From:
Sent: Thursday, 20 August 2020 11:38 AM
To:
Subject: RE: Flatter yield curve [SEC=OFFICIAL]

I don't think there's any good 'theory' about how exactly QE works, so it's not clear, to me at least, how you want to measure it (share of GDP, or share of outstanding). Most of what I've seen is about quantities. In that case, issuance by the AOFM is the same things as buying by us – both affect quantities. Bonds outstanding have increased by 30% since Jan, so if you're measuring by outstanding, that's a big move and should be accompanied by a big increase in (counterfactual) yield. I don't think we think that's happened. On the other hand if we bought up the whole stock, sure, the yield would fall a lot… So hard to know what's 'correct'. Actually both are probably wrong, since, as said, there is no good theory telling you what is 'right'. I think at least.

From:
Sent: Thursday, 20 August 2020 11:22 AM
To:
Subject: RE: Flatter yield curve [SEC=OFFICIAL]

Interesting – thanks That's cheaper than I had thought.

My thinking is that the change in yield should be related to the share of govt debt purchased, rather than the share of GDP. So, we might have to do less work than others for the same yield change. Am I missing something?

But I agree that defending an explicit long-end yield target might be hard, and moreover I don't think that there is much point in doing so in an Australian context (given we would not be counting on a long-end target to flow through the bank channels, as we were for the 3-year target).

To the extent that there are benefits to flattening, I think that buying all over the curve (and giving a quantity target) makes more sense.

D

From:
Sent: Thursday, 20 August 2020 11:10 AM
To:
Subject: RE: Flatter yield curve [SEC=OFFICIAL]

Agree, we can probably push the long end a bit lower, but might be hard (or rather, expensive) to set and defend an explicit yield target that far out (idea being that long end term premia are largely set in global markets, rather than domestically – also why we benefit from other's QE without having to do it ourselves necessarily).

I had a look at what the literature said about $ purchases vs change in yield – see D20/237591. My summary was that 1% of GDP purchases = 5 bps, give or take about 5 bps. So it's pretty balance sheet intensive, and also uncertain what you'll get… (and if you're pushing prices below the market, you're almost by definition paying 'too much' and so likely perhaps to suffer a big capital loss later on. Especially if it works in a macro sense – then yields should rise and you lose a truck load of cash. Not that profit is the objective, but maybe avoiding big losses is one objective…?)

From:
Sent: Wednesday, 19 August 2020 5:43 PM

To:
Subject: RE: Flatter yield curve [SEC=OFFICIAL]

Hi – thanks very much for your thoughts. I meant to send this on to you earlier but got caught chatting through the issues with others (including you).

FYI see Phil's email attached.

He was also interested in our ability to achieve a flatter curve. Keen to hear if you have strong thoughts on that front. My (fairly naïve) take is that there is nothing special about the Australian market that would mean we couldn't flatten the curve as other countries have done, provided that we took on a similarly large balance sheet.

I'll put together a quick response tomorrow morning (I have to run off shortly) – is it OK if I run it past you before it goes to Phil?

Cheers,

From:
Sent: Wednesday, 19 August 2020 4:59 PM
To:
Subject: RE: Flatter yield curve [SEC=OFFICIAL]

Balance is always good I think! (But maybe only because I think the costs outweigh the benefits…!)

From:
Sent: Wednesday, 19 August 2020 4:58 PM
To:
Subject: RE: Flatter yield curve [SEC=OFFICIAL]

Thanks – did Phil say he wanted cost/benefit ? You could include that anyway I suppose!

From:
Sent: Wednesday, 19 August 2020 4:56 PM

To:
Subject: RE: Flatter yield curve [SEC=OFFICIAL]

Some ideas in red below. Given it's going to the top, I'd also run by Marion to give her a chance to comment as she may have strong views. Cheers.

From:
Sent: Wednesday, 19 August 2020 4:41 PM
To:
Subject: Flatter yield curve [SEC=OFFICIAL]

Phil emails after the pre PDG to ask what the benefits of a flatter yield curve are (not sure he asked for the costs)

Some first order responses are;

- Depreciate the exchange rate – there is a high non-resident share of AGS; these investors are very risk averse and would not deploy to riskier $A assets, instead sell their AGS holdings and the $A
- Reinforce the forward guidance commitment – keeping rates low for long without being specific about how long, instead acting in the market to keep longer-term rates (out to 10-yrs for e.g.) low
- Reduce the total amount of duration in the market – the central bank buys the long duration bonds and removes them from the market, thus allowing investors to buy other duration assets such a riskier assets, driving down their yields (i.e. the portfolio rebalance channel)
- Cheaper government financing, flowing through to other long-tenor issuers (including the states and some corporates)

Balancing these are some costs:

- An explicit policy to target longer tenors or flatten the yield curve may be time-inconsistent if we don't expect to hold policy rates low for a very long time
- Related to this, achieving a sizeable flattening may necessitate a significant expansion of the balance sheet, and result in large losses if the policy stimulus is successful and interest rates eventually rise
- The most important tenor for FX, bank issuance, corporate borrowing, etc., is towards the shorter end (<5y), and so the extra stimulus delivered may be relatively modest

Do you know of other ones?

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From:
Sent: Thursday, 20 August 2020 4:52 PM
To: LOWE, Phil
Cc: KENT, Christopher KOHLER, Marion

Subject: RE: A question [SEC=OFFICIAL]

Hi Phil,

Thanks for your question – it set off some interesting discussion in the dealing room.

My own view is that a flatter curve is achievable but I am sceptical about how helpful it would be. Overall, I think the case is not decisive either way, and there is a lot uncertainty about the potential outcomes.

Below is what I might have put forward if it had come up for discussion yesterday. Please let us know if further thinking on this would be useful.

Best,

We could flatten the curve at a relatively low cost

- Bond purchases would increase the size of our balance sheet substantially, exposing us to losses (if we are successful in stimulating demand and inflation). But the increase required in Australia might be smaller than in other countries, as enhanced guidance could do more of the work for us, given our high credibility. Our relatively low stock of government debt might also reduce the amount of purchases required.

- Market functioning might be impaired if we end up holding a large share of government debt. But we could mitigate this, for example by increasing the CLF or using interest rate swaps in addition to bond purchases (as the RBNZ has floated).

- Bank profitability could be diminished a little, as a flatter curve may result in narrower NIMs. But much of this should be offset over time by improvements in loan quality (if we are successful).

But the benefits also seem low, particularly while tight COVID restrictions remain in place

- *Some depreciation of the exchange rate*. Part of this would be due to bond sales from risk-averse offshore investors, which would likely sell $A rather than reinvest in riskier $A assets. But the exchange rate channel seems less effective than usual while COVID is restricting education, tourism and other exports.

- *Some portfolio rebalancing*. The benefits of higher asset prices from rebalancing may also be blunted while COVID restricts consumption and investment options. I also worry a bit about inflating asset prices while economic growth is slow.

- *Little to no impact on government financing*. I doubt that a flatter curve would increase government issuance, for the reasons I presented yesterday. The marginal decrease in government interest costs seems very small.

- *Little to no impact on borrowing rates*. Unlike our 3-year target, I would not expect a flatter curve to do much work through the bank channels. Our banks' funding costs have little exposure to the long end, and diminished profitability might mute pass-through anyway. There may be some benefit for the few large businesses that can issue at long terms in our corporate bond market.

Out past 3 years, a quantity target may be preferable to a yield target

- A quantity target could have lower costs as defending a long-end yield target may require very large bond purchases, to counteract changes in global conditions.

- A quantity target seems more clearly tied to the potential benefits of a flatter curve, in particular for the portfolio rebalancing channel. This might make it easier to communicate.

From: LOWE, Phil
Sent: Wednesday, 19 August 2020 3:23 PM
To:
Cc: KENT, Christopher KOHLER, Marion
Subject: A question [SEC=OFFICIAL]

Hi

I thought your presentation was very good.
You said that you didn't want to open up the can of works on the case for a flatter AUD curve.
I was wondering what you thought about that case and our ability to achieve it?
Thanks
Phil

Philip Lowe | Governor
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THE EFFECT OF QE: THEORY AND EVIDENCE

We might expect a $100 billion QE program to lower government bond yields by around 30 basis points, and the exchange rate by 1-1½ per cent, although the error bands on both are wide. This would support activity at the margin, although may result in a capital loss to the Bank given negative estimated term premia on Australian Government bonds.

How QE affects bond yields: theory

- Signalling: QE underlines the commitment of the central bank to hold policy rates lower for longer (most relevant when the market is underestimating how stimulatory the central bank intends to be).
- Portfolio rebalance: buying bonds bids up their price and reduces term premia; bond sellers recycle funds into riskier or non-AUD assets, relaxing financial conditions, depreciating the exchange rate and promoting a wealth effect; bank deposits are created.
- Liquidity premia: central bank buying reduces the risk of dealers/investors being 'stuck' with bonds, and so reduces liquidity premia (most relevant during a period of market dysfunction).
- Government bond yields also represent the risk free rate in the economy, and so changes resulting from the above channels are likely to transmit to other interest rates and asset prices.[1]

How QE affects bond yields: evidence

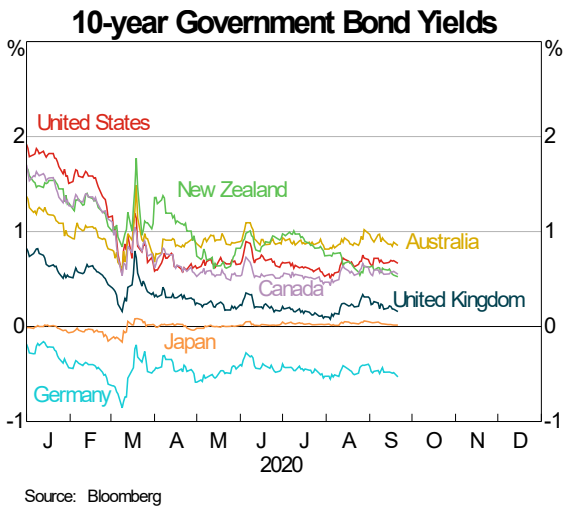
- The literature on the effect of QE on yields (based on the international experience) suggests that bond buying equivalent to 1 per cent of GDP reduces yields by around 5-7 basis points on average, although the range of estimates is wide.[2]
    - Event studies tend to find bigger effects than econometric time series studies, perhaps because the initial effect of QE can be relatively large but unwinds over time.
    - Later QE programs tended to have less effect, perhaps because they were expected by markets already, because bond yields were already low by that stage, or because QE is most effective in the midst of a crisis when liquidity premia are high.
    - The effects of QE are likely to be non-linear, and may accelerate if the remaining free-float of bonds is reduced to such an extent as to impair market function.
- 1 per cent of Australian nominal GDP is around $20 billion, so we might expect a $100 billion QE program to reduce yields by roughly 30 basis points, albeit the error bands are wide:
    - we would expect this to occur via lower term premia;
    - forward guidance and the three year yield target are already having a powerful signalling effect, and if anything a QE program might be expected to raise the expected future cash rate path by bringing forward the day when the Bank's inflation and employment goals are reached;
    - liquidity premia are already low;
    - we would expect longer-term yields to fall by more than short-term yields: short-term yields are already below 30 basis points, and are better controlled using our interest rate targets; in line with this, any QE program may be best targeted at the 4 to 10 year part of the curve. But it should not exclude longer maturities if the slope of the curve suggests that purchases there would be more advantageous (i.e. remove more duration).

1 Some studies find that during periods of market stress (but not otherwise), QE leads to risky bond yields falling by *more* than government yields, leading to a compression in credit spreads.

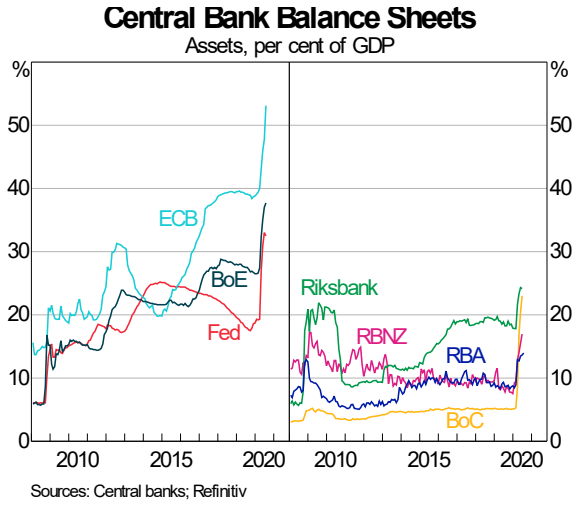
2 See e.g. here and here for review papers. Note that most papers scale bond purchases by nominal GDP (rather than by bonds outstanding, for example), including papers studying countries with relatively small government bond markets such as Sweden. Our own limited experience supports this: purchases equivalent to around 20 per cent of the Apr-23 and Apr-24 bond lines over August and early September were associated with a fall in yields for these bonds of only 3 to 4 basis points. Similarly, bond issuance by the AOFM since end 2019 has expanded the size of the government bond market by roughly 40 per cent, but we have not seen yields move significantly higher in response as might have been expected if bond market size is the relevant metric for assessing quantity changes.

- Experience with our 3-year yield target over August and early September suggests a slightly smaller effect: even with the help of an explicit yield target it took $12 billion of purchases (equivalent to around 0.6 per cent of GDP) concentrated in the 3-year part of the curve to reduce the 3-year yield from 0.28 per cent to 0.25 per cent; our purchases did not appear to have affected longer-term yields.
- (AOFM bond tender data suggests a much larger impact – of 2 basis points per $1 billion – but this is likely to be overstated as it assumes that the tail of a bond auction gives an accurate representation of overall bond demand; individual bond tenders are also small in size relative to a QE program.)
- For reference, Australian 10-year yields are little changed since the start of March, as are German and Japanese yields, while UK 10-year yields are around 25 basis points lower and US, Canadian and New Zealand 10-year yields are around 50 basis points lower (Graph 1). All countries bar Australia have QE-style programs in operation and have significantly expanded their balance sheets since March, although the change in yield seen is not closely related to the size of the expansion (Graph 2). A $100 billion QE program would put the total expansion in our balance sheet as a share of GDP since the start of March (indicated with a light-brown dot on the right-hand panel of Graph 2) at a similar size to that of the RBNZ, but less than the other central banks.

Graph 1



Graph 2



Transmission to the exchange rate (and the economy)

- Estimates suggest that lowering the 10-year yield by 30 basis points could result in a ¾ per cent depreciation of the exchange rate in the short-term (RTWI model), or a ½ to 1¼ per cent depreciation (event studies), although there is a high degree of uncertainty around these estimates. International evidence suggests that the medium-term depreciation could be larger.
- Our models suggest that a similar fall in yields at the short end of the yield curve, around the 2-year mark, would result in a larger depreciation: 1½ per cent (RTWI model) or ¾ to 1½ per cent (event studies), although as noted a QE program is likely to affect longer-term yields more than short-term yields.[3]
- International evidence typically suggests that the exchange rate effect of an expansionary QE shock is similar to that of a conventional monetary policy shock: the exchange rate depreciates, and this is typically found to be quite persistent. However, there are a wide range of results and there does not appear to be a clear consensus around the magnitude of the effect compared with conventional monetary policy (the error bands are wide, and one can find studies pointing in both directions).[4]

3 Note that in the real TWI model the 2-year and 10-year effects described above are not additive or independent, while in the event studies the effect of changes in longer tenors can thought as an 'additional' effect after accounting for the shared change with the 2-year yield, as described in D20/267190.

4 E.g. Neely (2011) finds that QE has a *smaller* effect than would be expected by a similar yield change caused by conventional policy, while Glick and Leduc (2018) find the opposite. See also D16/284516 for a literature review: "[the impact of QE is] not materially different than what would be expected from an equivalent change in conventional policy".

- The transmission of changes in the exchange rate to the real economy is less clear in the current environment. In particular, service exports are currently constrained by travel restrictions. They represent a large share of Australia's exports and are typically considered quite sensitive to changes in the exchange rate. As a result, the stimulatory benefit from a depreciation in exchange rate, while positive, may be less than usual.

Transmission to other asset prices and to the banking sector (and the economy)

- We would expect QE to boost other asset prices – both by reducing the discount rate and as investors who sold bonds recycle the proceeds into other assets – and so contribute to wealth effects.
- Australian governments tend to fund themselves at longer tenors, and so their costs of funding are lowered by purchases of longer-term bonds.[5] Most private-sector borrowing in Australia occurs at the short end of the yield curve and so the direct effect of lower long-term yields on borrowing and investing is likely to be relatively muted (albeit lower long-term interest rates may encourage borrowers to shift towards issuing longer-term debt, or taking fixed rate mortgages).
- In particular, the effect on bank funding costs are likely to be in the order of a few basis points only.
    - Banks predominantly fund themselves at the shorter end of the yield curve where our 3-year yield target is already keeping yields contained, and longer-term fixed rate borrowing is typically swapped back to floating (so that the spread between bank bond yields and the swap rate is what drives funding costs, not the level of longer-term yields per se).
    - Deposit rates might decline as the Bank's bond purchases increased the supply of deposits in the banking system (through bond purchases ultimately from the non-bank sector). In addition, long-term deposit rates might decline alongside a decline in swap rates (but these deposits account for a very small share of banks' overall funding). On the other hand, one-for-one pass-through to deposit rates is unlikely: the major banks are estimated to be paying low interest rates (between zero and 25 basis points) on a little over one-third of their deposit funding, and this share increases as deposit rates decline.
    - Pass-through to lending rates will depend on the effect of the low interest rate environment on banks' net interest margins (NIMs) and profits. The Bank's recent package of policy measures has worked to lower lending rates throughout the economy; in other words, this channel of the monetary policy transmission mechanism has remained effective. But the low interest rate environment has contributed to a decline in banks' NIMs, and banks may be reluctant to pass further reductions in funding costs through to lending rates in full.

Potential costs

- Estimates of term premia for Australia are currently negative in the order of -50 to -100 basis points; that is, bond yields are lower than estimates of expected future short-term rates.[6,7] A QE program would be expected to push term premia lower still, and might result in a capital loss for the Bank if the yields that bonds are purchased at do turn out to be lower than average future short-term rates.

FMG, 24 September 2020

5 Although if you consolidate the RBA balance sheet into that of the general government, this is less obviously the case: bond purchases have the effect of converting a long tenor fixed rate liability (the bond) into a floating rate liability (the Exchange Settlement balances created when the bond is purchased), the ultimate cost of which will depend on future short-term rates and will be transmitted back to the government via changes in the RBA dividend.

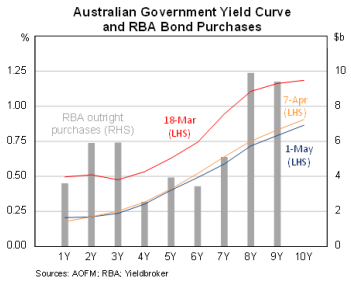
6 Negative term premia estimates are quite common for advanced economy government bond markets. While one would typically expect to be rewarded for buying a long-term bond and taking on interest rate risk, negative term premia can be justified from an economic perspective: to the extent that bond prices rise in bad states of the world, owning government bonds provides a form of 'insurance' which pays off when other asset prices are falling, and negative term premia are akin to an insurance premium.

7 Note that we cannot use OIS rates as estimates of expected future short-term rates, since OIS also contain term premia: similar to bonds, OIS contracts provide some 'insurance' to the extent that they rally in bad states of the world, and this benefit is reflected in the OIS rate. Rather, expected future short-term rates, and term premia, must be estimated in a model.

INDICATORS TO MONITOR THE EFFECTS (AND SIDE EFFECTS) OF THE RBA'S BOND PURCHASES – IDEAS TO PRIORITISE

Indicator Ideas

Initial effects on Australian financial markets

Effect	Question and indicator(s)	Available off the shelf	What else we could show	Priority and difficulty
Reductions in Australian government bond yields	*Are we seeing 'local supply' effects?* Intraday yields on bonds purchased	Intraday 3-year AGS yields Table of pre- and post-announcement yields	Intraday yields for all bonds purchased on a given day	Low; easy (once we have intraday semis yields set up properly in Findur – Michelle is on the case)
	Are we seeing broader effects? Yield curve changes for AGS and semis	Yield curve changes for AGS (not fully automated)	Automate AGS yield curves Semis yields curves	High; easy for AGS but harder for semis (same work as for the question below)
	Are we bringing down yields on semis in line with AGS? AGS–semis spreads	5-year spreads by state 3/5/10-year NSW spreads via what we publish in F2	Semis spreads to AGS across the curve	High; hard
	What is the relationship between these reductions and the maturity profile of our purchases? Yields curve changes vs purchases by maturity, perhaps as a share of stock outstanding	An unautomated graph: 	Automated graphs for AGS and semis, using purchases as a share of outstanding stock from the post-auction spreadsheet For outstandings, use Findur data for AGS and Austraclear data for semis	Medium; medium
Reductions in other key rates	*Are we bringing down AUD swap rates?* AGS–swaps spreads	3/10-year swap spreads to AGS (not clear where the spreadsheet for this lives)	Swap spreads to AGS across the curve	High; easy

	Semis – swap spreads			
Taking duration risk out of the market	***Stock:*** *How much duration have we taken out of the AGS and semis markets?* Total duration risk	None	Duration risk held by the market vs counterfactual risk held by the market absent any purchases by the RBA	Medium; medium–high
	Flow: *Are we taking out more duration than the AOFM and the CBAs are introducing via issuance?* Duration risk added and subtracted, week by week	None	Duration risk for bonds issued and purchased	Medium; medium–high
Downward pressure on AUD	*Are our key international interest rate differentials narrowing?* Spreads between AGS yields and government bond yields internationally	10-year AGS–UST spread Hedged and unhedged yield pick-up of AGS and semis vs other major gvt bond yields, accounting for funding costs	Spreads to yields in other major markets, and also spreads across the curve	Medium; medium
	Are non-residents exiting AGS and semis markets? Non-resident holdings	Non-resident holdings as a share of total stock outstanding of AGS and semis	Alternative, potentially finer-grained data on stocks and flows for non-residents from foreign govts and the AOFM	Low; not sure

Potential initial side effects and costs

Potential side effect	Question and indicator(s)	Available off the shelf	What we could show	Priority and time estimate
Bond market liquidity	*Are bond dealers having trouble sourcing particular AGS and semis lines in the market?*	analysis	The relationship between our holdings and RBA/AOFM stock lending activity	Low; not sure

	Stock lending activity by the RBA and the AOFM			
	Repo market specialness	No, would have to manually monitor on broker screens	Hard given limited repo data availability, especially by line	Medium; hard to automate,
Bond market liquidity (cont.)	*Is there any evidence of market inefficiency?* All of the indicators shown in the Bulletin article on market dysfunction remain relevant: • Bid–ask spreads • YC fitting errors • Bond–futures basis	General indicators from the Bulletin article	Specific indicators related to the bond lines where we are holding a substantial share of the stock outstanding	Medium; not sure
Interest rate risk on the RBA's balance sheet	*What losses will we face if it becomes necessary to increase interest rates?* Rate sensitivity of our bonds	RM's graph in the RBA annual report	Something similar but for a shorter time range	Very low; none if we undertake the work on duration risk that we are taking out of the market

Auction proposals

Potential proposal input	Question and indicator(s)	Available off the shelf	What we could show	Priority and time estimate
Distribution of previous RBA bond purchases	*What purchase parameters (i.e. size, maturity range and yield cut-offs) should we select to maximise the effects of our purchases without market distortion?* Purchases as a share of stock outstanding	As a share of each bond line for AGS and semis	As a share of specified maturity ranges, by Cth and state/territory	Medium; little extra work if we undertake the work on the maturity profile of our purchases

	Concentration: Share of RBA purchases by line			
	Have our semis purchases been 'evenly' distributed relative to various metrics? Semis purchases as a share of state and territory metrics	None	Changes in semis spreads vs the RBA's semis purchases as a share of stock outstanding and issuance by state	Low; medium
Auction efficiency/'fairness'	*Is there any evidence of market manipulation ahead of our auctions?* Abnormal yield movements in the lead up to our auctions Fitting errors for eligible bonds	Not exactly, though the MLES model update for the auction proposal has much of what we need	A pre-auction summary of eligible bond lines that have behaved strangely, to inform our in-auction decisions Curve showing yield changes by bond line from previous day's close or over past week	High; easy–medium
	Are there any counterparties that are disproportionately successful in our auctions? Distribution of our purchases by counterparty Are there any CPs consistently offering (not necessarily being filled for) large parcels across or in a specific line?	None, to my knowledge Can just use YB output and create some summary table	Purchases (and perhaps bids) by bond line by counterparty	Medium; easy

THE EFFECT OF QE: POSSIBLE SIZE AND LENGTH OF A QE ROGRAM

We might expect a $100 billion QE program to lower government bond yields by around 30 basis points. Such a program could be implemented over 6 months (but reviewed before six months expire).

For a review of estimates of the effect of a QE program on yields and the exchange rate, *see* *D20/261595*

Size and time horizon

- Which **part of the curve**: 4-10 years, but also longer. We should not be too prescriptive, but be prepared to react to market conditions. If purchases at the ultra-long end remove more duration for a similar purchase amount, this may be more effective every now and then.
- **Size more important than over what horizon**. There is a flow-versus-stock debate in terms of what matters more for yields, with the consensus being that it's the stock that counts. In other words, the time horizon of the program (and how much is front loaded, etc) is less important than the projected cumulative amount. Pace could always be varied a little based on market conditions. And there'd be no need to wait for 6 months to expire before reconsidering the size of the program.
- **Size**: Overall size should be calibrated on desired yield outcome, without affecting market functioning. As there is an RBA bond lending program in place, market disruption is unlikely to be an issue.
    - From a market functioning perspective, a purchase program could purchase at least the amount issued by the AOFM. Since early April, the AOFM has issued net around $225bn. Semis have issued net around $60bn in the same six month period.
    - AGS (Treasury bonds) currently outstanding is $700 bn (face value). Semis outstanding is $330bn.

    Since March, we have purchased around $50 bn AGS since March and $12 bn in semis, or about 3% of annual GDP.

    - Other central banks' recent asset purchase programs amounted to 6-10% of GDP since March. Note that the programs have included purchases for market functioning (we purchased between March and May around $40bn AGS or 2 per cent of GDP, much of this for market functioning). Based just on the current monthly purchase pace, purchases over 6 months would amount to more like 2-10% of GDP (as noted above, however, the overall program size is more important than the monthly purchase for yield outcomes).

Table 1: Sovereign Bond Purchases

	Start date	End date	Purchase target		Purchases since March		Purchases since end April		Current monthly purchase pace	
			Nominal	% of GDP	Nominal	% of GDP	Nominal	% of GDP	Nominal	% of GDP
Fed	March 2020	Open-ended	Unlimited	-	$1,929bn	9.9	$411bn	2.1	$80bn	0.4
ECB	March 2020	June 2021	€1,176bn[(a)(b)]	10.0	€649bn[(b)]	6.2	€490bn[(b)]	4.7	€66bn	0.6
BoE	March 2020	End 2020	£290bn	13.2	£235bn	12.6	£154bn	8.3	£19bn	1.0
RBNZ	March 2020	June 2022	NZ $100bn[(b)]	30.6	NZ $34bn[(b)]	11.6	NZ $26bn[(b)]	8.8	NZ $5bn	1.7

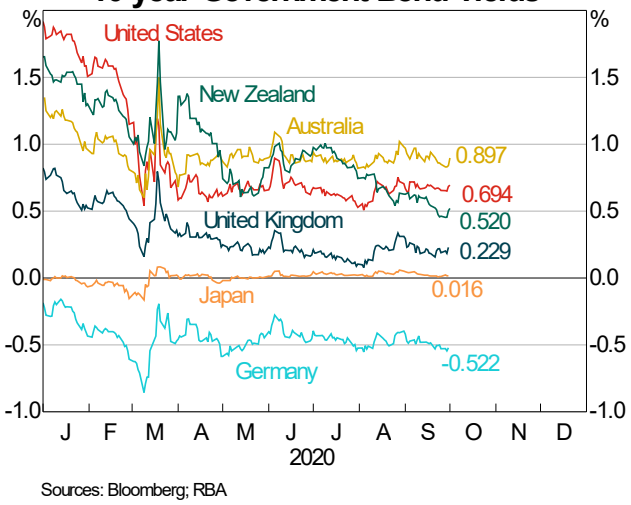
- (a) The total size of the PEPP (€1,350bn) includes government bonds and private sector assets. The estimated purchase target for government bonds is based on the current composition of asset holdings.
- (b) Includes local and semi-government bonds.

    - In Australia, A$100bn would amount to 5 per cent of GDP, which is at the lower range of international purchase programs, although the TFF at 10% of GDP is sizeable. Graph 2 below

gives an "all in" balance sheet comparison; here, the difference between the RBA and RBNZ program, for example, seems to be closer to around 5 per cent of GDP over the past year.

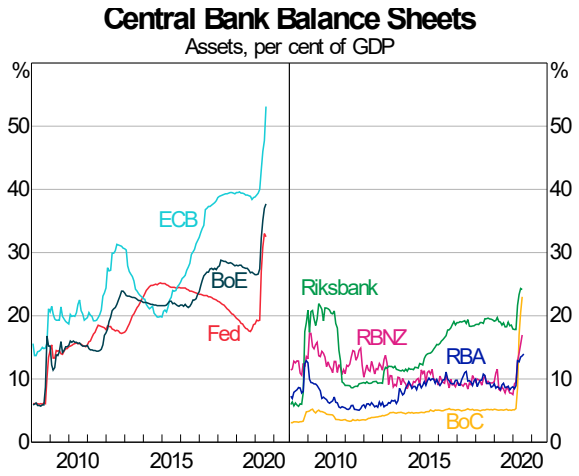
- 10-year AGS yields have in recent months been around 20-30 basis points above USTs. A 30 bp decline in this yield would bring AGS yields in line with USTs (all else equal), but still significantly above other major currencies.

Graph 1



Sources: Bloomberg; RBA

Graph 2



Sources: Central banks; Refinitiv

- Over which **horizon?** As discussed above, the overall quantity appears more important than the flow in determining the yield effect. One consideration for the time horizon is how much AGS could be purchased in a relatively short time without affecting market functioning. The most recent period is more relevant given the increase in issuance, although behaviour of foreign investors matters a lot and that behaviour could change quickly.
    - The RBA purchased around $50bn of AGS since March with little sign of market issues. Most of this was purchased during a period of market dysfunction (and served to alleviate this).
    - The TFF (with a total size of around $200bn) has extended $83 bn over the past 6 months. ADIs holdings of AGS increased by $30[1] bn (and holdings of semis increased by a similar amount bn) over that period; not all of this is may have been funded by the TFF, given deposit inflows. But funding is fungible.
    - Assuming similar AOFM issuance over 6 months ($200bn), absorption of perhaps $50 bn AGS by ADIs via use of funding from the TFF (40 per cent of 120 bn), yields a net increase for other buyers of 150 bn (at a minimum) absent any purchases by the Bank. ADI absorption of AGS may also be higher if the CLF changes (but not necessarily).
    - As described above, other central banks implemented similar sized or larger programmes over six months. However, the starting points/depth of their debt markets were very different.

FMG, 1 October 2020

1 Figures rounded throughout this section, since some are face value, and some are cash value.

THE EFFECT OF LOWER RATES ALONG THE CURVE

The Minutes of the September Board meeting noted that a lower exchange rate would provide further support to the economic recovery. When the value of the exchange rate is broadly in line with fundamentals, as is presently the case, direct intervention is unlikely to be effective. However, further policy options that lower the yield curve, and interest rate differentials, would put downward pressure on the Australian dollar. This note presents estimates from a range of models to assess how a depreciation in the exchange rate resulting from a lower yield curve could transmit through the economy. Though subject to uncertainty, our estimates suggest that a further lowering of short-term rates and a substantial flattening in the yield curve would have helpful but modest effects on activity, unemployment and inflation.

Yield curve policy and the exchange rate

A number of policies are available to alter the yield curve (over and above changing the overnight cash rate), including asset purchases and yield curve targeting. For the purposes of our simulations below, we consider the exchange rate effects from lowering the yield curve in addition to other interest rate effects. However, we abstract from the method chosen to lower interest rates (that is, we do not distinguish the pure price, or interest rate channel, from the quantitative, or portfolio balance, channel). Our focus is mainly on the macroeconomic effects of exchange rate depreciation, as the assumed decline in the cash rate is small (it declines from 13 basis points to 10 basis points in two of the scenarios, and is unchanged in another) and our models capture the effects of changes to longer-term yields largely through the exchange rate.

To do this, we use ID's suite of models to estimate the likely exchange rate responses to various interest rate scenarios, and then assess the economic effects accordingly. Taking the baseline yield curve as of the September Board meeting (to abstract from recent changes in expectations), the sensitivity of exchange rate responses and macroeconomic outcomes is considered via three illustrative interest rate policy options:

- Option A: The 10-year rate is lowered to 0.5 per cent while the short-end of the curve is unchanged
- Option B: The 10-year rate is lowered to 0.25 per cent and the short-end is lowered to 0.1 per cent
- Option C: The entire yield curve is lowered by approximately 15 basis points

Estimating the exchange rate effect

We use two models to estimate a range for the exchange rate effect corresponding to options A, B and C. The first model is the 'forward-looking' real TWI model (see Chapman, Jaaskela and Smith 2018). This error correction model makes use of the entire maturity spectrum from 3-month to 10-years.[1] Therefore, this model allows us to test the effect of changing interest rates of different maturities. The model parameters are estimated using yield curve data up to the September Board meeting. The parameters from the baseline model are combined with the inputs of each option to estimate the 'equilibrium' value of the exchange rate and determine the associated depreciation.

In addition to the real TWI model, we estimate a model based on an event study of RBA Board announcements (see 2020).[2] The model complements the existing real TWI ECM by providing an estimate of the exchange rate effect from monetary policy announcements and subsequent changes in the yields of different maturities.[3]

These two models are used to estimate a range of exchange rate responses, which are depicted in the shaded area of Graph 2. Option A, where only the long end of the curve declines, is expected to induce a depreciation of 0.6–0.9 per cent over the forecast horizon. Option B, which involves the most aggressive yield curve easing strategy (particularly at the long end), is expected to result in a depreciation of between 0.9 per cent and 1.9

1 Specifically, the variables included in the long-term cointegrating relationship are the 8-quarter ahead BAT terms of trade forecast, and three yield curve factors: level, slope and curvature. The yield curve factors are estimated from real interest rate differentials across the maturity spectrum of Australia less the G3. The G3 include the United States, Japan and Germany, weighted by share of GDP.

2 This model uses an event study of RBA Board announcements to estimate the AUD/USD effect over the Sydney trading day of changes in the 2-year AGS yield and the slope (changes in the 10-year AGS yield orthogonal to movements in 2-year AGS yield).

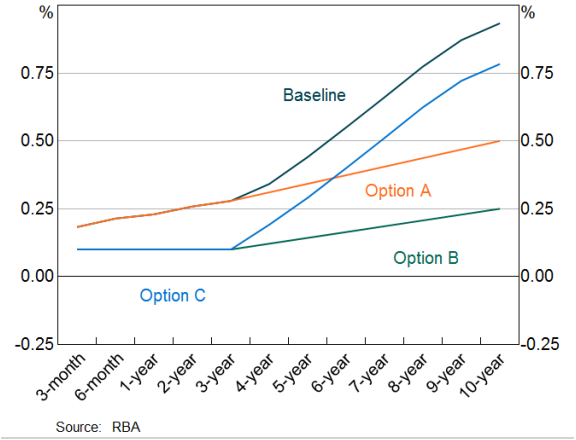
3 Monetary policy shocks can also occur on other days, but identifying all these events is beyond the scope of the work in 2020. While the ECM estimates the effect of permanent shocks to the yield curve factors in the cointegrating term, the event study focuses on RBA board announcements to identify exogenous shocks to monetary policy and limit omitted variable bias.

per cent. Note that the reduction in long-term yields in this scenario accounts for around three quarters of the estimated depreciation; while short-term rates have a larger effect on the exchange rate, the presence of the effective lower bound means long-term yields account for more of the depreciation. Option C, a small parallel shift in the yield curve, is estimated to reduce the exchange rate by around 0.7 per cent.

We consider these range of estimates to represent lower bounds. BIS estimates using Australian data suggest that each of these scenarios could result in larger exchange rate depreciations than shown below.[4] Moreover, the exchange rate effect has increased over time as interest rates have declined, and is now larger than the average effect estimated over the last twenty years.

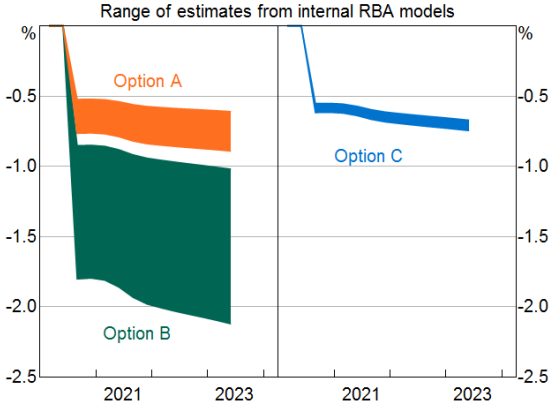
The empirical international literature does not clearly separate how the interest rate and portfolio balance effects on the exchange rate differ. The latter could be quite material in Australia's case given the relatively high foreign ownership of Australian government securities (although this share has moderated in recent years). All else equal, a larger portfolio balance effect could induce a larger than usual exchange rate depreciation and hence larger macroeconomic effects than shown below.

Graph 1
AGS Curve



Source: RBA

Graph 2
Effect of AGS Curve Policy on Exchange Rate
Range of estimates from internal RBA models



Source: RBA

Exchange rate depreciation and the economy

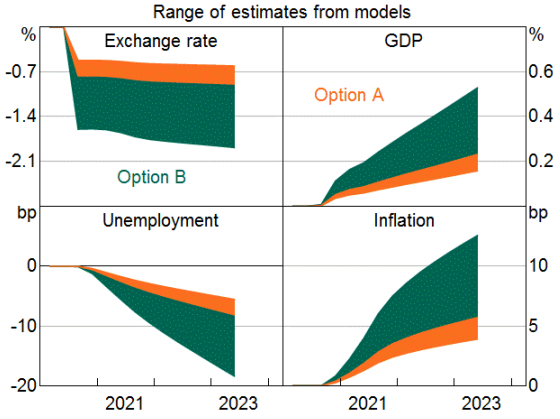
To consider how different interest rate policies and exchange rate responses transmit through to key economic variables, we turn to the MARTIN macroeconomic model. In MARTIN, an exchange rate depreciation reduces the price of Australian-produced goods and services relative to goods and services produced overseas. In the below estimates, we have not placed any restrictions on the usual relationships between the exchange rate and exports. The substitution towards Australian goods as a result of the exchange rate depreciation leads to increased domestic investment and consumption and this expansion in economic activity flows through to the labour market. Higher wages growth as a result of the tighter labour market and an increase in the price of imported goods and services raises firm's costs and leads to higher inflation. Recent work has found that constraining exports and imports to account for international border closures only reduces the stimulatory effect on activity by around 15 per cent (Gaffney 2020 forthcoming).

The summary results are as follows:

- Options A and C increase the level of GDP by around 0.2 per cent, reduce the unemployment rate by a bit under 10 basis points and increase inflation by around 5 basis points.
- Option B increases the level of GDP by 0.3–0.5 per cent over the forecast horizon. The unemployment rate declines by close to 10 to 20 basis points and inflation increases by around 10 basis points.

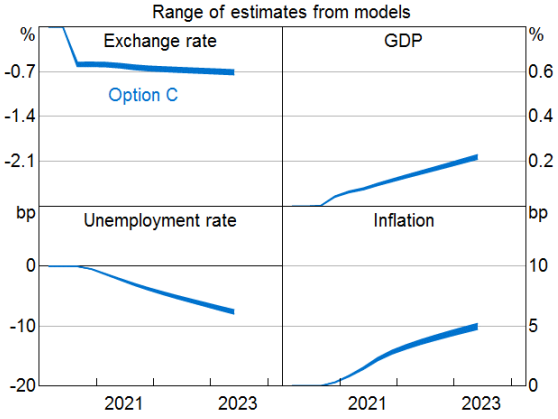
4 See Ferrari, Kearns and Schrimpf (2017).

Graph 3
Effect of AGS Curve Policy on Economic Indicators
Range of estimates from models



Source: RBA

Graph 4
Effect of AGS Curve Policy on Economic Indicators
Range of estimates from models



Source: RBA

Discussion

A lower yield curve should result in a modest but helpful depreciation in the exchange rate. There are a number of policies that could be put in place to deliver the desired change in yields and would generate downward pressure on the exchange rate. The range of estimates shown are based on historical data. External research and more recent observations suggest a lower yield curve could bring about a larger depreciation than assumed above. It is also possible that the expansionary effect of the exchange rate channel is not as strong as previously estimated in an environment where international borders are closed.

Lowering rates along the yield curve would also reduce government financing costs (although this may not be a binding constraint on expenditure currently and is not explicitly modelled in MARTIN).

Overall, these findings suggest that a policy that lowers interest rates across the yield curve can improve economic outcomes to a modest degree. Given the presence of the effective lower bound for short-term rates, policies that also lower long-term rates are likely to bring about greater exchange rate depreciations.

Market Analysis and Macroeconomic Modelling
12 October 2020

From:
Sent: Tuesday, 27 October 2020 2:59 PM
To: ID Market Analysis
Subject: FW: ID Chatter: Recent Literature on Quantitative Easing and the Exchange Rate [SEC=OFFICIAL]

From:
Sent: Tuesday, 27 October 2020 14:03 PM
To:

Cc: A

Subject: RE: ID Chatter: Recent Literature on Quantitative Easing and the Exchange Rate [SEC=OFFICIAL]

Argument 1 is quite appealing in its simplicity, but I think we have some evidence that something 'more' is happening at the moment from I work and the recent 'event study'. The question is whether there is anything we can do to identify why the yield curve multiplier might be larger at the moment? How well does the idea that the multiplier has increased because QE operates through additional channels (Argument 3) stack up? As you say in Argument 1, QE elsewhere doesn't seem to have affected the model's ability to track the exchange rate. Or can we line the change in the multiplier up with the ramping up of QE elsewhere, even if the size of the change isn't big enough to render the model useless at tracking actual outcomes within usual tolerances? What other factors could explain periods of increased sensitivity?

From:
Sent: Tuesday, 27 October 2020 1:38 PM
To:

Cc:

Subject: RE: ID Chatter: Recent Literature on Quantitative Easing and the Exchange Rate [SEC=OFFICIAL]

Some musings on unconventional policies (QE vs YCC; portfolio balance vs signalling channels) and the exchange rate ahead of PDG in the context of the RTWI model (and following Chris's pre-PDG question) – what the model sees, has or has not seen and how that might be reflected in its coefficients and tracking errors:

- Argument 1 – the model sees it all.
    - QE works through two channels, the signalling/fwd guidance & portfolio balance channels. The model captures the effects of unconventional policies through movements in the relative government yields across the curves. It is unclear how much of an effect the portfolio balance channel has on the exchange rate beyond its effect on the long-term interest rates. If the effect is small, it does not matter for the exchange rate which channel dominates or whether they are separately identified. To some extent this argument is supported by the observation that the model has been tracking the exchange rate movements well during the periods of large QE operations by the ECB and Fed when yield-seeking' and 'diversification' flows pushed up the Australian dollar. Moreover, the model tracks the exchange rate better when the information content of the entire yield curve is utilised (instead of a 'simple' yield differential).

- Argument 2 – the model sees and has seen almost all of 'it' but may underestimate the impact of some unconventional policies.

- It is reasonable to argue that the estimated 'historical average' coefficients [associated with the yield curves] may underestimate the importance of QE episodes. Put differently, periodically the yield curve multiplier might be bigger than estimated and we may well be going through one of those episodes as we speak. This underestimation may stem from the fact that the model is too crude as it does not distinguishing between the fwd guidance channel (that operates through risk-free short term rates) and the portfolio rebalancing channel (that works through term premia) and as such the model downplays the importance of changes in the yield curves during the unconventional policy episodes.
- On the one hand, the rebalancing effect might be strongest as pool of risk free assets is reduced and investors are forced to rebalance into riskier/higher yielding assets (including non-Australian assets that create the FX effect). In the case of credible YCC, however, which largely works through the signalling channel, we're 'hoping' that investors will rebalance their portfolios, and chase higher yields in different markets (either domestically or internationally). This may suggest a smaller (or more uncertain) FX impact. But it's not clear that the size of this effect is substantially different between the two approaches. Typically, the short-term end of the curve is estimated to have a stronger FX effect, if taken at face value, this actually suggests that YCC via the signalling channel – which works pre-dominantly through short-term interest rates – ought to have a larger FX multiplier (than the portfolio balance channel if identified separately).

- Argument 3 – the model misses some additional effects that come via portfolio reallocation channel.
  - There are assets/asset classes above and beyond government bonds that have a direct impact on the exchange rate; in essence the model omits some important variables. Unconventional policies may also change the historical relationship between government bond yields and those in other domestic asset markets that may impact the exchange rate as investors seek yield outside of Australia. But these are outside any historical experience - what are those alternative assets, what is their credit worthiness? SMS note [D19/480563] suggests foreign investors are still committed to Australian assets perhaps there is less substitution out of Australian assets.
  - Investors may also reallocate their portfolios *within* Australia. In general, as this involves no cross-border transactions, there's no FX effect. But, it is easy to imagine situations where this may not be so, for instance, if (international) investors diversify away from unhedged AGS positions to riskier domestic assets, e.g. Australian equities, and want to hedge some of this newly acquired position. This would involve: buying (selling) spot USD (AUD) – AUD would depreciate, and [USD] being sold to forward markets; after the initial adjustment, maintaining the hedging ratio will have on-going FX effects depending on equity valuations.

From:
Sent: Tuesday, 20 October 2020 12:26 PM
To: JAASKELA, Jarkko

Cc:

Subject: RE: ID Chatter: Recent Literature on Quantitative Easing and the Exchange Rate [SEC=OFFICIAL]

Hi

I have a few responses to your earlier questions:

- Based on what has summarised below, how different do we think the exchange rate effect might be if we achieved scenarios by QE rather than YCC? Are the channels of effect and their relative importance the same? Or do some, eg the signalling channel, operate differently enough that we think we can say something concrete about it?
  We've been talking about this question in team meetings and have a few ideas, but we need a bit more time to think this through.

- In note, there are a couple of reasons given for why the exchange rate might be more sensitive to changes in the yield curve than historical averages suggest. Is this a big effect? If we take the 'endpoint' estimates vs the longer-run historical numbers, is the effect marginally higher? Twice as big? I am conscious that people have been given license to think the effect is bigger, but maybe we want to provide some bounds to that?

  The historical estimates were 2.7 (change in 2-year) and 1.9 (change in slope).

  The end-points are a bit problematic. The estimates over smaller sample periods appear to be dependent on the whether we are in an easing cycle, i.e. at the end-points the slope becomes quite negative (around -2), while the short-term yield is much larger (around 9). But I don't think lowering the 10-year yield now will cause an appreciation as seen following Phil's speech.

  Taking into account the strong increase in the estimate on the 2-year yield, and also the estimates from the BIS paper were 5.4 and 4.6 respectively, the exchange rate effect could now be *1.5 to 2 times as big* as the historical estimates.

- One final question for . Given that you base your scenarios on the yield curve as at early September, how far have expectations already shifted towards your scenarios, ie how much might be left, should one of those options be announced as policy?
  Since September 8 (around the time I estimated the scenarios for MM), AGS 2-year yields have declined 10bps and 10-year yields have declined 22bps.
  The actual change in yields is similar to Option C which lowered yields 15bps across maturities.
  If Option B was announced as policy, i.e. lowering 10-year yield to 25bps, the estimates suggests a further 0.25-1 per cent depreciation.
  But given recent evaluations of model estimates, my feeling is that the answer is *at least* a further 1 per cent depreciation.

Options	Change AGS 2-year (bps)	Change AGS 10-year (bps)	Expected depreciation (from note) (%)
A (3-year target 10bps; 10-year target 50bps)	0	-40	-0.6 to -0.9
B (3-year target 10bps; 10-year target 25bps)	-15	-70	-0.9 to -1.9
C (reduce level 15bps)	-15	-15	-0.7 (both models gave similar result)

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w: www.rba.gov.au

From:
Sent: Wednesday, 14 October 2020 12:58 PM
To:

Cc:

Subject: RE: ID Chatter: Recent Literature on Quantitative Easing and the Exchange Rate [SEC=OFFICIAL]

Dear (it seems you are on email - aren't you supposed to be on holidays?) and

It strikes me that there would be some value in trying to answer the following questions:

- Based on what has summarised below, how different do we think the exchange rate effect might be if we achieved I scenarios by QE rather than YCC? Are the channels of effect and their relative importance the same? Or do some, eg the signalling channel, operate differently enough that we think we can say something concrete about it?
- In 's note, there are a couple of reasons given for why the exchange rate might be more sensitive to changes in the yield curve than historical averages suggest. Is this a big effect? If we take the 'endpoint' estimates vs the longer-run historical numbers, is the effect marginally higher? Twice as big? I am conscious that people have been given license to think the effect is bigger, but maybe we want to provide some bounds to that?
- One final question for . Given that you base your scenarios on the yield curve as at early September, how far have expectations already shifted towards your scenarios, ie how much might be left, should one of those options be announced as policy?

More generally, I think it is worth working out what the next round of questions might be - I'm sure there are more. They will get harder and harder to answer definitively, but you don't know until you try.

From:
Sent: Tuesday, 13 October 2020 11:22 AM
To:
Cc:

Subject: RE: ID Chatter: Recent Literature on Quantitative Easing and the Exchange Rate [SEC=OFFICIAL]

Thanks

I thought this was an interesting and very timely chatter, nice work.

A few musings and questions that came to me as I was reading it, and thinking about what the international evidence might mean for Australia:

- For Australia, it seems plausible that the portfolio balance channel is somewhat different from that in Europe or the US. In those economies, large DB pension / life insurers need to maintain long duration to match their liabilities, so substitute into corporate bonds etc. We don't have those. At the same time, we have high foreign ownership of AGS. E.g. foreign reserve managers might substitute into sovereign bonds issued by other countries. Or hedged foreign investors who are searching for yield might search elsewhere. We've already seen foreign holdings of AGS decline as % outstandings.
- The link to the XCcy basis is interesting. How should we think about that? Following from the previous point, is the idea that if you have (i) unhedged investors shifting out of Australia, that shows up via the exchange rate, and (ii) hedged foreign investors shifting out of Australia, which shows up via the XCcy basis? Or is there another link to the XCcy basis?
    - In which case – how much foreign investment is hedged or unhedged?
- How does the carry trade come into all of this? That's been a long-running feature of the AUD. Any particular implications from a QE program? It lowers yields, but also dampens vol, so I'm not sure what that means on balance.
- For what it's worth, I'm a little sceptical on the ability of SVARs to explain financial market prices. They tend to find it hard to capture all the forward-looking information that is built into prices. Every SVAR I've run has had whacky things happen with the exchange rate, but maybe that's my lack of ability!

No need to answer that all now. Time permitting, it would be interesting to build on what you have by fleshing out the framework for thinking about all of this in an Australian context, and bringing any data to bear on the potential shift in balance sheets.

We just had a chat with Phil in which this came up as well.

Again, nice work and thanks for delving into this topic. Lots of great material here.