Yield Curve Control in Japan

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Macroprudential Conference in Eltville, Rhine,
26-27 June 2024

Motivation

- YCC is a monetary policy that targets or caps one or more specific yields, and it is potentially a very powerful tool.
- How effective is YCC?
  - A recent study on Australia (Lucca and Wright (2023), Journal of Finance) finds that YCC has operated largely through the super-narrow channel.
  - What about Japan?
- This paper compares Japanese and Australian YCC purchase effects, and proposes a novel method to quantify YCC effect for Japan.

Terminologies

- Definitions from Lucca and Wright (2023)
  - Narrow channels: Those that impact only the specific class of securities being purchased by the central bank.
  - Supernarrow channels: Those that impact only the specific security
  - Broad channels: Those that affect the prices of all longer-duration assets being bought by the central bank (portfolio balance channel or signalling channel).
- Purchase (implementation) effect: The effect that occurs when actual purchases and holdings take place.
- Announcement effect: The effect where market participants anticipate future central bank actions and incorporate them into price formation in advance.

What we do

- Identify YCC and QE purchases and examine these purchase effects by applying the panel regression approach of Lucca and Wright (2023) to Japan.
- Estimate overall YCC effect using our macrofinance shadow rate models isolating it from other unconventional monetary policy effects.
- Estimate macroeconomic effect of YCC using factor-augmented vector autoregression (FAVAR) approach.
- Discuss a theoretical extension of Lucca and Wright (2023).

What we find

- CUSIP-specific regressions show that YCC purchase effect is limited,
  - But capturing a broader effect as YCC purchases also lowered JGBi yields.
- Yield-curve models detect significant overall effects of YCC in the presence of stable and exceptionally large BOJ bond holdings.
  - YCC contributed 1/3 of the total impact of unconventional monetary policies on average in the first several years of YCC (based on a shadow rate analysis).
  - YCC has stimulated output and inflation (based on a FAVAR analysis).

Related studies

- Krishnamurthy and Vissing-Jorgensen (2011), Lucca and Wright (2023)
- Wu and Xia (2016), Krippner (2013), Joslin et al. (2014), Wright (2011), Koeda and Wei (2023a) and Koeda and Wei (2023b)
- Vayanos and Vila (2021), Koeda and Ueno (2022)
- Fukunaga et al. (2015), Sudo and Tanaka (2021), Hattori and Yoshida (2022), Shiratsuka (2024), BOJ (2024)

Unconventional monetary policies

- Generally categorized into three types of policies (e.g., Giovanni et al. 2018)
  (1) Forward guidance,
  (2) Quantitative easing (large-scale asset purchases)
  (3) Negative interest rate policy
- The BOJ's first "Review of Monetary Policy from a Broad Perspective" meeting on December 4, 2023 underscores the role of these policies in lowering the long-term interest rate.
- Taking into account these policies, this paper highlights the role of YCC.
  - We separate YCC purchases from QE purchases
  - We construct a shadow rate that primarily captures the effects of YCC netting out other policy effects

YCC and timeline of monetary policy actions taken by the BOJ (Table 1)

Date	Statement
2013.4.4	QQE introduced
2016.1.29	NIRP added to QQE
2016.9.21	YCC added to QQE
2018.7.31	The targeted range of yield fluctuations widened
2021.3.19	YCC cap of 0.25% introduced
2022.12.20	YCC cap raised to 0.5%
2023.7.28	YCC cap raised to 1%
2023.10.31	YCC flexibility increased
2024.3.19	YCC officially abandoned

Australian YCC vs. Japanese YCC (Table 2)

	Australia	Japan
Targeted maturity	3 years, decline unless updated	10 years, automatically updated with new bonds
Purchase patterns	Irregular	Irregular
Target rate	Essentially the same as the cap	Remained around 0% even when the cap increased
Initial bond holding at onset of YCC	Several % of GDP	$\approx$ 70% of GDP

"YCC" purchases vs. "QE" purchases

- Under YCC, a central bank sets a price target for securities of a given maturity, without specifying the quantity of securities to be purchased.
  - We define "YCC" purchases as those JGB purchases by the BOJ under its fixed rate method
- Under QE, a central bank sets a specific quantity of securities to buy, but leaves prices to be determined by market forces.
  - We define "QE" purchases as those JGB purchases by the BOJ under its competitive auction method

BOJ bond purchase data

- **BOJ releases on monetary policy operations**
  - The amount of bond purchases by the BOJ for each operation date by operation method, categorized by maturity buckets
  - Maturity buckets:
    "greater than 1 year and less than or equal to 3 years,"
    "greater than 3 year and less than or equal to 5 years,"
    "greater than 5 years and less than or equal to 10 years,"
    "greater than 10 year and less than or equal to 25 years," and
    "greater than 25 years."
- **BOJ releases on its bond holdings**
  - The stock of its bond holding at the issue level, released a few times a month.
  - Disclosure Period: The time frame starting from the day after a specific release date and ending on the subsequent release date.
- **MOF auction results**
  - Specific information about each issue, such as maturity date and issue number (known as "Kaigo").

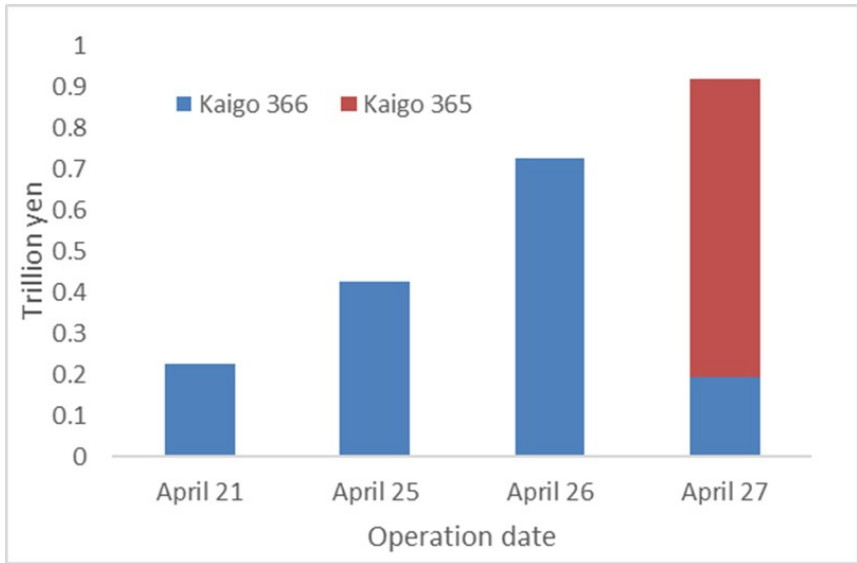
Identifying YCC and QE purchases during 4/21-4/28

- On April 21, 25, 26, and 27 in 2022, there were YCC operations with purchases of 0.2251, 0.4277, 0.7275, and 0.9215 trillion yen, respectively, for the maturity bucket of "greater than 5 years and less than or equal to 10 years."
- During the disclosure period covering April 21 to April 28 in 2022, the BOJ holding increased by 1.5738 (=2.0506-0.4768) trillion yen for Kaigo 366, and by 0.7428 (=3.3320-2.5892) trillion yen for Kaigo 365, etc.
- We first allocate the BOJ purchases to the most recently issued on the run bonds under these fixed-rate operations. If the purchase on a specific operation day exceeds the increase in the BOJ's holdings of this bond, the remaining purchased amount is allocated to the next most recently issued bond

Identifying YCC and QE purchases during 4/21-4/28, 2022 for a maturity bucket ($5 < \text{years} \leq 10$)

Our identification scheme first assigns YCC purchases to the most recent on- the-run securities

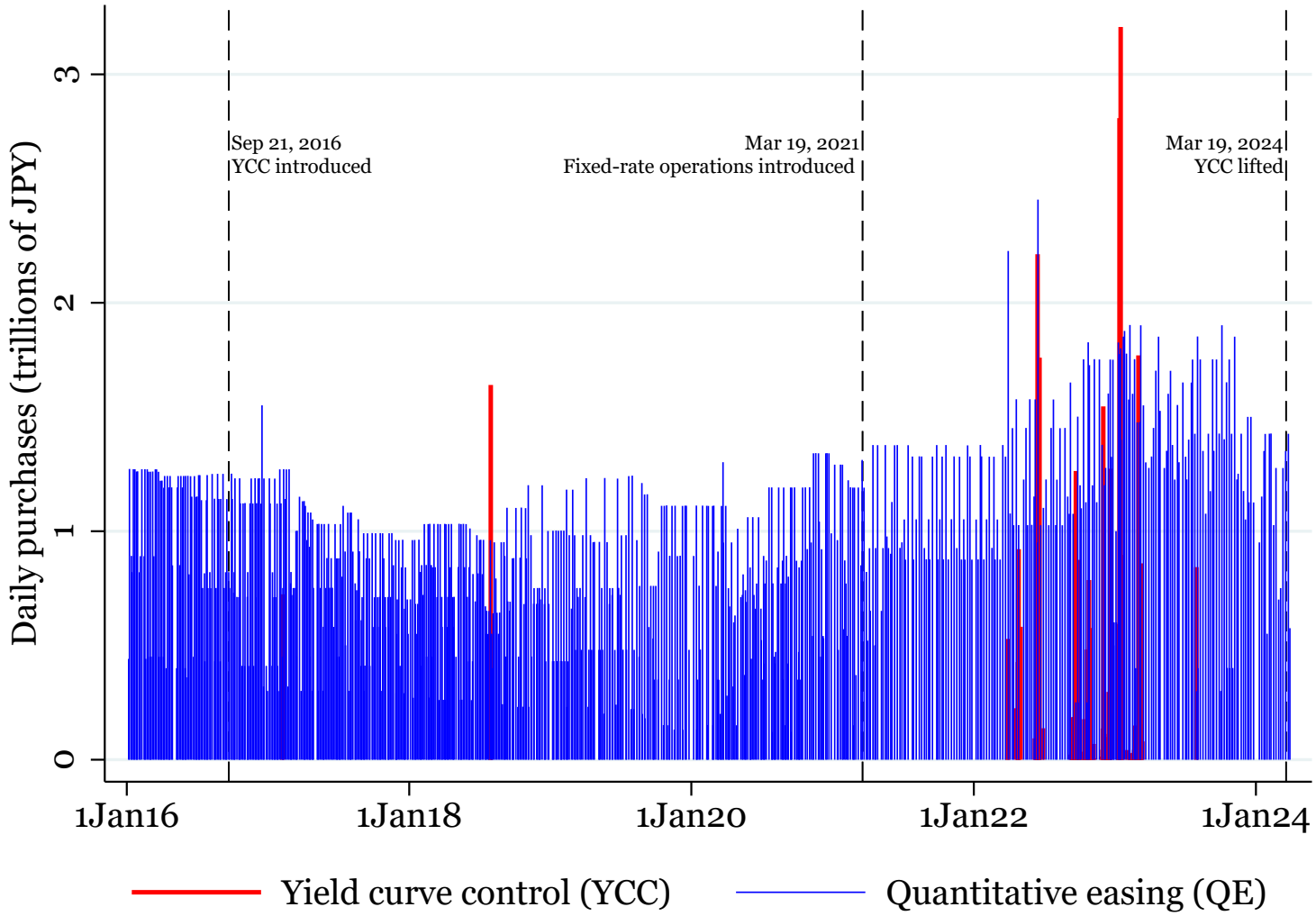
- BOJ holding increased by ¥1.5738 trillion for Kaigo 366 and ¥0.7428 trillion for Kaigo 365



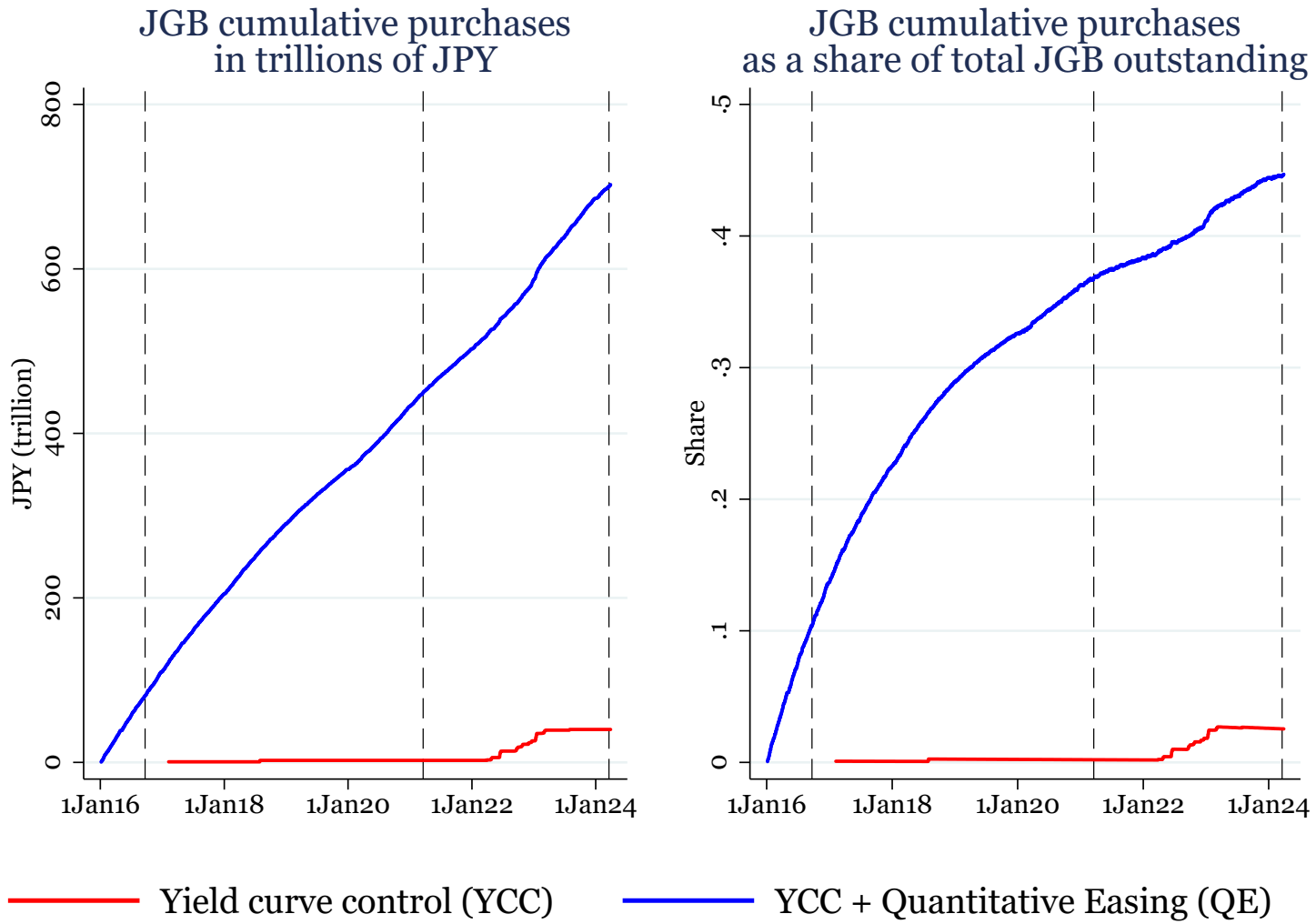
The scheme then updates the issue-level flow information by subtracting YCC purchase amounts and repeat the algorithm for QE purchases using the updated information

- No QE purchases for Kaigo 366, ¥0.015 trillion for Kaigo 365.

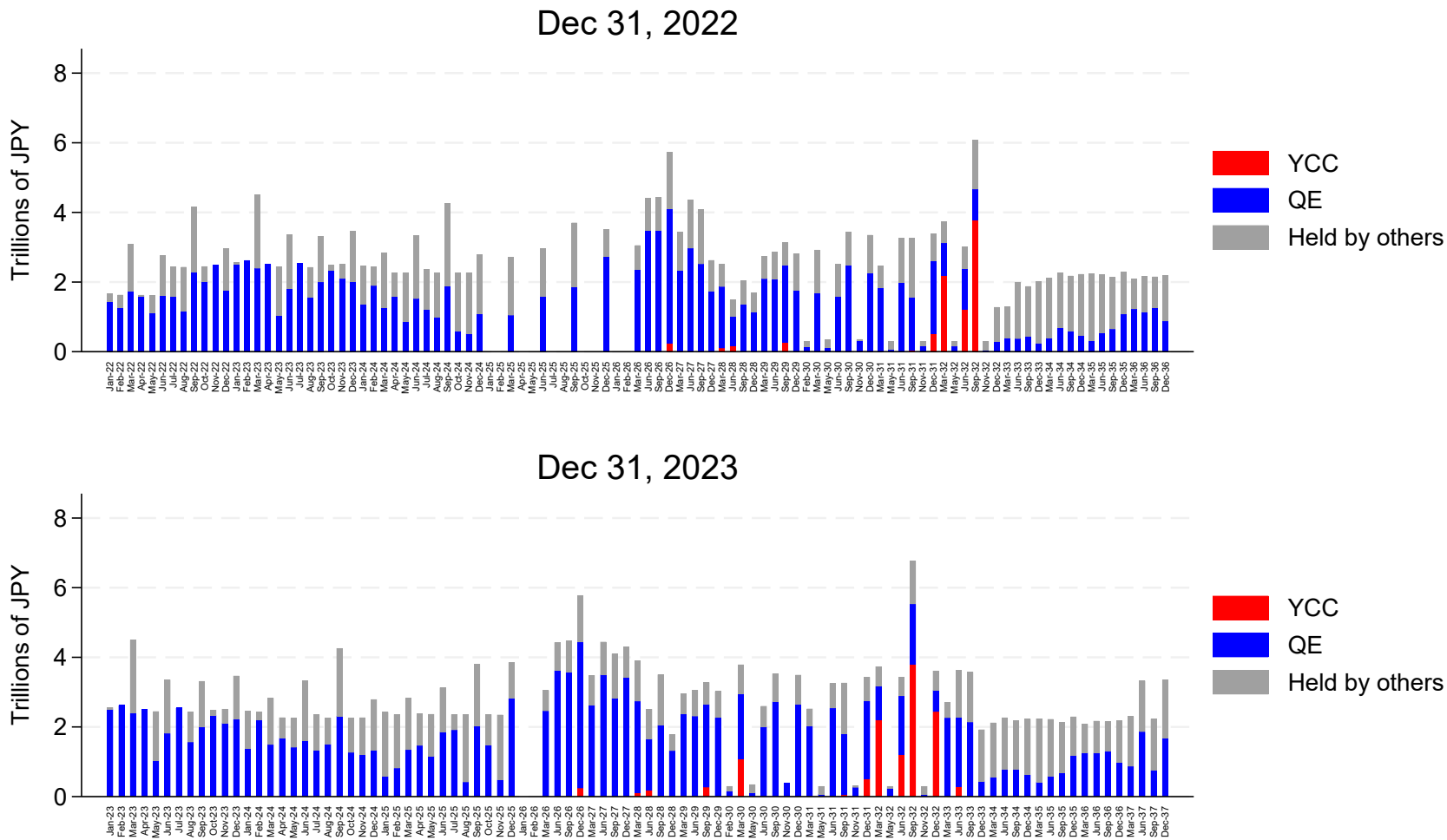
BOJ purchases under different programs



Cumulative BOJ purchases under YCC and QE since 2016

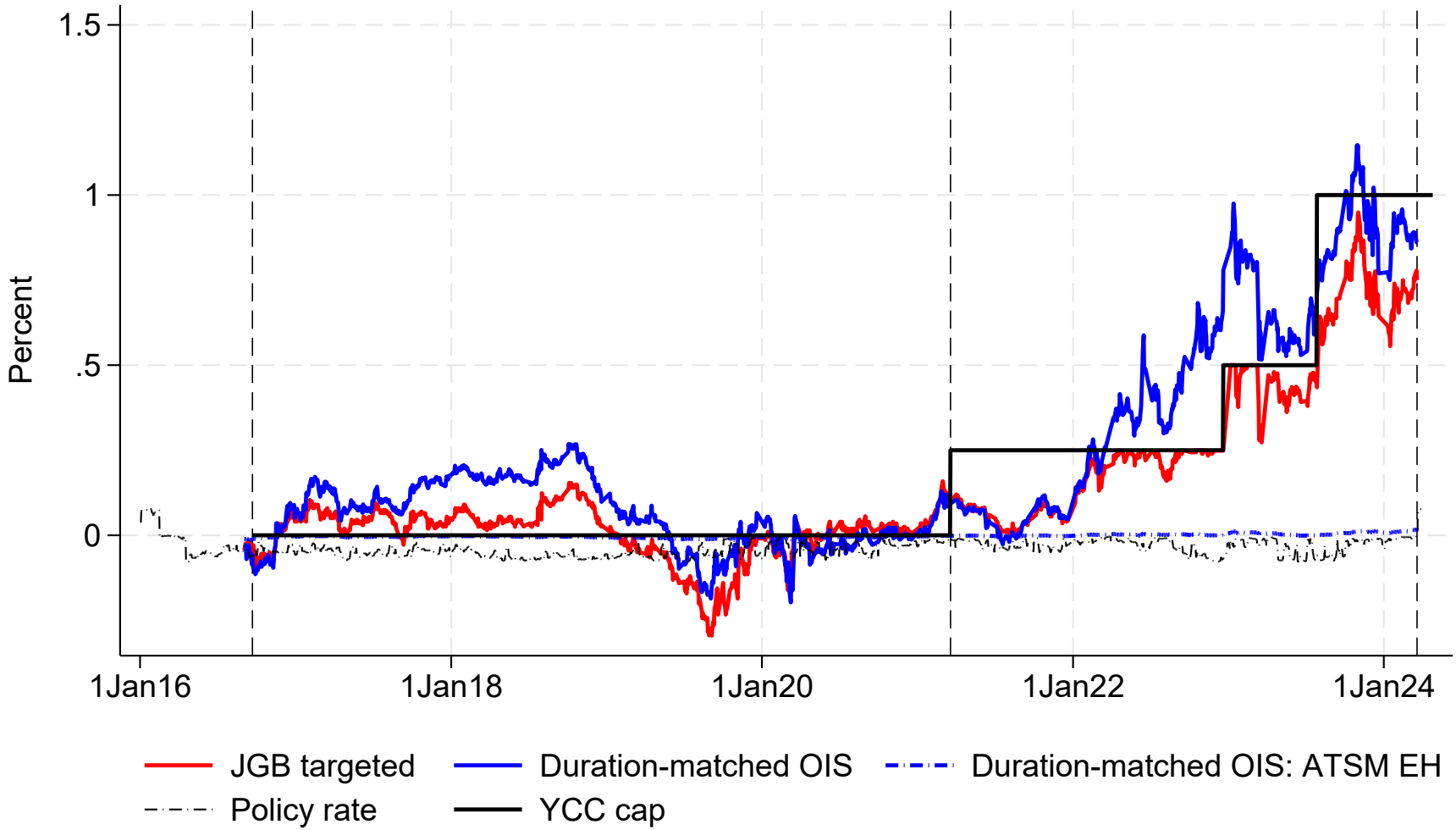


Distribution of cumulative BOJ purchases against amounts held by holders since 2016



Yields on JGBs targeted by YCC (Figure 4)

Evidence for signaling effect?



The panel regression of Lucca and Wright (2023)

$$\Delta y_{it} = \alpha_t + \beta' BUY_{it} + \gamma X_{it} + \epsilon_{it}, \tag{1}$$

where y_{it} is the yield on an JGB with CUSIP number i and date t or the duration-matched OIS yield (in bps), BUY is a vector containing daily JGB purchases. α_t denotes day fixed effects, and X_{it} is a vector of controls.

Response of changes in JGB yields and duration-matched OIS yields to JGB purchases over the entire YCC period (Sept. 21, 2016-Mar. 19, 2024)

	(1) ΔJGB	(2) ΔOIS	(3) ΔJGB	(4) ΔOIS
YCC-TOT	0.79^{***}	-0.05		
	[0.26]	[0.44]		
QE-TOT	0.01	0.06		
	[0.08]	[0.10]		
YCC-CUSIP			-0.83^{**}	0.26
			[0.35]	[0.22]
QE-CUSIP			-0.06	0.01
			[0.13]	[0.08]
N	423,553	423,553	423,553	423,553
Time effects?			Y	Y

Decomposition of changes in JGB yields to BOJ purchases over the entire YCC period

	(1) ΔJGB	(2) Δ(JGB - NS)	(3) Δ(NS − OIS)	(4) ΔOIS
YCC-CUSIP	-0.83^{**}	-1.19^{***}	0.10	0.26
	[0.35]	[0.39]	[0.28]	[0.22]
QE-CUSIP	−0.06	0.02	−0.09	0.01
	[0.13]	[0.08]	[0.13]	[0.08]
N	423,553	423,553	423,553	423,553
Time effects?	Y	Y	Y	Y

Decomposition of changes in JGB duration-matched OIS to JGB purchases during the entire YCC period

	(1) ΔOIS	(2) ΔOIS^{EH}	(3) Δ(OIS-OIS^{EH})
YCC-CUSIP	0.26	-0.01	0.27
	[0.22]	[0.01]	[0.23]
QE-CUSIP	0.01	0.02^{***}	-0.01
	[0.08]	[0.01]	[0.08]
N	423,553	423,553	423,553
Time effects?	Y	Y	Y

Response of changes in JGB and JGBi yields to BOJ purchases during a subsample period (May 6, 2022-Mar. 19, 2024)

	(1) ΔJGB	(2) ΔJGBi	(3) Δ(JGB − JGBi)
YCC-CUSIP	-0.86^{**}	-0.78^{***}	-0.56
	[0.38]	[0.29]	[0.61]
QE-CUSIP	-0.72^{*}		-2.80^{*}
	[0.43]		[1.67]
QE-CUSIP (JGBi)		8.14	−11.2
		[13.04]	[9.49]
N	107,493	3,108	3,108
Time effects?	Y	Y	Y

Response of changes in JGB and JGBi yields to BOJ purchases during the entire YCC period

	(1) ΔJGB	(2) ΔJGBi	(3) Δ(JGB − JGBi)
YCC-CUSIP	−0.83**	−0.72**	−0.60
	[0.35]	[0.29]	[0.59]
QE-CUSIP	−0.06*		−1.07
	[0.13]		[0.84]
QE-CUSIP (JGBi)		8.17	−6.62
		[9.56]	[7.13]
N	423,553	9,162	9,162
Time effects?	Y	Y	Y

YCC effect in Japan

- While we did not find strong evidence for broad effect of YCC purchases, YCC itself may still have significant broad effects
- Broad channels could take the form of
  - Signaling channel by lowering the expected future short rate (See empirical evidence in Figure 4).
  - Portfolio balance channel (See Koeda and Ueno (2022) who extend Vayanos and Vila (2021) incorporating a YCC policy)
- To understanding the full impact of YCC, we utilize the MF-SRTSM framework as developed by Koeda and Wei (2023a)

Macrofinance shadow rate term structure framework

Koeda and Wei (2023a) extend the standard shadow rate term structure model (SRTSM) by incorporating

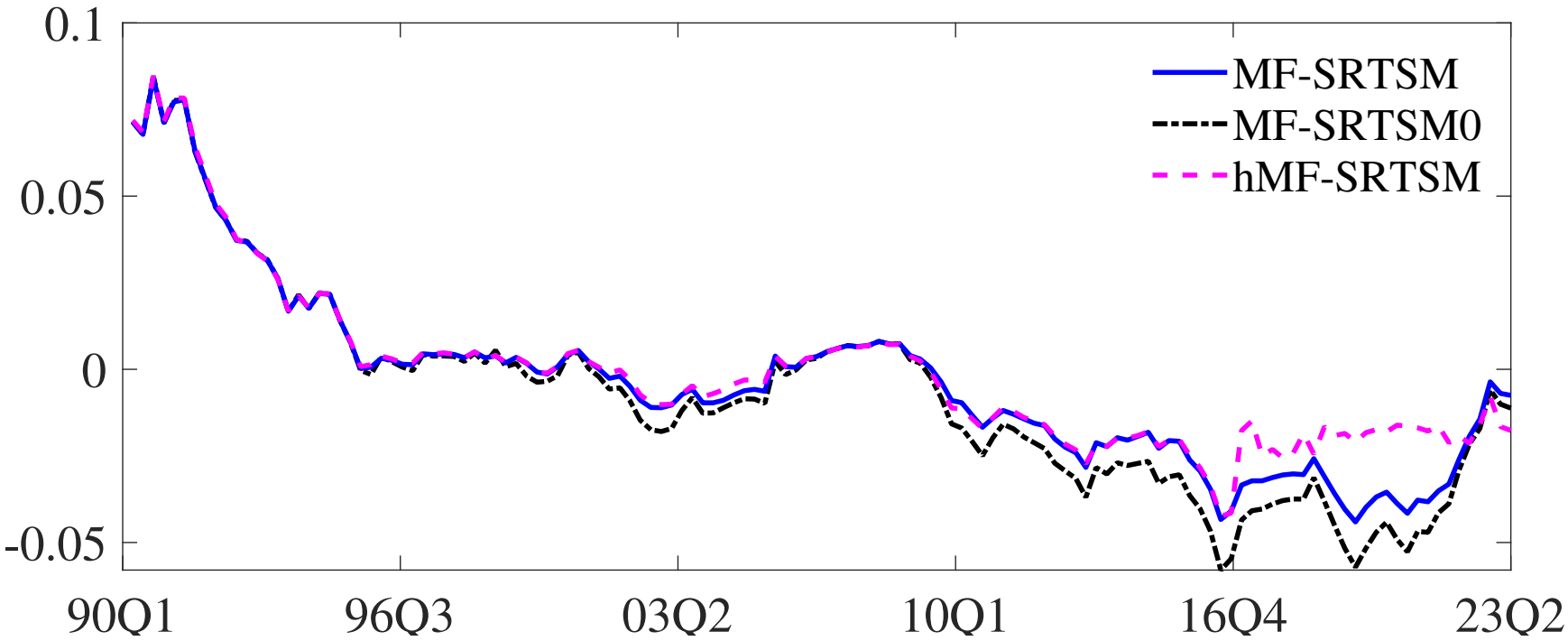
- Key macroeconomic factors (GDP growth and inflation) "unspanned" by yield curve factors (Joslin et al., 2014).
- Outcome-based forward guidance, modeled by two prerequisites for shifting to a positive policy rate environment:
  (i) The shadow rate must exceed the ELB, and
  (ii) A combined measure of inflation and output must surpass a predefined level.

By explicitly modeling this forward guidance, we net out its influence from the shadow rate

Hypothetical yields in the absence of YCC

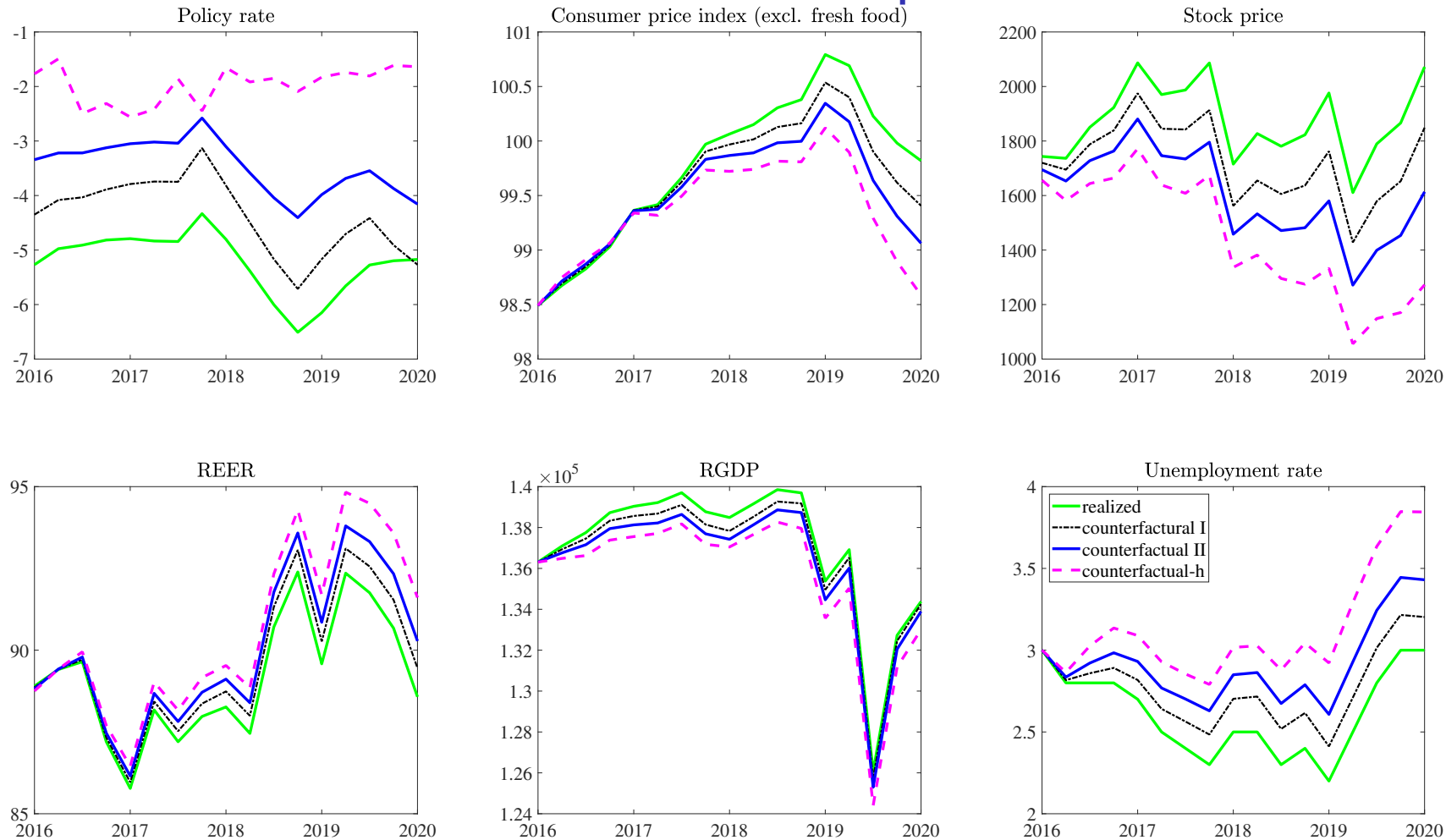
- Akin to the backcasting exercise in Gürkaynak et al. (2008), we construct hypothetical yields that could have emberged if YCC had not been implemented
- We estimate the relationship among nominal and real bond yields, and expected inflation, for the period 1990 to 2015, prior to the implementation of YCC.
  - The real bond yield is measured by inflation-indexed JGB (JGBi) yield, and expected inflation is measured by the ESP forecast, a professional forecast conducted by the Japan Center for Economic Research.
- Using the hypothetical yields, we recompute the shadow rate under MF-SRTSM (termed hMF-SRTSM)

YCC and shadow rates



Taken from Koeda and Wei (2023b). The pink dashed line shows the hMF-SRTSM shadow rate, the blue dashed line shows the MF-SRTSM shadow rate, and the black dash-dotted line shows the MF-SRTSM0 shadow rate. The sample period is 1990Q1 through 2023Q2. Forward rates in 1, 2, 4, 8, 20, 28, and 40 quarters are used in estimation as in Wu and Xia (2016).

Macroeconomic effect of YCC in Japan



Taken from Koeda and Wei (2023b). The pink dashed lines show what would have happened if the monetary policy shocks were set to generate the hMF-SRTSM shadow rate. The blue solid (black dashed) lines show what would occur to these variables, if the monetary policy shocks were set to generate the MF-SRTSM (MF-SRTSM0) shadow rate. The difference between the pink dashed and blue solid lines captures the YCC effect. Solid green lines show the shadow rate from the canonical shadow rate model (top left) and the observed economic variables between 2016Q4 and 2020Q4.

YCC: Theory

- Lucca and Wright (2023) propose a simple model with the spirit of Vayanos and Vila (2021, VV)
- In VV, the supply by the government for the bond maturity τ net of the preferred habitat demand is given by

$$z_t(\tau) = \alpha log P_t(\tau) - \beta_t(\tau), \tag{2}$$

where

$$\beta_t(\tau) = \theta_0(\tau) + \theta(\tau)\beta_t. \tag{3}$$

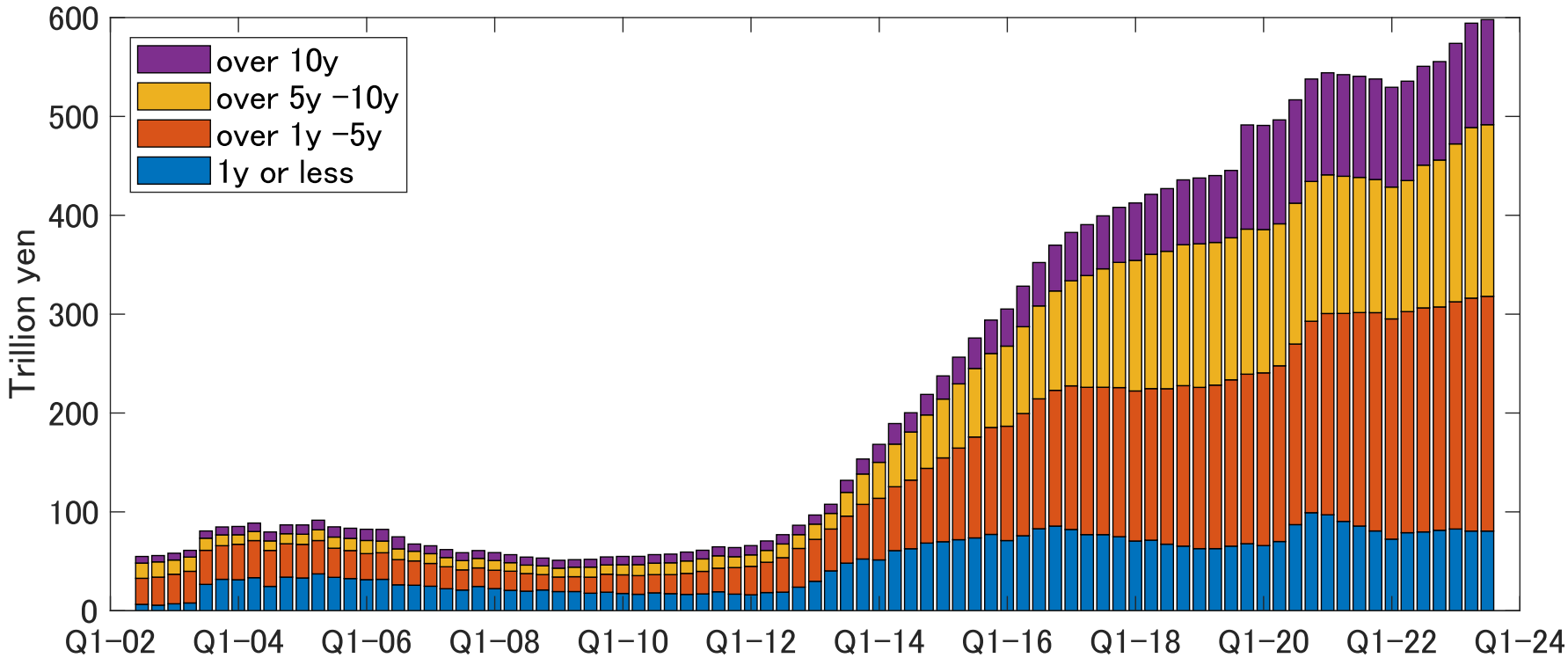
- Koeda and Ueno (2022) extend VV by incorporating a YCC cap, interpreting α as the strictness of YCC

$$\alpha(\tau, P_t(\tau)) = \begin{cases} \alpha & \text{if } \tau = \tau^* \text{ and } y_t(\tau) \geq y^* \\ 0 & \text{otherwise} \end{cases} \tag{4}$$

where τ^* is the targeted maturity and y^* is the cap on the targeted-maturity yield.

- Koeda and Ueno (2022) show as long as the cap is credible, the bond yield will be kept at or below the cap even when there are no BOJ bond purchases.

Japanese government bonds and bills held by BOJ

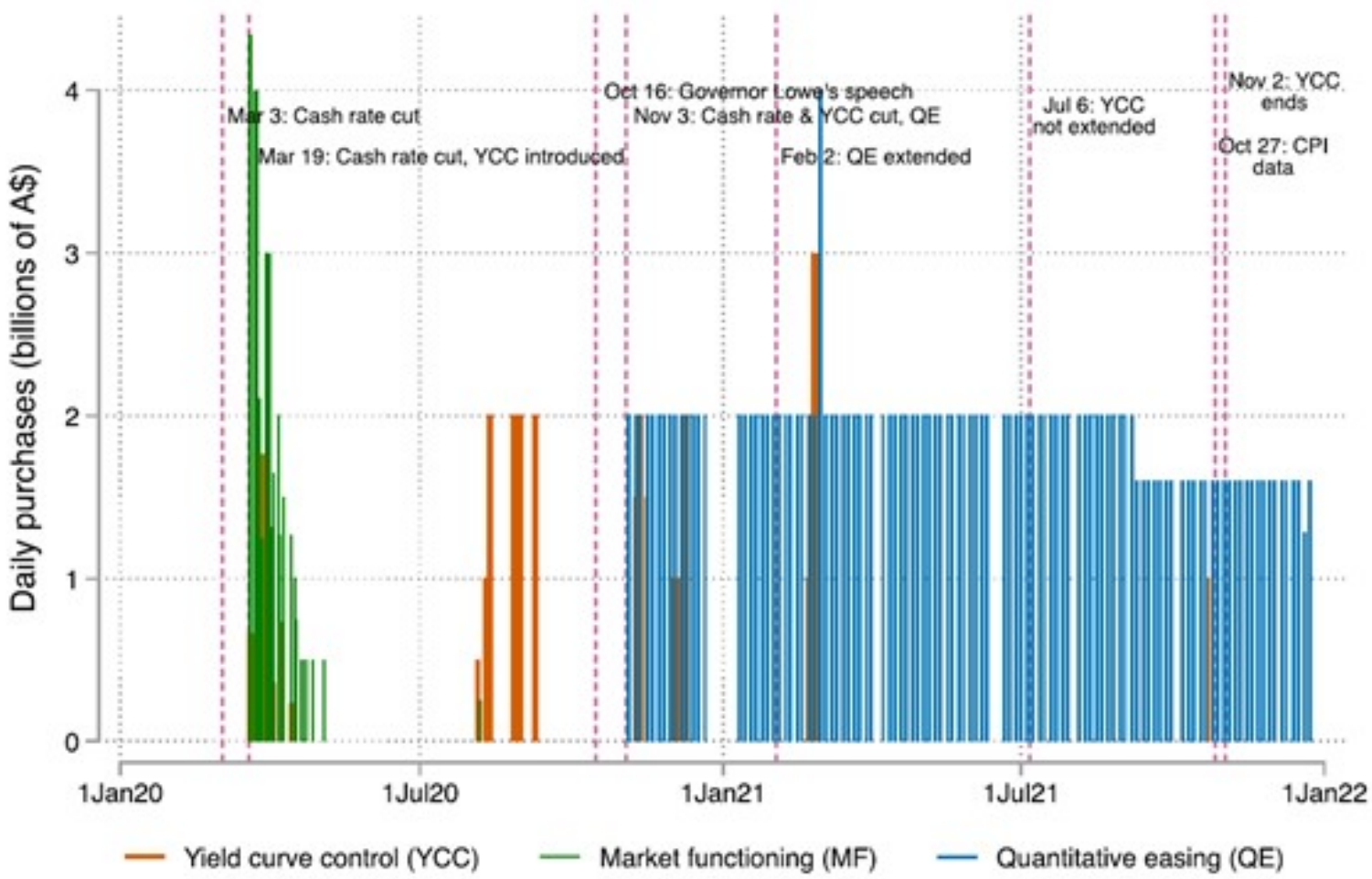


NOTE: Data source: BOJ

Conclusion

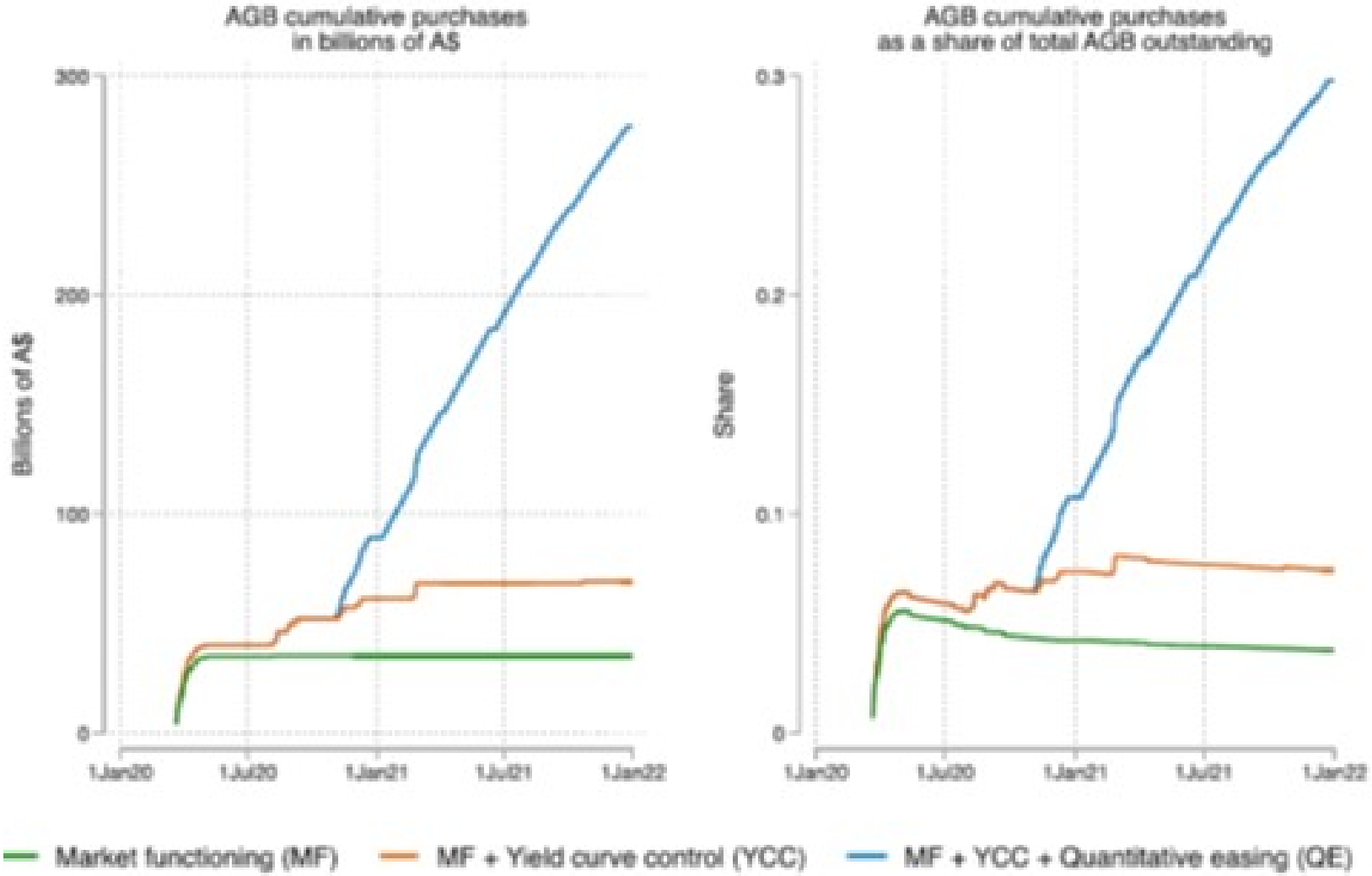
- We should not completely deny YCC
  - YCC effects were significant overall (1/3 of total impact of unconventional monetary policies during the YCC period) and stimulated inflation and output
  - Purchase effects were limited but they seem to be broader than super narrow
- However, the costs and benefits of YCC require further investigation
- Our approach can be applied to analyze the effect of quantitative tightening going forward

Reference: RBA purchases under different programs



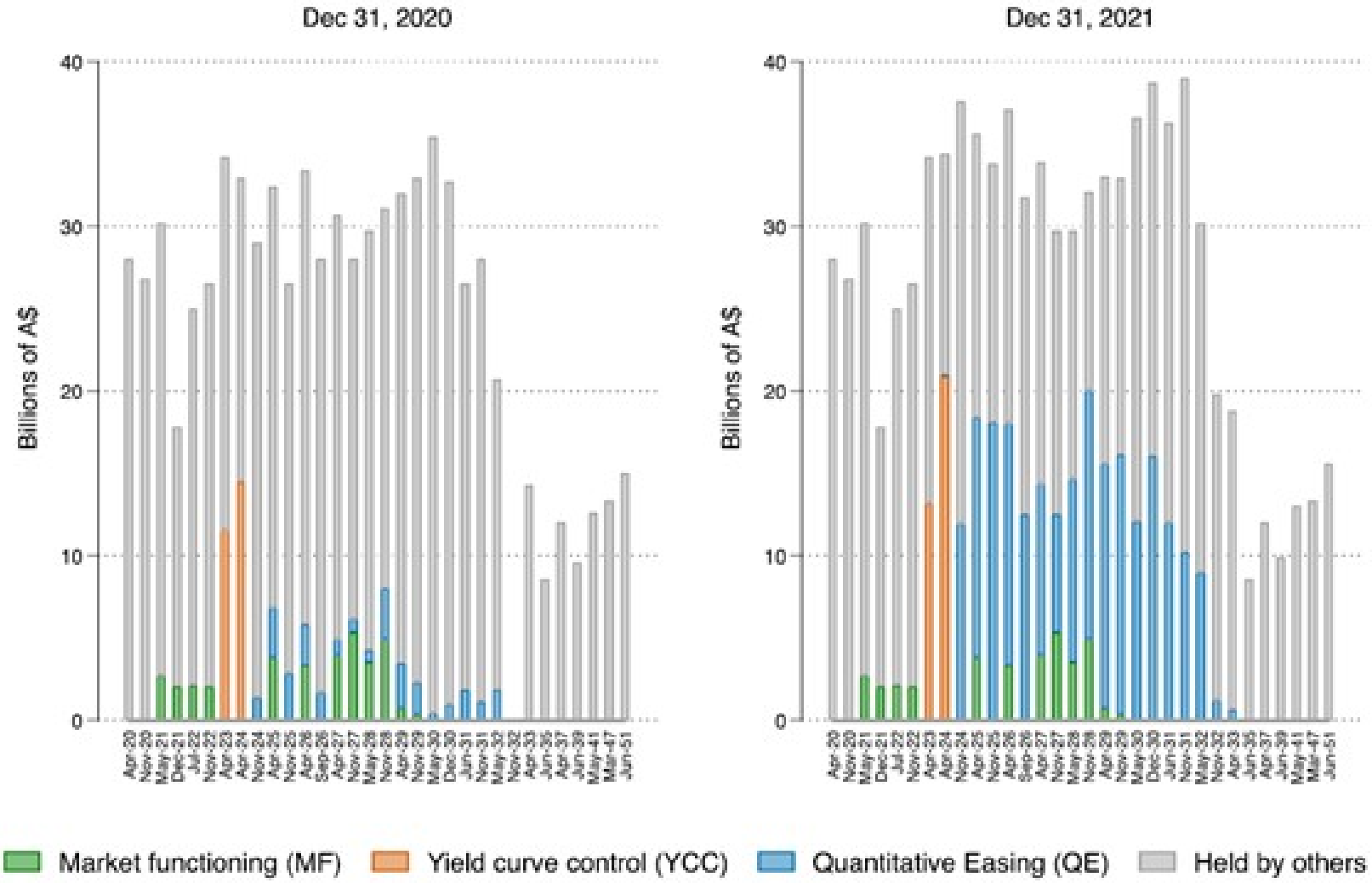
Source: Lucca and Wright (2023), Figure 1

Reference: Cumulative RBA purchases under long-dated OMOs and bond purchase programs



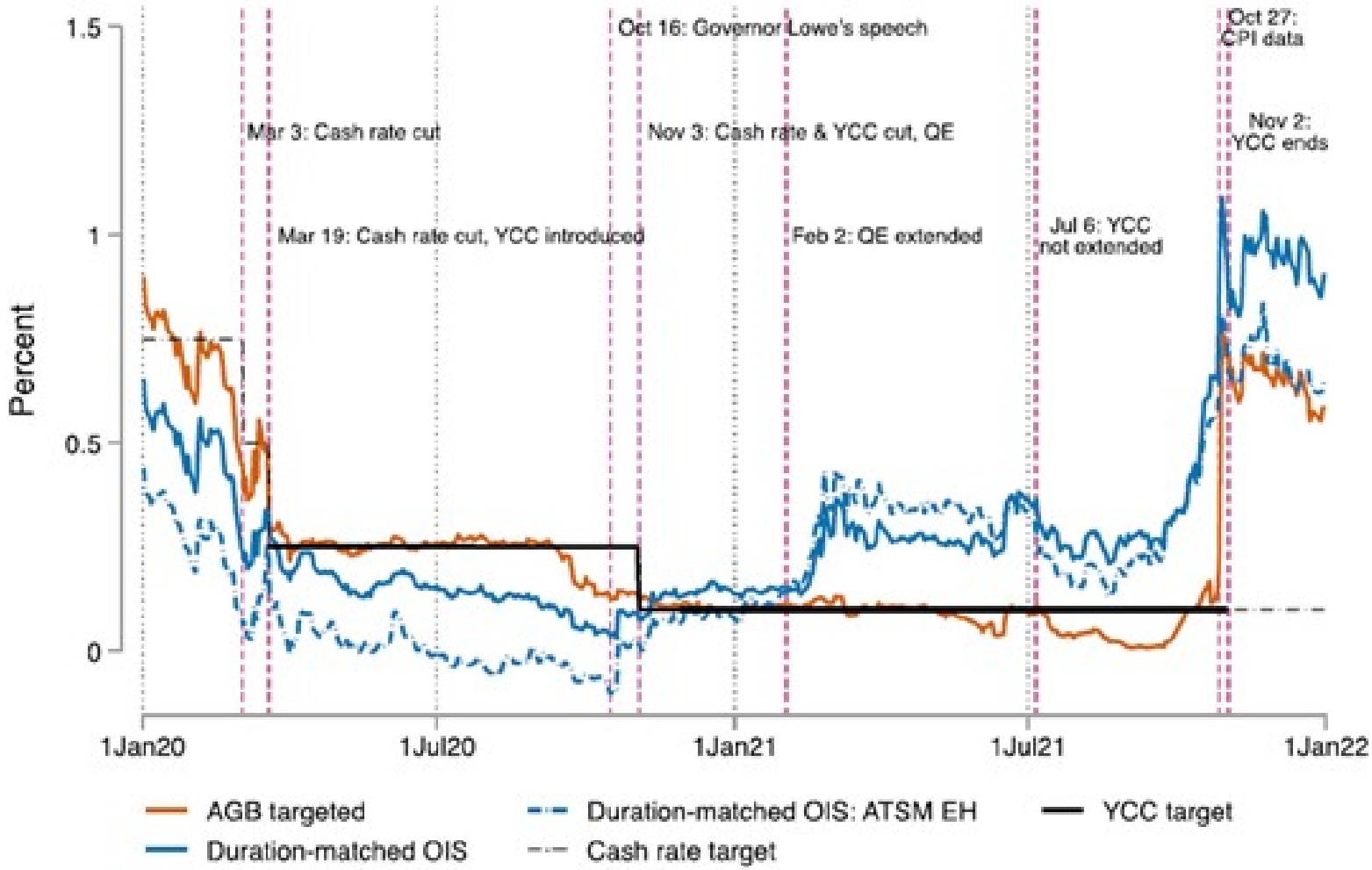
Source: Lucca and Wright (2023) Figure 2

Reference: Distribution of cumulative RBA purchases against amounts held by holders



Source: Lucca and Wright (2023) Figure 3

Reference: Yields on AGBs Targeted by YCC



Source: Lucca and Wright (2023) Figure 4

Reference: Response of Changes in AGB and Duration-Matched OIS Yield to AGB Purchases

	(1) ΔAGB	(2) ΔOIS	(3) ΔAGB	(4) ΔOIS	(5) ΔAGB	(6) ΔOIS	(7) ΔAGB	(8) ΔOIS	(9) ΔAGB
MF-TOT	−2.3***	−1.3			−1.5**	−0.5			
	[0.9]	[0.8]			[0.6]	[0.6]			
YCC-TOT	1.2	0.7			1.2	0.8			
	[0.8]	[0.5]			[0.8]	[0.5]			
QE-TOT	−0.5*	−0.2			−0.5*	−0.2			
	[0.3]	[0.2]			[0.3]	[0.2]			
MF-CUSIP			0.3	0.5			0.1	0.0	0.2
			[0.8]	[0.7]			[0.9]	[0.6]	[0.7]
YCC-CUSIP			−2.0*	−0.1			−2.3**	−0.3	−2.2*
			[1.2]	[0.4]			[1.1]	[0.4]	[1.1]
QE-CUSIP			−0.8**	−0.1			−0.8**	−0.1	−0.4
			[0.3]	[0.2]			[0.3]	[0.2]	[0.3]
N	14,050	14,050	14,050	14,050	14,025	14,025	14,025	14,025	14,050
Time effects?			Y	Y			Y	Y	Y
Excl. March 20, 2020?					Y	Y	Y	Y	
Add. controls?									Y

Source: Lucca and Wright (2023)

Reference: Decomposition of Changes in AGB Yields to RBA Purchases

	(1) ΔAGB	(2) Δ(AGB-NS)	(3) Δ(NS-OIS)	(4) ΔOIS	(5) ΔAGB	(6) Δ(AGB-NS)	(7) Δ(NS-OIS)	(8) ΔOIS
MF-CUSIP	0.3	−2.3***	2.1**	0.5	0.1	−1.6**	1.7*	0.0
	[0.8]	[0.8]	[0.8]	[0.7]	[0.9]	[0.6]	[0.9]	[0.6]
YCC-CUSIP	−2.0*	−1.4***	−0.5	−0.1	−2.3**	−1.3***	−0.6	−0.3
	[1.2]	[0.3]	[0.8]	[0.4]	[1.1]	[0.3]	[0.8]	[0.4]
QE-CUSIP	−0.8**	−0.4***	−0.3	−0.1	−0.8**	−0.4***	−0.3	−0.1
	[0.3]	[0.1]	[0.2]	[0.2]	[0.3]	[0.1]	[0.2]	[0.2]
N	14,050	14,050	14,050	14,050	14,025	14,025	14,025	14,025
Time effects?	Y	Y	Y	Y	Y	Y	Y	Y
Excl. March 20, 2020?					Y	Y	Y	Y

Source: Lucca and Wright (2023)

Reference: Decomposition of Changes in AGB Duration-Matched OIS to AGB purchases

	(1) ΔOIS	(2) ΔOIS^{EH}	(3) $\Delta(OIS\text{-}OIS^{EH})$	(4) ΔOIS	(5) ΔOIS^{EH}	(6) $\Delta(OIS\text{-}OIS^{EH})$
MF-CUSIP	0.5	−0.3	0.9	0.0	0.0	0.0
	[0.7]	[0.3]	[1.0]	[0.6]	[0.2]	[0.8]
YCC-CUSIP	−0.1	0.1	−0.2	−0.3	0.2	−0.5
	[0.4]	[0.3]	[0.7]	[0.4]	[0.3]	[0.6]
QE-CUSIP	−0.1	0.0	−0.1	−0.1	0.0	−0.1
	[0.2]	[0.1]	[0.2]	[0.2]	[0.1]	[0.2]
N	14,050	14,050	14,050	14,025	14,025	14,025
Time effects?	Y	Y	Y	Y	Y	Y
Excl. March 20, 2020?				Y	Y	Y

Source: Lucca and Wright (2023)

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