, wider increments make it more profitable for market makers to provide liquidity, and so should draw in more market making resources and thereby improve liquidity conditions. However, conversely, wider increments make it more costly for investors and arbitragers to trade, so could drive away users of the product. The net effect may depend on starting liquidity conditions: in a very liquid market, narrow increments should help to attract investors and arbitragers, and high trading volumes should make intermediating the market profitable to market makers, even with narrow bid-ask spreads; this scenario appears to accord with the findings of Fleming *et al* (2024) regarding the US Treasury market. In a less liquid market with lower trading volumes, market makers may need wider bid-ask spreads to incentivise them to provide intermediation services. The dependence of the net effect of tick size changes on starting liquidity conditions is consistent with the model and empirical evidence presented in Werner *et al* (2023), who examine equity exchanges in the United States and Japan.

5.4.1 Increment changes during and between futures roll periods

We analyse futures roll periods similarly to syndication periods, with a few adjustments: the treatment variable is set equal to 1 (as, unlike for syndication periods, there is no need to scale the effects for roll periods); the reference day d_0 is set to be nine days before the expiry day, which day d is relative to; and roll periods are excluded from the controls whereas syndication announcement and pricing dates are included.

Figure 21 shows estimated effects on bid-ask spreads and best depth for the 3-year futures contract from four distinct samples:

- 'pre-narrowing', which covers December 2019 and March and June 2020, where the minimum price increment during the roll period was equal to the normal increment of 0.5 basis points.

- 'post-narrowing', which covers September 2020 to September 2022, where the minimum price increment was reduced from 0.5 to 0.2 basis points during the roll period.

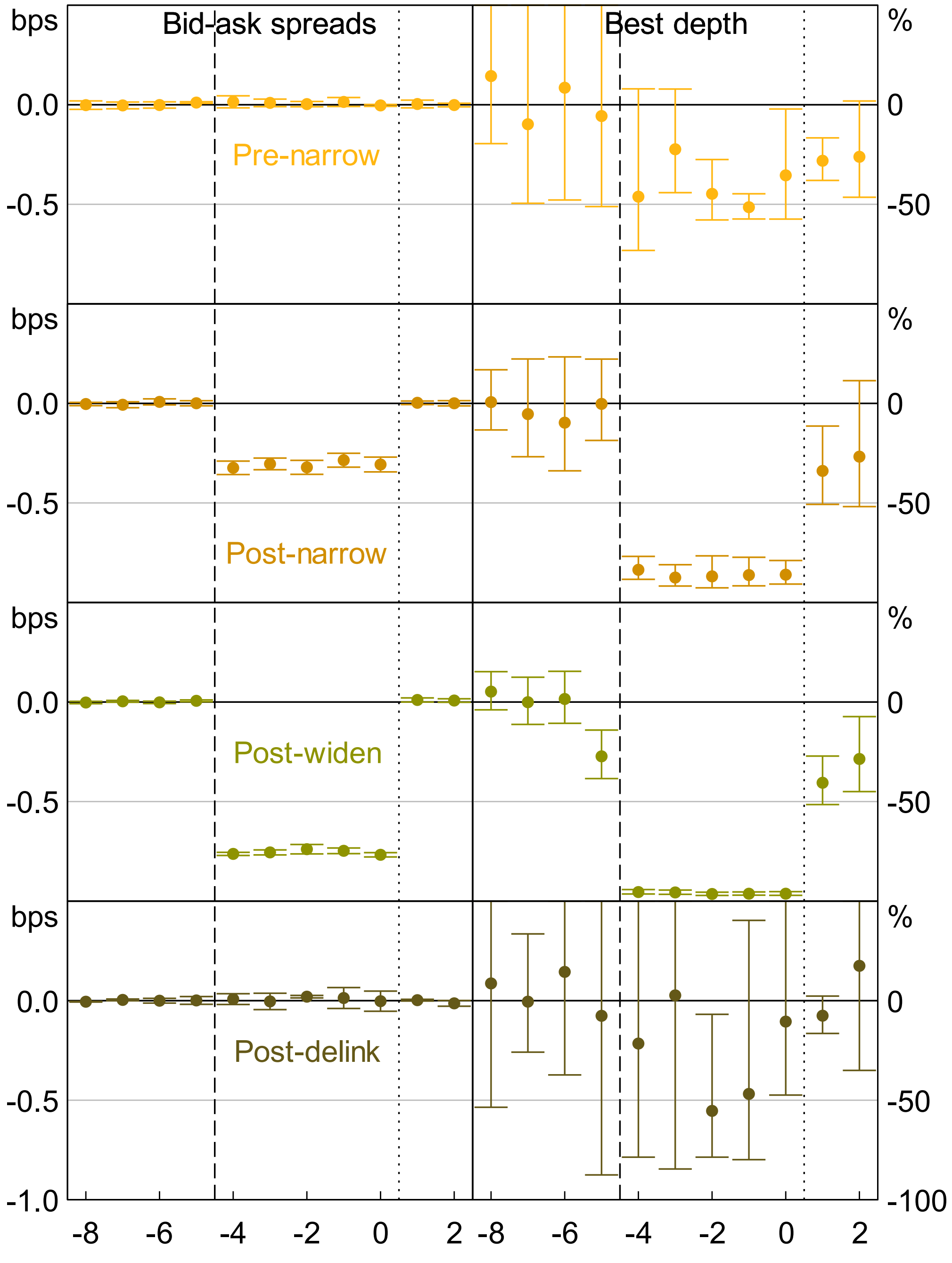
- 'post-widening', which covers December 2022 to December 2024, where the minimum price increment was reduced from 1 to 0.2 basis points during the roll period (as the normal increment was increased from 0.5 to 1 basis point in October 2022, which we analyse further below).[24]

24 Subsequently, in July 2025, the ASX reverted the normal increment for the 3-year futures contract to 0.5 basis points, though we do not analyse the effects of this increment change.

- 'post-delinking', which covers March and June 2025, where trading in the roll and outright futures markets were delinked, so that the minimum price increment for outright futures trading remained at 1 basis point despite the roll trading in 0.2 basis point increments.

Figure 21: Effects in Futures Roll Periods on Measures of Liquidity for 3-year Futures

Multiday effects, dashed line = start of roll period, dotted line = end of roll period



Notes: Whiskers show 80 per cent confidence intervals. X-axis shows days relative to the expiry day. Some confidence intervals for best depth are truncated.

Sources: Authors' calculations; Bloomberg.

These adjustments are clearly visible in the top panel of Figure 3, which shows no change in average bid-ask spreads around rolls initially, then periodic dips from 0.5 to 0.2 basis points, then a step-up in the general level of bid-ask spreads but no change in the level during rolls, and finally no change around rolls once again, though now at a higher level. Note that the pre-narrowing sample contains just three episodes, and the post-delinking sample just two episodes, so the confidence intervals for these samples tend to be wider than for the other two samples.

The four left panels of Figure 21 show the estimated effects on bid-ask spreads. As noted earlier, bid-ask spreads are usually very close to the minimum price increment, and this is typically the case during roll periods too (other than for the front contract on expiry day and the day before). This results in estimated effects on bid-ask spreads from pre-roll to the roll period of close to 0, 0.3, 0.8 and 0 basis points, respectively, for the four samples just described, that is, equal to the change in minimum price increment.

Table 1 presents analogous results from a local randomisation approach within a simple regression discontinuity design, which uses the five days immediately prior to the beginning of the roll period as the control (rather than the single day five days before the roll period begins), and estimates a single treatment effect for the whole roll period (rather than a different treatment effect for each day within the roll period).[25] This approach again finds falls in bid-ask spreads of close to the change in minimum price increments across the four samples.

Table 1: Local Randomisation Estimates of Effects of Futures Roll Periods

Estimates by contract by sample, 5-day bandwidth

	3-year futures contracts				**10-year futures contracts**		
	Pre-narrowing	Post-narrowing	Post-widening	Post-delinking	Pre-narrowing	Post-narrowing	Post-delinking
Bid-ask spreads	0.0	–0.3***	–0.8***	0.0	–0.2***	–0.4***	0.0
(basis points)	(0.0, 0.0)	(–0.4, –0.3)	(–0.9, –0.6)	(0.0, 0.0)	(–0.3, –0.2)	(–0.4, –0.3)	(0.0, 0.0)
Best depth	–34	–83***	–96***	–31**	–74***	–95***	–31**
(per cent)	(–71, 42)	(–91, –69)	(–98, –93)	(–46, –12)	(–85, –55)	(–96, –92)	(–46, –14)
Turnover	–24*	–19***	–31***	–38**	–19	–42***	–27
('000s of contracts)	(–46, –3)	(–27, –11)	(–41, –20)	(–65, –11)	(–42, 2)	(–49, –34)	(–55, 0)
Price impact	2.0**	1.7*	3.4***	1.1*	4.5***	6.3***	1.9***
(basis points per $b of net flow)	(0.3, 3.7)	(0.1, 3.4)	(2.5, 4.4)	(0.0, 2.2)	(1.8, 7.4)	(4.8, 7.8)	(0.7, 3.2)

Notes: *, ** and *** denote statistical significance at the 10, 5 and 1 per cent levels, respectively. Parentheses show bootstrapped 90 per cent confidence intervals.

Sources: Authors' calculations; Bloomberg.

The four right panels of Figure 21 show the estimated effects on best depth for the 3-year contract. One might expect depth at the best available price to fall as the minimum price increment narrows. For example, in the post-narrowing sample, bids within a single 0.5 basis point increment prior to the roll could now be spread over 2½ smaller 0.2 basis point increments during the roll. And this is indeed what we see, in both Figure 21 and in the local randomisation estimates shown in Table 1. But depth falls by more than might be expected naively if the minimum increment was the only

25 No controls were used in this simple design. Consistent with the local randomisation approach, we use a uniform kernel and a polynomial of order 1. We use a 5-day bandwidth as this is supported by some bandwidth selection methods, but other bandwidths produce qualitatively similar results.

explanation, assuming that orders would be layered uniformly between price increments were that possible. For example, during the roll period, depth falls by:

- around 85 per cent in the post-narrowing sample whereas a 60 per cent fall would be more in line with the change in minimum price increment.

- around 95 per cent in the post-widening sample whereas an 80 per cent fall would be more in line with the change in minimum price increment.

Additionally, based on the estimates in Table 1, depth falls by around one-third in the pre-narrowing and post-delinking samples where bid-ask spreads are unchanged, though the estimate for the former sample lacks statistical significance. Underlying turnover, shown in Table 1, also tends to fall during the roll period. This excludes trades associated with the roll itself, which inflate turnover substantially.

Thus, the roll period itself seems to result in less depth, not just the mechanical change in minimum price increment (when such a change occurs). This conclusion is supported by the bottom row of Table 1, which shows that the estimated price impact of trades increases by a few basis points during the roll period, indicating that the roll is associated with worse liquidity conditions than normal. Two potential explanations for this include that:

- the roll diverts investors' and dealers' attention and resources from the outright market, and so results in worse liquidity conditions for a period

- the narrower minimum price increment (when implemented) – and therefore lower bid-ask spread – means that market makers earn less from intermediating trades and so devote fewer resources to that activity, in terms of their balance sheet capacity, resulting in worse liquidity conditions.

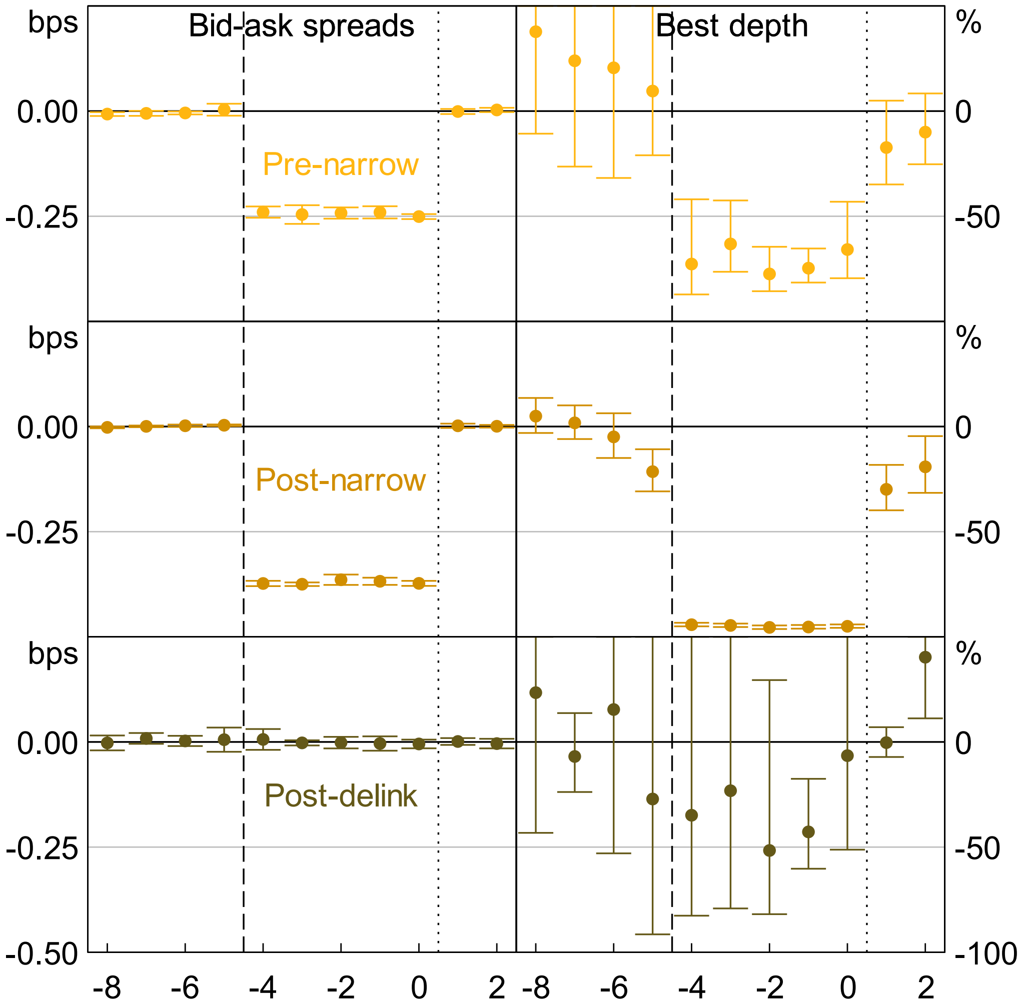
Liaison with market participants suggests that both explanations are to some extent true, with the latter explanation noted as applying in particular for algorithmic market makers.

Figure 22 shows the same as Figure 21 but for the 10-year contract, for which there is no distinct post-widening sample. In the pre-narrowing sample, the minimum price increment during the roll period falls from 0.5 basis points to 0.25 basis points. In the post-narrowing sample, covering September 2020 to December 2024, the minimum price increment during the roll period falls from 0.5 basis points to 0.1 basis point. In the post-delinking sample, the minimum price increment for outright futures trading remained at 0.5 basis points during the roll despite the roll trading in 0.1 basis point increments. These adjustments are clearly visible in the top panel of Figure 4. Again, the pre-narrowing sample contains just three episodes, and the post-delinking sample just two, so confidence intervals for these samples tend to be wider than for the other sample. As before, Table 1 contains analogous results from a local randomisation approach.

Overall, the pattern of results is very similar to the 3-year contract: the bid-ask spread falls by roughly the same magnitude as the change in minimum price increment across the three samples (being 0.25, 0.4 and 0 basis points respectively); market depth falls, and more so than might be expected given the mechanical effect of a smaller minimum price increment (by around 75 per cent in the pre-narrowing sample, whereas 50 per cent might be expected; by around 95 per cent in the post-narrowing sample, whereas 80 per cent might be expected; and by around one-third in the post-delinking sample despite no change in the tick size); price impact increases; and turnover falls. Again, these results suggest that the roll period results in worse liquidity conditions.

Figure 22: Effects in Futures Roll Periods on Measures of Liquidity for 10-year Futures

Multiday effects, dashed line = start of roll period, dotted line = end of roll period



Notes: Whiskers show 80 per cent confidence intervals. X-axis shows days relative to the expiry day. Some confidence intervals for best depth are truncated.

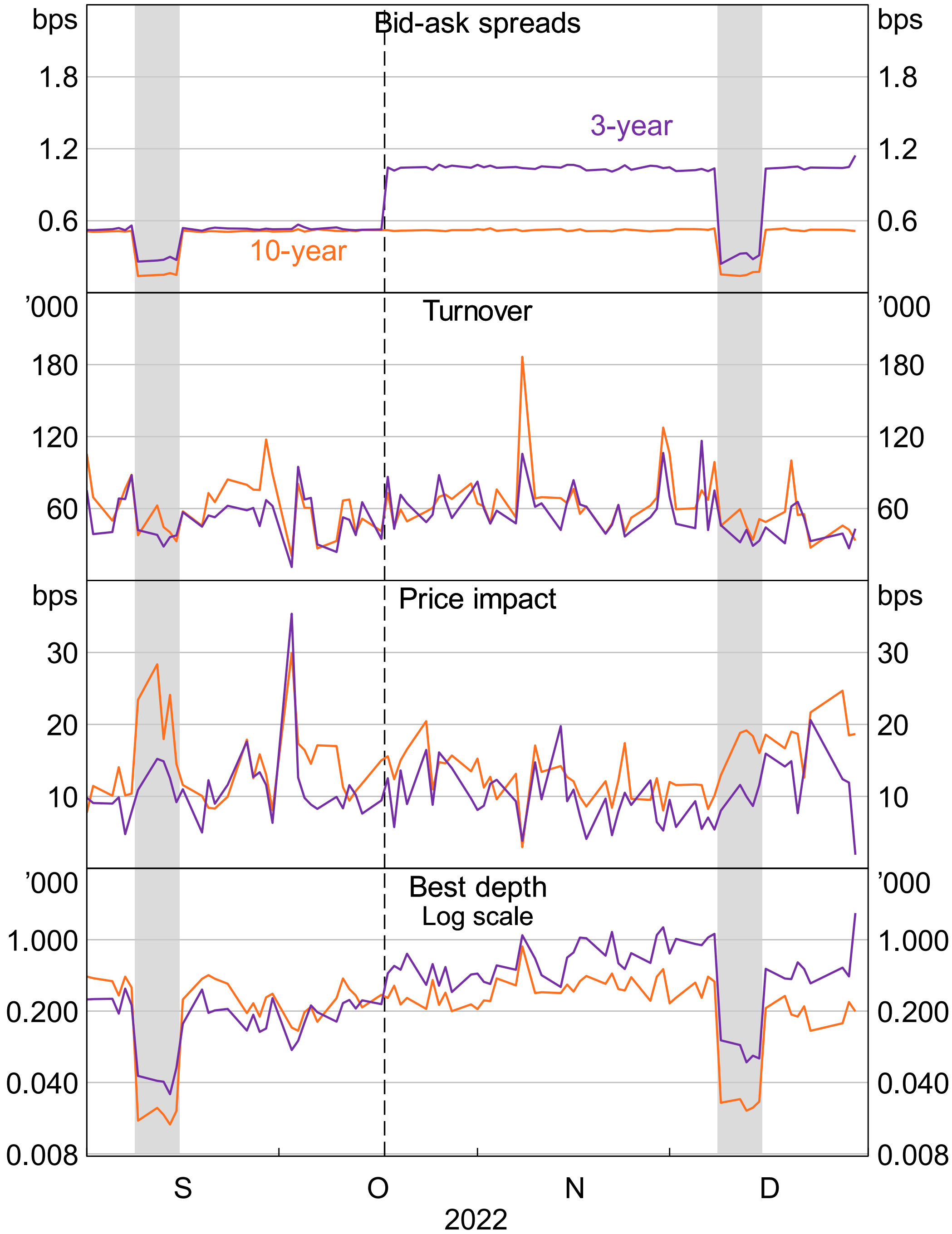
Sources: Authors' calculations; Bloomberg.

5.4.2 Increase in the minimum price increment for the 3-year futures contract

In October 2022, the ASX increased the minimum price increment that the 3-year futures contract could trade in, from 0.5 to 1 basis point, in an effort to improve liquidity conditions in that contract. Figure 23 shows daily measures of liquidity around the change, for both the 3-year contract, which experienced the change, and the 10-year contract, which saw no change in minimum price increment and so can act as a control. From a visual inspection, depth in the 3-year contract seems to have increased relative to depth in the 10-year contract, and price impact perhaps fell, while it is hard to discern a clear pattern in turnover.

Figure 23: Measures of Liquidity for 3- and 10-year Futures around Increment Increase

Total for turnover and averages for others, dashed line = increment increase, shading = rolls, daily



Notes: Best depth and turnover are shown in thousands of contracts. Price impact is shown in basis points per $1 billion of net flow.

Sources: Authors' calculations; Bloomberg.

To formalise this visual analysis, we use a difference-in-differences approach with the 10-year contract as a never-treated control. That is, for each liquidity metric, we compare the difference between the 3-year and 10-year contract after the increase in minimum price increment to the difference between the two contracts before the increase in minimum price increment. The idea is that the 10-year contract will capture any market-wide impacts on liquidity, with the difference between the two contracts isolating events that only affect the 3-year contract. This implicitly assumes that there were no events affecting liquidity in the 10-year contract but not the 3-year contract, and that the only event affecting liquidity in the 3-year contract specifically was the increase in the minimum price increment. It is likely that liquidity in the 3-year futures contract (and 3-year AGS) was gradually improving over time, due to a policy of the AOFM to issue more 3-year bonds to support liquidity in that sector and the end of unconventional monetary policies by the RBA, among other things. In principle this would violate our assumptions, but in practice any improvement in liquidity due to these slow-moving factors, measured over a short period, is likely to be small in size.

More formally, for each liquidity measure, we use OLS to estimate the following equation:

$$y_{c,d,t} = \alpha_d d + \beta_t t + \sum_{e,d} \gamma_e x_{e,d} + \delta_p p_{c,d} + \varepsilon_{c,d,t}$$

where $y_{c,d,t}$ is the measure for contract c at time t on date d and $p_{c,d}$ is a binary post-treatment variable, indicating whether the contract was treated and the date is after the treatment (so $p_{c,d}$ equals one for 3-year futures starting from 18 October 2022, and zero otherwise). We include fixed effects for dates (α_d) and times of day (β_t), and we cluster errors ($\varepsilon_{c,d,t}$) by date and time of day. We also control for event types e occurring in the period around the increment increase through binary variables $x_{e,d}$, which cover the news and flow events analysed above, including syndication events, as well as RBNZ policy decisions and RBA minutes. Our coefficient of interest is δ_p , which can be interpreted as the aggregate average treatment effect on the treated for the period considered. We consider the full period between the September and December 2022 futures roll periods, and two shorter periods of ±20 and ±10 days around the increment increase.

In line with the visual inspection, we find that depth in the 3-year contract increased materially relative to depth in the 10-year contract following the increase in the minimum price increment (Table 2). While the magnitude of the increase in depth is around what one might mechanically expect following a doubling in increment size, the estimated fall in price impact after the increment increase suggests that the ASX's change improved liquidity conditions beyond the mechanical effect on depth (bottom row of Table 2). Turnover was little changed to slightly lower. Overall, a wider increment seems to have improved liquidity conditions in the 3-year futures contract, as was the ASX's intention in making the change.

Table 2: Difference-in-differences Estimates of Effects of Increment Increase

Average treatment effects on the treated, estimates by length of pre-/post-treatment periods

	Full period between rolls	± 20 days around increase	± 10 days around increase
Bid-ask spreads	0.5***	0.5***	0.5***
(basis points)	(0.0)	(0.0)	(0.0)
Best depth	94***	65***	71***
(per cent)	[84, 103]	[56, 74]	[60, 83]
Turnover	–0.1*	0.0	0.0
('000s of contracts)	(0.0)	(0.0)	(0.1)
Price impact	–2.8***	–2.8***	–3.0**
(basis points per $b of net flow)	(0.5)	(0.8)	(1.0)

Notes: *, ** and *** denote statistical significance at the 10, 5 and 1 per cent levels, respectively. Parentheses show standard errors clustered by date and time of day; square brackets show an interval of ±1 standard error.

Sources: Authors' calculations; Bloomberg.

6. Conclusion

We examine tick-level data on Australian Government bond futures over the period of October 2019 to June 2025. We find that AGS futures were very liquid from mid-2020 to early 2021, when the market's expectations for future interest rates were aligned with the RBA's yield target. Conversely, liquidity deteriorated at the onset of COVID-19 and around the end of the yield target in late 2021, and remained low through 2022 and into 2023 as market participants reassessed their views of the outlook for the cash rate. Measures of liquidity improved through 2024 and early 2025, to be broadly in line with levels seen in late 2019 before the COVID-19 pandemic.

Turning to regular market-moving events, we find a clear distinction between uncertain news events and pre-announced and known flow events. Uncertain news events – including announcements of the RBA's monetary policy decisions, major ABS data releases, and AGS syndication announcements – lead to higher turnover but worse liquidity conditions: market participants actively trade on the news and adjust their portfolios, but at the same time are less willing to provide liquidity to others, and trades move futures prices by more than usual. Pre-announced and known flow events – including AGS syndications, which typically involve the sale of $10 to $15 billion worth of a bond, as well as smaller flows such as RBA purchases and AOFM tenders – improve liquidity by serving as a focal point that brings investors to the market. Conversely, the futures roll period sees liquidity deteriorate, as focus and resources shift away from the outright futures market to the roll market and some market makers scale down their liquidity provision. Finally, an increase in the minimum price increment for the 3-year contract, implemented by the ASX in October 2022 to try to improve liquidity conditions, appears to have been successful, with various indicators of liquidity improving after the change.

The AGS market is a key market for the implementation of the RBA's monetary policy decisions, so it is important that the RBA has a deep understanding of that market, how liquid it is – and indeed what 'liquid' means – and how various measures of liquidity respond to major events. By studying liquidity in the AGS futures market in detail we further this understanding. This should assist with, most importantly, the design of any market operations in the future that might involve outright transactions in AGS, should such operations prove necessary. It should also strengthen the RBA's ability to interpret and extract relevant signals from the AGS market in order to better inform policy decisions.

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