Supplementary Internet Appendix

to accompany the paper

The Demand for Government Debt

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IA.I The evolution of government debt holdings and marginal buyers for the Euro area, Japan and the United Kingdom

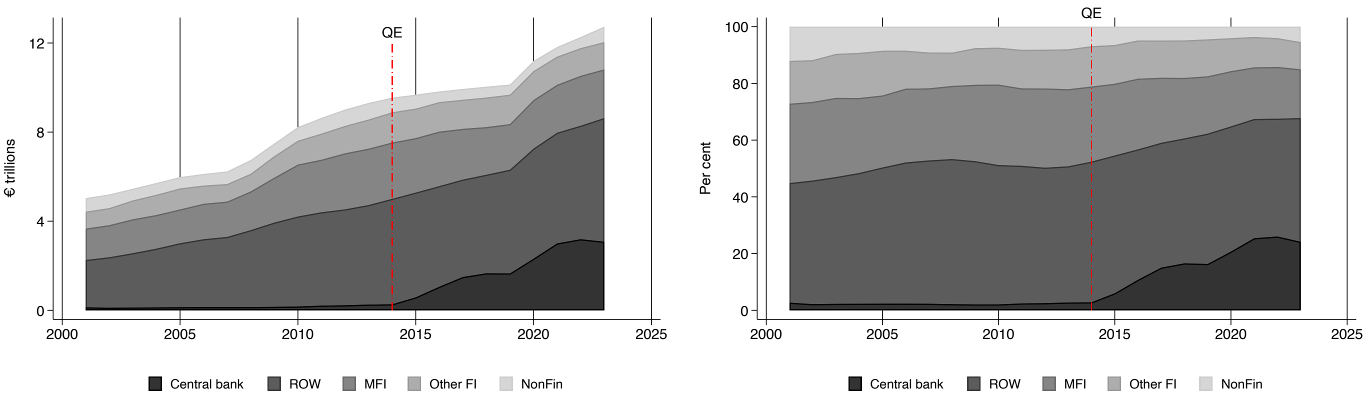
In this section, we repeat the same analysis as in Section 2 for the Euro area, Japan and the United Kingdom.

IA.I1 Euro area

In the Euro area, QE also brought about notable compositional shifts in the holders of government debt. We report the changes in the average shares of each sector in Table IA.1 Panel (a). The average share of the central bank in the holdings of government bonds has increased from 2.4% to 17.9%. The share of monetary financial institutions, which is comprised to a large extent of commercial banks, has fallen from 26.9% to 20.9%. The share of non-financial corporations has also dropped from 8.9% to 4.7%. The share of foreign investors declined slightly from 47.8% to 44.4%. The share of other financial institutions (which include mutual funds, pension funds, insurance companies) has declined from 14% to 12.1%.

The role of the central bank as a major player in European sovereign debt markets clearly stands out, as indicated by the regression results reported in Table IA.1 Panel (b). The central bank has absorbed 53% of every unit of new government debt since the beginning of the ECB/Eurosystem's public sector asset purchases program in March 2015. This is in contrast with the estimate of -13% prior to QE (insignificant and at a very low base as the central bank holdings of government

Figure IA.1: Total holdings and shares of different sectors - Euro Area



(a) Total holdings

(b) Shares

Note: Panels IA.1(a) and IA.1(b) show the total market value of the government debt holdings and market shares of each sector in the Euro area, respectively, between 2001 and 2023 (yearly data). Central bank refers to the holdings of the ECB/Eurosystem. ROW refers to foreign investors (official and private). MFI refers to monetary financial institutions, such as banks and money market funds. Other FI refers to non-monetary financial institutions, such as pension funds, insurance companies, mutual funds. QE starts in 2015. *Source: European Central Bank.*

debt averaged only 2.7% prior to the quantitative easing program), likely owing to the fact that the Eurosystem had been shedding bond holdings at a time when total government debt supply increased pre-GFC.

The responsiveness of each sector to changes in government debt also uncovers an important story. According to our estimates, prior to QE, for an additional increase in government debt, the marginal purchase response of different sectors was 44% for foreign investors, 47% for monetary financial institutions, 20% for non-monetary financial institutions, and 2% for non-financial corporates (insignificant). Following the launch of the Eurosystem's public sector bond purchases, these numbers have dropped to 24% for monetary financial institutions, to 17% for foreign investors and to 2% for non-monetary financial institutions (insignificant) and 4% for the non-financial sector.

Even though our estimates cannot directly speak to which sectors were net sellers to the central bank, they are nonetheless consistent with the estimates of Koijen et al. (2021) in a study of portfolio rebalancing during initial phases of the ECB's PSPP program. During that time period,

Table IA.1: Average shares and marginal response by sectors in the Euro area

Panel (a): Average shares by sector over different periods

Avg. Share	CB	ROW	OtherFI	MFI	NonFin
Pre-QE	2.4	47.8	14	26.9	8.9
Post-QE	17.9	44.4	12.1	20.9	4.7

Panel (b): Marginal holdings by sector over different periods

	(1)	(2)	(3)	(4)	(5)
VARIABLES	CB	ROW	OtherFI	MFI	NonFin
Pre-QE * Pct. Ch. Gov. Debt	-0.13	0.44***	0.20***	0.47***	0.02
	(0.13)	(0.06)	(0.03)	(0.02)	(0.03)
Post-QE * Pct. Ch. Gov. Debt	0.53***	0.17**	0.02	0.24***	0.04*
	(0.16)	(0.08)	(0.04)	(0.01)	(0.02)
Observations	22	22	22	22	22
R-squared	0.53	0.49	0.48	0.81	0.01

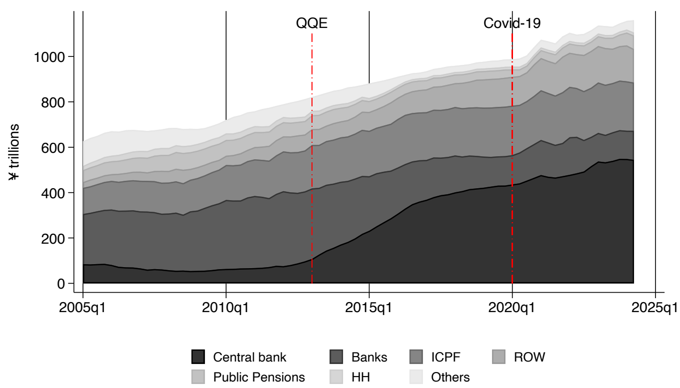
Note: Panel (a) shows the average share of each investor group over different time periods. Panel (b) reports the coefficients of the OLS regression of Equation (2) for the Euro area. CB refers to the holdings of the ECB/Eurosystem. ROW refers to foreign investors (official and private). MFI refers to monetary financial institutions, such as banks and money market funds. Other FI refers to non-monetary financial institutions, such as pension funds, insurance companies, mutual funds. Data are yearly. Pre-QE is between 2001 and 2014. Post-QE is between 2005 and 2023. Standard errors are robust to arbitrary heteroskedasticity and autocorrelation with the lag structure automatically selected using the Newey and West (1994) procedure. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. *Source: European Central Bank*

they find based on a confidential security-level dataset that foreign investors sold €0.40, banks sold €0.20 and mutual funds sold €0.06 per unit purchased by the Eurosystem.

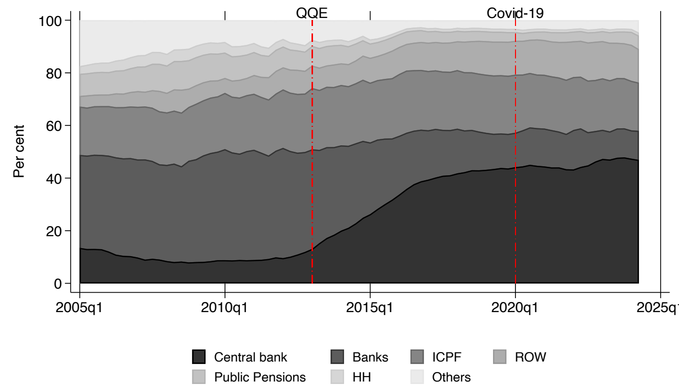
IA.I2 Japan

In Japan, the expansion of the central bank's footprint in government debt markets has gone furthest with its share of government bond holdings reaching around 45% since the Covid-19 crisis (Table IA.2, panel (a)). Along with the central bank, holdings of Japanese government bonds by foreign investors also increased from 7% prior to the qualitative and quantitative easing program to

Figure IA.2: Total holdings and shares of different sectors - Japan



(a) Total holdings



(b) Shares

Note: Panels IA.2(a) and IA.2(b) show the total market value of the government debt holdings and market shares of each sector in Japan, respectively, between 2005Q1 and 2024Q2 (quarterly data). Central bank refers to the holdings of the Bank of Japan. Banks refer to commercial banks. ICPF refers to insurance companies and pension funds. ROW refers to foreign investors (official and private). HH refers to households. Others combine all other remaining sectors. Qualitative and quantitative easing (QQE) starts at 2013Q2. Covid-19 is at 2020Q1. *Source: Bank of Japan.*

14% recently.[34] The share of insurance companies and pension funds remained constant at around 20%. As a flip-side of the rise in the Bank of Japan's holdings, the share of banks fell from 38% to 13%, the share of public pensions declined from 9% to 4%, the share of households declined from around 4% to 1%, and the share of all other sectors declined from 11% to 3%.

The estimates of the marginal response by each sector in Japan are consistent with an outsized role by the central bank purchases, especially since the beginning of the QQE program until the Covid-19 crisis. During this period, the central bank bought 1.79 units of government bonds per unit of increase in the total amount outstanding of government bonds, that is, Bank of Japan purchases even exceeded the amounts of new debt placed by the government in markets. Banks, on the other hand, reduced their holdings by 0.92 units per unit of increase in government debt, suggesting that banks were the major sellers to the central bank in this episode. Since the Covid-19

[34]The rise in the role of foreign investors might be reflecting the arbitrage trade foreigners do to take advantage of covered interest parity deviations as they swap dollars for Japanese yen and invest those in (mostly short-term) Japanese government debt securities (see, for example, Rime et al., 2022)

Table IA.2: Average shares and marginal response by sectors over time in Japan

Panel (a): Average shares by sector over different periods

Avg. Share	CB	Banks	ICPF	ROW	PP	HH	Others
Pre-QQE	9.9	38.6	20.6	6.7	9.1	3.7	11.4
QQE	33.7	22.2	22.6	10.4	5	1.4	4.7
Post-Covid	45.4	12.8	20	13.5	3.8	1.1	3.4

Panel (b): Marginal holdings by sector over different periods

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
VARIABLES	CB	Banks	ICPF	PP	HH	ROW	Others
Pre-QQE * Pct. Ch. Gov. Debt	0.11	0.48***	0.26***	-0.05	0.01	0.03	0.16
	(0.12)	(0.07)	(0.09)	(0.05)	(0.04)	(0.07)	(0.14)
QQE * Pct. Ch. Gov. Debt	1.79***	-0.92***	0.14	-0.21***	-0.06**	0.15	0.11
	(0.22)	(0.19)	(0.14)	(0.07)	(0.03)	(0.13)	(0.25)
Post-Covid * Pct. Ch. Gov. Debt	0.41***	0.18***	0.14***	0.04**	0.00	0.16***	0.07
	(0.10)	(0.06)	(0.04)	(0.02)	(0.01)	(0.05)	(0.06)
Observations	77	77	77	77	77	77	77
R-squared	0.56	0.34	0.24	0.18	0.07	0.05	0.02

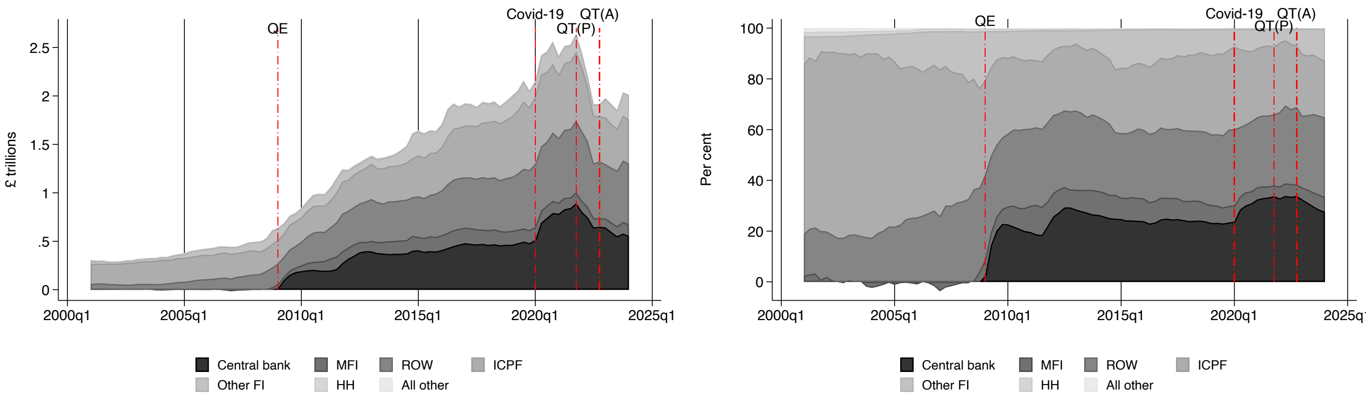
Note: Panel (a) shows the average share of each investor group over different time periods. Panel (b) reports the coefficients of the OLS regression of Equation 2 for Japan. Tha sample runs between 2005Q1-2024Q2. CB refers to the holdings of the Bank of Japan. Banks refer to commercial banks. ICPF refers to insurance companies and pension funds. ROW refers to foreign investors (official and private). PP refers to public pensions. HH refers to households. Others combine all other remaining sectors. Qualitative and quantitative easing (QQE) starts at 2013Q2. Covid-19 is at 2020Q1. Standard errors are robust to arbitrary heteroskedasticity and autocorrelation with the lag structure automatically selected using the Newey and West (1994) procedure. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. *Source: Bank of Japan*

crisis, the marginal response by each sector has become more balanced even as the marginal role of the central bank still remains the highest.

IA.I3 United Kingdom

The rate at which the share of the central bank has grown in UK debt markets following QE is only second to Japan. Since then, the share of the central bank has increased from essentially zero to roughly one third of the market (Table IA.3 Panel (a)). Similar to Japan, the share of foreign investors has also picked up from 24% to 30%. The share of insurance companies and pension funds dropped from around 62% to 24%. The share of banks increased to 5% and other financial institutions declined from 12% to 9%.

Figure IA.3: Total holdings and shares of different sectors - United Kingdom



(a) Total holdings

(b) Shares

Note: Panels IA.3(a) and IA.3(b) show the total market value of the government debt holdings and market shares of each sector in the United Kingdom, respectively, between 2001Q1 and 2024Q2 (quarterly data). Central bank refers to the holdings of the Bank of England. MFI refers to monetary financial institutions, such as banks and money market funds. Negative values for MFIs are due to market making activities. ROW refers to foreign investors (official and private). ICPF refers to insurance companies and pension funds. HH refers to households. All other refers to a combination of all other remaining sectors. QE starts in 2009Q1, Covid-19 is at 2020Q1, and QT starts in 2022Q1. *Source: Office for National Statistics.*

The marginal response by each sector, reported in Table IA.3 Panel (b), also shows that the Bank of England's balance sheet expanded with QE, the marginal response of the central bank to an additional unit of increase in the government debt rose to 39%. After March 2020, this response has further increased to 53%. It is, however, interesting to note that while the central bank gained market share mostly from insurance companies and pension funds initially, the pace of absorption of this sector of newly issued government bonds has increased compared to the pre-GFC period.

Table IA.3: Average shares and marginal response by sectors over time in the UK

Panel (a): Average shares by sector over different periods

Avg. Share	CB	ROW	ICPF	MFI	HH	OFI	AllOther
Pre-GFC	0	24.1	62.4	-.2	1.3	11.6	.8
Post-GFC	23.4	28.7	28.2	8.3	.5	10.7	.2
Post-Covid	30.3	27.9	28.9	5	.2	7.6	.1
Post-QT	31.5	30.1	24.4	5.2	.2	8.5	.1

Panel (b): Marginal holdings by sector over different periods

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
VARIABLES	CB	ROW	ICPF	MFI	HH	OFI	All Other
Pre-GFC * Pct. Ch. Gov. Debt	-0.00	0.20***	0.13***	0.20***	0.00	0.45***	0.00
	(0.08)	(0.03)	(0.04)	(0.03)	(0.00)	(0.05)	(0.00)
Post-GFC * Pct. Ch. Gov. Debt	0.39***	0.17***	0.22***	0.10***	0.00***	0.11	0.00
	(0.07)	(0.04)	(0.04)	(0.03)	(0.00)	(0.11)	(0.00)
Post-Covid * Pct. Ch. Gov. Debt	0.53***	0.12***	0.20***	-0.01	0.00***	0.14***	0.00
	(0.11)	(0.03)	(0.03)	(0.01)	(0.00)	(0.02)	(0.00)
Post-QT * Pct. Ch. Gov. Debt	0.31***	0.28***	0.27***	0.03***	0.00***	0.12***	-0.00
	(0.08)	(0.02)	(0.03)	(0.01)	(0.00)	(0.04)	(0.00)
Observations	92	92	92	92	92	92	92
R-squared	0.51	0.42	0.44	0.30	0.12	0.35	0.01

Note: Panel (a) shows the average share of each investor group over different time periods. Panel (b) reports the coefficients of the OLS regression of Equation 2 for the United Kingdom. The sample runs between 2001Q1-2024Q2. CB refers to the holdings of the Bank of England. MFI refers to monetary financial institutions, such as banks and money market funds. ROW refers to foreign investors (official and private). ICPF refers to insurance companies and pension funds. HH refers to households. All other refers to a combination of all other remaining sectors. Post-GFC starts in 2009Q1 and Covid-19 is in 2020Q1. QT starts in 2022Q1. Standard errors are robust to arbitrary heteroskedasticity and autocorrelation with the lag structure automatically selected using the Newey and West (1994) procedure. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. *Source: Office of National Statistics*

IA.II Estimation of elasticities of various sectors in other countries

In this section, we repeat our analysis for US Treasuries for Japanese and UK government bonds. Here, we do not repeat our analysis for the Euro area since we do not have quarterly data for the Euro area. In the main text, we thus resort to the results in Koijen et al. (2021) in order to provide a comparison.

We relegate these results to the Internet Appendix, because of several caveats making the elasticity estimation for Japan and the United Kingdom using our methodology not as reliable as the United States. Most importantly, there are not as many monetary policy shock measures for these jurisdictions. This makes the isolation of central bank information shocks difficult. Moreover, in most cases, we are not able to construct an instrument that yields a strong first stage. We report the results in this section, but these caveats should be taken into consideration while interpreting them.

IA.II1 Japan

For Japan, we use monetary policy shocks from Kubota and Shintani (2022) (henceforth, BOJ KS) and from Kearns et al. (2022) (henceforth BOJ KSX). Both studies use a high-frequency event study approach to isolate monetary policy surprises at different parts of the yield curve. Kubota and Shintani (2022) report surprises for the target monetary policy (short-end) and the path (the longer-end). Kearns et al. (2022) trace the high-frequency responses at 3-month, 2-year and 10-year segments of the yield curve following monetary policy announcements by the Bank of Japan. We take the 8-year zero coupon rates from Bloomberg.

We follow a similar approach as we did for the United States. We present the results of the first stage regressions with alternative monetary policy surprise instruments in Table IA.4. In the first column, we report the results using different shocks of BOJ KS individually. In the second column, we report the results using the shocks of BOJ KSX individually. In the third and fourth columns, we report the results with the first principal component of BOJ KS and BOJ KSX, respectively.

In the last column, we use the first principal component of all the shocks. All cases lead to a weak instruments problem.

While the caveats discussed above are important in interpreting results, we report the second stage results in Table IA.5 to facilitate some tentative comparison to our results for the United States. In order to make the sample period comparable to the one we reported for the United States, we report the second stage results using the PCA 1 BOJ (KSX). For Japan, we find that, the "Others" sector in the Flow of Funds, which comprises sectors other than the central bank, banks, insurance companies and private and public pension funds, and households, has the highest elasticity - though it is a rather small sector. Households also exhibit a high elasticity. Public pension funds and banks are also elastic investors. We find a higher point estimate for banks in Japan compared to those in the United States. We also find a somewhat higher point estimate for foreign investors (official and private combined) compared to the United States, it is, however, statistically insignificant. We find that insurance companies and private pension funds are inelastic investors in Japanese government bond markets.

Table IA.4: First-stage results with alternative specifications of monetary policy surprises for Japan

VARIABLES	(1) JP 8Y Yield (ZC)	(2) JP 8Y Yield (ZC)	(3) JP 8Y Yield (ZC)	(4) JP 8Y Yield (ZC)	(5) JP 8Y Yield (ZC)
BOJ KS Target	-0.0003***				
	(0.0001)				
BOJ KS Path	-0.0002				
	(0.0002)				
BOJ KSX 3m		-0.9889			
		(1.2214)			
BOJ KSX 2y		1.0840			
		(2.0802)			
BOJ KSX 10y		-1.5583*			
		(0.9186)			
PCA 1 BOJ (KS)			0.0008*		
			(0.0005)		
PCA 1 BOJ (KSX)				-0.0003*	
				(0.0002)	
PCA 1 BOJ (KS, KSX)					-0.0002***
					(0.0001)
Observations	60	77	60	77	60
R-squared	0.9471	0.9241	0.9454	0.9229	0.9451
Trend	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes
Sample	2005q2-2020q1	2005q2-2024q2	2005q2-2020q1	2005q2-2020q1	2005q2-2024q2
Effective F-stat	2.86	1.48	2.47	4.21	7.49
Crt. Val. $\alpha = 5\%$ and $\tau = 10\%$	13.06	16.83	23.11	23.11	23.11

Note: This table reports the coefficients of the first-stage regression for the second-stage Equation 5 estimated for Japan. The sample period varies depending on the availability of data across different monetary policy surprises and based on the availability of Flow of Funds data. All reported right-hand side variables are normalized. Controls include log GDP, GDP growth, inflation, log broad JPY index, log VIX, the quarterly return on the Nikkei stock index and the 8-year zero coupon US Treasury yield. Effective F-stat is calculated using the methodology in Olea and Pflueger (2013). The final row reports the critical values of a test of weak instruments with a 5% confidence level and a 10% worst-case bias. Standard errors are robust to arbitrary heteroskedasticity and autocorrelation with the lag structure automatically selected using the Newey and West (1994) procedure. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table IA.5: Yield elasticity of demand across different sectors in Japan

VARIABLES	(1) log(ROW)	(2) log(Banks)	(3) log(HH)	(4) log(ICPF)	(5) log(PP)	(6) log(Others)
JP 8Y Yield (ZC)	11.92	47.43**	74.35***	-1.70	61.87*	130.35***
	(28.79)	(21.95)	(15.36)	(11.53)	(35.18)	(43.21)
Observations	77	77	77	77	77	77
Trend	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Anderson-Rubin Wald test (p-val)	0.66	0.15	0.03	0.88	0.25	0.00
Underidentification LM stat (p-val)	0.12	0.12	0.12	0.12	0.12	0.11

Note: This table reports the coefficients of the second-stage regression specified in Equation (5) using PCA 1 BOJ (KSX) as an instrument for yields. The sample period is between 2005q2 and 2024q2. Controls include log GDP, GDP growth, inflation, log broad JPY index, log VIX, the quarterly return on the Nikkei stock index and the 8-year zero coupon US Treasury yield. Anderson-Rubin test has the null hypothesis that the estimated coefficient is equal to zero. The underidentification test has the null hypothesis that the model is underidentified. Standard errors are robust to arbitrary heteroskedasticity and autocorrelation with the lag structure automatically selected using the Newey and West (1994) procedure. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

IA.II2 United Kingdom

For the United Kingdom, we use monetary policy shocks from Braun et al. (2025) (henceforth, BOE BMAS) and from Kearns et al. (2022) (henceforth BOE KSX). Both studies use a high-frequency event study approach to isolate monetary policy surprises at different parts of the yield curve. Braun et al. (2025) report surprises for the target monetary policy (short-end), the path (the middle) and quantitative easing (the longer-end). Kearns et al. (2022) trace the high-frequency responses at 3-month, 2-year and 10-year segments of the yield curve following monetary policy announcements by the Bank of Japan. We take the 8-year zero coupon rates from Bloomberg.

We follow a similar approach as in the rest of the paper. We present the results of the first stage regressions with alternative monetary policy surprise instruments in Table IA.6. In the first column, we report the results using different shocks of BOE BMAS individually. In the second column, we report the results using the shocks of BOE KSX individually. In the third and fourth columns, we report the results with the first principal component of BOE BMAS and BOE KSX, respectively. In the fifth column, we use the first principal component of all the shocks. All cases lead to a weak instruments problem. In this case, however, we are able to resolve the weak instruments problem by using the QE surprises identified by Braun et al. (2025) (i.e. BOE BMAS QE). However, the problems due to the inclusion of information effects remain, and hence again the results should be interpreted with caution.

Keeping these caveats in mind, we report the second stage results in Table IA.7 to facilitate some tentative comparison to our results for the United States. We use the BOE BMAS QE as the instrument in the second stage. For the United Kingdom, we find a statistically significant downward-sloping demand function for foreign investors. We find that banks (classified as Monetary Financial Institutions - MFI) and households exhibit similar elasticity to foreigners. However, the estimate is statistically insignificant for these sectors. An interesting feature of UK government bond markets is we estimate upward sloping demand curves for the insurance company and pension fund (ICPF) sectors as well as Other Financial Institutions (OFI) which include investment funds. This result is similar to the finding of upward sloping demand curves for the ICPF sector in the Euro area (Koijen et al., 2021).

Upward-sloping demand curves in the context of financial assets can be due to several factors and can provide amplification of shocks in financial markets. ICPFs typically have long-duration liabilities and have to match them with long-duration, low-risk assets, such as government bonds (e.g. Domanski et al., 2017). Similarly, OFIs could receive inflows as other investors sell their government bonds to the central bank and they might invest these inflows further into government bond (e.g. Fang and Xiao, 2025). This would create a positive feedback loop pushing yields even further during QE periods and create feedback loops amplifying downward price pressures during QT periods. Such amplification dynamics could have played a role during the UK gilt crisis in 2022.

Table IA.6: First-stage results with alternative specifications of monetary policy surprises for the United Kingdom

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	UK 8Y Yield (ZC)	UK 8Y Yield (ZC)	UK 8Y Yield (ZC)	UK 8Y Yield (ZC)	UK 8Y Yield (ZC)	UK 8Y Yield (ZC)
BOE BMAS Path	-0.0001					
	(0.0001)					
BOE BMAS Target	0.0001					
	(0.0001)					
BOE BMAS QE	0.0002***					0.0002***
	(0.0001)					(0.0000)
BOE KSX 3m		1.5144				
		(1.0812)				
BOE KSX 2y		-0.9297***				
		(0.3099)				
BOE KSX 10y		1.8578***				
		(0.7211)				
PCA 1 BOE (BMAS)			-0.0008**			
			(0.0004)			
PCA 1 BOJ (KSX)				0.0001		
				(0.0005)		
PCA 1 BOE (BMAS, KSX)					-0.0004	
					(0.0006)	
Observations	79	79	79	79	79	79
R-squared	0.9312	0.9287	0.9265	0.9240	0.9245	0.9290
Trend	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Sample	2004q3-2024q1	2004q3-2024q1	2004q3-2024q1	2004q3-2024q1	2004q3-2024q1	2004q3-2024q1
Effective F-stat	3.11	2.07	4.89	0.06	0.37	31.94
Crt. Val. $\alpha = 5\%$ and $\tau = 10\%$	18.60	19.99	23.11	23.11	23.11	23.11

Note: This table reports the coefficients of the first-stage regression for the second-stage Equation 5 estimated for the United Kingdom. The sample period varies depending on the availability of data across different monetary policy surprises and based on the availability of Flow of Funds data. All reported right-hand side variables are normalized. Effective F-stat is calculated using the methodology in Olea and Pflueger (2013). The final row reports the critical values of a test of weak instruments with a 5% confidence level and a 10% worst-case bias. Standard errors are robust to arbitrary heteroskedasticity and autocorrelation with the lag structure automatically selected using the Newey and West (1994) procedure. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table IA.7: Yield elasticity of demand across different sectors in the United Kingdom

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	log(ROW)	log(MFI)	log(OFI)	log(HH)	log(ICPF)	log(Others)
UK 8Y Yield (ZC)	18.51**	18.28	-46.52*	15.23	-15.64***	0.71
	(8.55)	(30.27)	(25.87)	(9.80)	(5.62)	(24.82)
Observations	79	63	79	79	79	79
Trend	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Anderson-Rubin Wald test (p-val)	0.03	0.53	0.09	0.14	0.01	0.98
Underidentification LM stat (p-val)	0.08	0.24	0.08	0.02	0.08	0.06

Note: This table reports the coefficients of the second-stage regression specified in Equation (5) using BOE BMAS QE as an instrument for yields. The sample period is between 2004q3 and 2024q1. Controls include log GDP, GDP growth, inflation, log broad GBP index, log VIX, the quarterly return on the FTSE 100 stock index and the 8-year zero coupon US Treasury yield. Anderson-Rubin test has the null hypothesis that the estimated coefficient is equal to zero. The underidentification test has the null hypothesis that the model is underidentified. Standard errors are robust to arbitrary heteroskedasticity and autocorrelation with the lag structure automatically selected using the Newey and West (1994) procedure. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

IA.III Additional tables and figures

IA.III1 Results with all controls

In this section, we report the full estimation results of the first stage and the second stages of Equation (5), where Table IA.8 reports the first-stage and Table IA.10 reports the second stage, and Equation (6), where Table IA.9 reports the first-stage and Table IA.11 reports the second stage.

In particular, the elasticities with respect to the other variables included in the regressions give further information on the investment behaviors of various sectors. For example, the coefficient in the second stage for the 5-year German yield is negative, consistent with it being defined as the outside asset. In addition, for many sectors the coefficient for log GDP is negative suggesting lower holdings of Treasuries in boom periods.

Table IA.8: First-stage results with alternative specifications of monetary policy surprises - Full results with control variables

VARIABLES	(1) 8Y Yield (ZC)	(2) 8Y Yield (ZC)	(3) 8Y Yield (ZC)	(4) 8Y Yield (ZC)	(5) 8Y Yield (ZC)	(6) 8Y Yield (ZC)	(7) 8Y Yield (ZC)
Swanson FFR	0.0012***						
	(0.0003)						
Swanson FG	0.0006**						
	(0.0003)						
Swanson LSAP	-0.0002						
	(0.0002)						
BRW		0.0005**					
		(0.0002)					
KSX (3M)			0.0009***				
			(0.0003)				
KSX (2Y)			0.0001				
			(0.0002)				
KSX (10Y)			0.0006**				
			(0.0002)				
JK MP				0.0012***			
				(0.0003)			
Nakamura-Steinsson					0.0012***		
					(0.0002)		
PCA 1 (JK MP, BRW, KSX)						0.0011***	
						(0.0001)	
PCA 1 (JK MP, BRW, KSX, NS)							0.0012***
							(0.0001)
log GDP	-0.0340	0.0353	0.0498	0.0431	0.0407	0.0435	0.0412
	(0.0485)	(0.0536)	(0.0488)	(0.0516)	(0.0481)	(0.0509)	(0.0489)
GDP growth	0.1676***	0.0265	0.0137	0.0175	0.0194	0.0182	0.0181
	(0.0430)	(0.0484)	(0.0442)	(0.0437)	(0.0437)	(0.0450)	(0.0448)
inflation	-0.0885	-0.0404	-0.0189	-0.0697	-0.0717	-0.0384	-0.0506
	(0.0587)	(0.0691)	(0.0576)	(0.0618)	(0.0813)	(0.0575)	(0.0792)
log broad dollar index	0.0404**	0.0462***	0.0491***	0.0478***	0.0507***	0.0487***	0.0513***
	(0.0177)	(0.0091)	(0.0090)	(0.0102)	(0.0101)	(0.0096)	(0.0109)
log VIX	-0.0027*	-0.0069***	-0.0056***	-0.0066***	-0.0069***	-0.0062***	-0.0065***
	(0.0016)	(0.0008)	(0.0006)	(0.0006)	(0.0008)	(0.0006)	(0.0007)
5Y German yield (zc)	0.8607***	0.7374***	0.7071***	0.7021***	0.7932***	0.7215***	0.7839***
	(0.1241)	(0.1259)	(0.1210)	(0.1289)	(0.1190)	(0.1237)	(0.1205)
trend	-0.0008	0.0019**	0.0019**	0.0019**	0.0023***	0.0020***	0.0023**
	(0.0015)	(0.0008)	(0.0008)	(0.0008)	(0.0009)	(0.0008)	(0.0009)
trend squared	0.0000	-0.0000***	-0.0000***	-0.0000***	-0.0000***	-0.0000***	-0.0000***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Observations	60	80	80	80	73	80	73
R-squared	0.9207	0.9038	0.9083	0.9078	0.9030	0.9085	0.9045
Sample	1994q2-2019q2	1994q2-2024q2	2004q3-2024q2	1994q2-2024q2	2004q3-2022q3	2004q3-2024q2	2004q3-2022q3
Effective F-stat	4.84	4.46	8.33	13.71	45.60	47.01	68.65
Crt. Val. $\alpha = 5\%$ and $\tau = 10\%$	15.15	23.11	18.68	23.11	23.11	23.11	23.11

Note: This table reports the coefficients of the first-stage regression for the second-stage Equation 5. The sample period varies depending on the availability of data across different monetary policy surprises. All reported right-hand side variables are normalized. Effective F-stat is calculated using the methodology in Olea and Pflueger (2013). The final row reports the critical values of a test of weak instruments with a 5% confidence level and a 10% worst-case bias. Standard errors are robust to arbitrary heteroskedasticity and autocorrelation with the lag structure automatically selected using the Newey and West (1994) procedure. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table IA.9: First-stage results with alternative specifications of monetary policy surprises - using information on outside asset - with control variables

VARIABLES	(1) 8Y Yield (ZC)	(2) 8Y Yield (ZC)	(3) 8Y Yield (ZC)	(4) 8Y Yield (ZC)	(5) 8Y Yield (ZC)	(6) 8Y Yield (ZC)	(7) 8Y Yield (ZC)
Swanson FFR	0.0022***						
	(0.0006)						
Swanson FG	0.0005						
	(0.0005)						
Swanson LSAP	-0.0008						
	(0.0005)						
BRW		0.0001					
		(0.0003)					
KSX (3M)			0.0016***				
			(0.0004)				
KSX (2Y)			-0.0003				
			(0.0004)				
KSX (10Y)			0.0010**				
			(0.0004)				
JK MP				0.0018***			
				(0.0005)			
Nakamura-Steinsson					0.0012**		
					(0.0005)		
PCA 1 (JK MP, BRW, KSX)						0.0013***	
						(0.0002)	
PCA 1 (JK MP, BRW, KSX, NS)							0.0014***
							(0.0004)
log GDP	0.1533**	0.2092***	0.2201***	0.2111***	0.1852***	0.2158***	0.1851***
	(0.0601)	(0.0397)	(0.0313)	(0.0352)	(0.0328)	(0.0361)	(0.0329)
GDP growth	0.0437	-0.0374	-0.0718***	-0.0492	-0.0286	-0.0538	-0.0348
	(0.0847)	(0.0454)	(0.0278)	(0.0332)	(0.0394)	(0.0360)	(0.0382)
Inflation	-0.0008	-0.0021**	-0.0014	-0.0024**	-0.0011	-0.0020**	-0.0008
	(0.0009)	(0.0009)	(0.0009)	(0.0010)	(0.0008)	(0.0009)	(0.0007)
log broad dollar index	0.0165	0.0226**	0.0266***	0.0267***	0.0326**	0.0252***	0.0333***
	(0.0174)	(0.0106)	(0.0090)	(0.0095)	(0.0135)	(0.0095)	(0.0123)
trend	-0.0042*	-0.0026**	-0.0024***	-0.0023**	-0.0013	-0.0024**	-0.0013
	(0.0022)	(0.0010)	(0.0008)	(0.0010)	(0.0009)	(0.0009)	(0.0009)
trend squared	0.0000	0.0000	-0.0000	-0.0000	-0.0000	-0.0000	-0.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Observations	60	80	80	80	73	80	73
R-squared	0.8010	0.7909	0.8132	0.8045	0.7913	0.8026	0.7975
Sample	1994q2-2019q2	1994q2-2024q2	2004q3-2024q2	1994q2-2024q2	2004q3-2022q3	2004q3-2024q2	2004q3-2022q3
Effective F-stat	2.65	0.17	7.89	12.07	8.05	25.62	18.58
Crt. Val. $\alpha = 5\%$ and $\tau = 10\%$	16.85	23.11	16.04	23.11	23.11	23.11	23.11

Note: This table reports the coefficients of the first-stage regression for the second-stage Equation 6. The sample period varies depending on the availability of data across different monetary policy surprises. All reported right-hand side variables are normalized. Effective F-stat is calculated using the methodology in Olea and Pflueger (2013). The final row reports the critical values of a test of weak instruments with a 5% confidence level and a 10% worst-case bias. Standard errors are robust to arbitrary heteroskedasticity and autocorrelation with the lag structure automatically selected using the Newey and West (1994) procedure. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table IA.10: Yield elasticity of demand across different sectors in the United States: Second stage results - Panel (a) of Table 4 - with control variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
VARIABLES	log(ROW Off)	log(ROW Pri)	log(IF)	log(Banks)	log(PF)	log(IC)	log(SLG)
8Y Yield (ZC)	1.53	19.31*	22.04***	32.76***	10.85*	12.42***	1.51
	(7.01)	(9.93)	(6.73)	(11.38)	(5.79)	(3.76)	(9.40)
log GDP	-1.31*	-0.71	-1.80***	-4.41***	-0.51	-2.09***	-0.07
	(0.76)	(0.90)	(0.49)	(1.06)	(0.78)	(0.43)	(0.79)
GDP growth	0.38	-0.79	0.73*	2.04**	-0.22	0.38	0.49
	(0.44)	(0.83)	(0.42)	(0.83)	(0.52)	(0.44)	(0.66)
inflation	0.18	2.47**	3.45***	8.06***	1.94	0.44	4.22
	(0.94)	(1.22)	(1.27)	(2.48)	(1.57)	(1.58)	(3.35)
log broad dollar index	-1.27***	-1.21***	-1.21***	-1.84**	-1.19***	-0.94***	-1.18*
	(0.31)	(0.46)	(0.36)	(0.72)	(0.30)	(0.32)	(0.71)
log VIX	-0.04	0.07	0.06	0.14	0.01	-0.04	-0.01
	(0.06)	(0.08)	(0.06)	(0.13)	(0.07)	(0.03)	(0.07)
5Y German yield (zc)	-2.17	-16.75**	-20.92***	-26.54***	-14.63***	-11.24***	5.65
	(4.50)	(7.40)	(4.25)	(7.69)	(4.31)	(3.16)	(7.69)
trend	0.15***	-0.01	0.03**	-0.12***	-0.08***	-0.05***	-0.04
	(0.02)	(0.03)	(0.02)	(0.04)	(0.02)	(0.01)	(0.04)
trend squared	-0.00***	0.00	0.00	0.00***	0.00***	0.00***	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Observations	80	80	80	80	80	80	80
Anderson-Rubin Wald test (p-val)	0.83	0.03	0.00	0.00	0.05	0.00	0.87
Underidentification LM stat (p-val)	0.06	0.06	0.06	0.06	0.06	0.06	0.06

Note: This table reports the coefficients of the second-stage regression specified in Equation (5) using PCA 1 (JP MP, BRW, KSX) as an instrument for yields. The sample period is between 2004q3 and 2024q2. Anderson-Rubin test has the null hypothesis that the estimated coefficient is equal to zero. The underidentification test has the null hypothesis that the model is underidentified. Standard errors are robust to arbitrary heteroskedasticity and autocorrelation with the lag structure automatically selected using the Newey and West (1994) procedure. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table IA.11: Yield elasticity of demand across different sectors in the United States: Second stage results - Panel (b) of Table 4 - with control variables

	(1)	(2)	(3)	(4)	(5)
VARIABLES	log(IF)-log(DebtOA$_{IF}$)	log(Banks)-log(DebtOA$_{Banks}$)	log(PF)-log(DebtOA$_{PF}$)	log(IC)-log(DebtOA$_{IC}$)	log(SLG)-log(DebtOA$_{SLG}$)
8Y Yield (ZC)	20.09***	33.34***	12.70***	12.72***	6.10
	(5.45)	(6.13)	(4.16)	(3.92)	(7.87)
log GDP	-4.67***	-10.24***	-3.54***	-3.32***	-0.54
	(1.15)	(1.78)	(1.02)	(1.20)	(1.62)
GDP growth	1.88***	4.94***	1.28***	1.30***	0.37
	(0.55)	(1.50)	(0.43)	(0.47)	(0.38)
Inflation	0.07***	0.08**	0.02	0.01	0.06
	(0.03)	(0.04)	(0.02)	(0.01)	(0.05)
log broad dollar index	0.55**	-0.47	-0.64	-0.19	-1.40**
	(0.24)	(0.54)	(0.43)	(0.27)	(0.58)
trend	0.13***	0.07	0.00	0.04***	-0.07*
	(0.02)	(0.05)	(0.02)	(0.01)	(0.04)
trend squared	-0.00***	0.00	0.00*	0.00	0.00**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Observations	80	80	80	80	80
Controls	X	X	X	X	X
Anderson-Rubin Wald test (p-val)	0.000	0.000	0.001	0.001	0.441
Underidentification LM stat (p-val)	0.090	0.090	0.090	0.090	0.090

Note: This table reports the coefficients of the second-stage regression specified in Equation (6) using PCA 1 (JP MP, BRW, KSX) as an instrument for yields. The sample period is between 2004q3 and 2024q2. Anderson-Rubin test has the null hypothesis that the estimated coefficient is equal to zero. The underidentification test has the null hypothesis that the model is underidentified. Standard errors are robust to arbitrary heteroskedasticity and autocorrelation with the lag structure automatically selected using the Newey and West (1994) procedure. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

IA.III2 Sensitivity to variables used in X_t and W_t

We repeat the baseline regression where we use a broader set of covariates in the characteristics vector ($\mathbf{X_t}$) and the outside asset proxies ($\mathbf{W_t}$). We use log GDP, GDP growth, inflation, log broad dollar index and the total face value of outstanding Treasuries in the asset characteristics vector $\mathbf{X_t}$, and we use log VIX, AAA bond spread, 5-year (zero-coupon) German government bond yield, S&P 500 dividend yield for the outside asset specification $\mathbf{W_t}$. The results, reported in Table IA.12 are similar to those in the baseline regression.

In Table IA.13, we keep the $\mathbf{X_t}$ and $\mathbf{W_t}$ as in the baseline regression, but use a linear trend instead of a quadratic trend. The results are again similar.

In Table IA.14, we lag all control variables used in the regression. The ordering of the sectors remains similar, though the point estimates somewhat decrease.

Table IA.12: Second stage: Broader set of controls

VARIABLES	(1) log(ROW Off)	(2) log(ROW Pri)	(3) log(IF)	(4) log(Banks)	(5) log(PF)	(6) log(IC)	(7) log(SLG)
8Y Yield (ZC)	3.48	25.47***	20.87***	25.11**	9.43	14.77***	-1.47
	(5.59)	(9.06)	(8.03)	(9.88)	(6.99)	(4.37)	(9.49)
log GDP	-0.35	-0.55	-0.90	-0.37	-1.09*	-1.85***	2.49***
	(0.46)	(1.07)	(0.79)	(1.11)	(0.58)	(0.51)	(0.66)
GDP growth	0.31	-0.45	0.44	0.05	-0.02	0.61**	-0.90***
	(0.29)	(0.56)	(0.42)	(0.60)	(0.27)	(0.27)	(0.34)
Inflation	-0.01	0.02	0.03	0.05**	0.03*	0.00	0.02
	(0.01)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.02)
log broad dollar index	-0.57**	-0.90	-0.66	0.64	-1.63***	-0.72	0.48
	(0.29)	(1.01)	(0.68)	(0.77)	(0.32)	(0.47)	(0.36)
log UST (fv)	0.84***	0.81*	0.42**	1.29***	-0.43***	0.51***	0.88***
	(0.07)	(0.49)	(0.21)	(0.39)	(0.08)	(0.12)	(0.26)
log VIX	-0.02	0.05	0.09*	0.31***	-0.00	-0.05	0.09**
	(0.04)	(0.06)	(0.06)	(0.07)	(0.08)	(0.03)	(0.05)
ICE BofA OAS AAA	0.64	6.56	-1.53	2.70	-4.74*	-1.09	9.63
	(1.87)	(7.87)	(3.75)	(5.69)	(2.49)	(2.71)	(8.28)
5Y German yield (zc)	-2.78	-19.89***	-20.01***	-22.03***	-13.86***	-12.14***	7.14
	(4.53)	(6.55)	(6.77)	(7.74)	(4.88)	(3.50)	(6.95)
SP500 dividend yield	3.37	7.70	-3.73	-53.92***	9.04	12.38	-48.21***
	(2.76)	(20.64)	(11.16)	(12.56)	(7.06)	(8.43)	(15.28)
trend	0.12***	-0.06*	0.03	-0.02	-0.08***	-0.09***	0.05*
	(0.01)	(0.04)	(0.04)	(0.05)	(0.03)	(0.03)	(0.03)
trend squared	-0.00***	0.00	-0.00	0.00	0.00***	0.00***	-0.00**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Observations	80	80	80	80	80	80	80
Anderson-Rubin Wald test (p-val)	0.51	0.01	0.00	0.00	0.15	0.00	0.88
Underidentification LM stat (p-val)	0.09	0.09	0.01	0.02	0.09	0.09	0.09

Note: This table reports the coefficients of the second-stage regression specified in Equation (5) using PCA 1 (JK MP, BRW, KSX) as an instrument for yields, where we use log GDP, GDP growth, inflation, log broad dollar index and the total face value of outstanding Treasuries in the asset characteristics vector $\mathbf{X_t}$, and we use log VIX, AAA bond spread, 5-year (zero-coupon) German government bond yield, S&P 500 dividend yield for the outside asset specification $\mathbf{W_t}$. The sample period is between 2004q3 and 2024q2. Anderson-Rubin test has the null hypothesis that the estimated coefficient is equal to zero. The underidentification test has the null hypothesis that the model is underidentified. Standard errors are robust to arbitrary heteroskedasticity and autocorrelation with the lag structure automatically selected using the Newey and West (1994) procedure. *** p<0.01, ** p<0.05, * p<0.1.

Table IA.13: Second stage: Linear trend

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
VARIABLES	log(ROW Off)	log(ROW Pri)	log(IF)	log(Banks)	log(PF)	log(IC)	log(SLG)
8Y Yield (ZC)	-10.10	23.19*	24.33***	53.40***	21.27***	20.68***	7.64
	(10.08)	(13.25)	(7.19)	(13.21)	(6.57)	(6.04)	(12.43)
log GDP	-1.61	-0.61	-1.75***	-3.89*	-0.25	-1.88**	0.09
	(1.44)	(1.03)	(0.59)	(2.07)	(1.44)	(0.83)	(1.00)
GDP growth	-0.15	-0.62	0.84**	2.98**	0.26	0.76	0.77
	(0.78)	(0.97)	(0.43)	(1.20)	(0.95)	(0.65)	(0.47)
inflation	-2.51	3.37***	3.98***	12.83***	4.35***	2.35*	5.63
	(2.20)	(1.20)	(1.31)	(3.85)	(1.55)	(1.41)	(4.73)
log broad dollar index	-1.85***	-1.01***	-1.10***	-0.80	-0.66**	-0.52	-0.88**
	(0.43)	(0.30)	(0.30)	(0.60)	(0.33)	(0.37)	(0.44)
log VIX	-0.13	0.10	0.08	0.29**	0.09	0.02	0.04
	(0.08)	(0.10)	(0.07)	(0.14)	(0.08)	(0.05)	(0.10)
5Y German yield (zc)	0.72	-17.72**	-21.49***	-31.67***	-17.22***	-13.30**	4.12
	(7.67)	(8.80)	(4.22)	(9.18)	(3.77)	(5.75)	(7.46)
trend	0.04**	0.03***	0.05***	0.08***	0.02	0.03***	0.02**
	(0.02)	(0.01)	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)
Observations	80	80	80	80	80	80	80
Anderson-Rubin Wald test (p-val)	0.31	0.06	0.00	0.00	0.00	0.00	0.54
Underidentification LM stat (p-val)	0.07	0.07	0.07	0.07	0.07	0.07	0.07

Note: This table reports the coefficients of the second-stage regression specified in Equation (5) using PCA 1 (JK MP, BRW, KSX) as an instrument for yields. The difference between this table and the Panel (a) of Table 4 is that we use a linear trend instead of a quadratic trend. The sample period is between 2004q3 and 2024q2. Anderson-Rubin test has the null hypothesis that the estimated coefficient is equal to zero. The underidentification test has the null hypothesis that the model is underidentified. Standard errors are robust to arbitrary heteroskedasticity and autocorrelation with the lag structure automatically selected using the Newey and West (1994) procedure. *** p<0.01, ** p<0.05, * p<0.1.

Table IA.14: Second stage: Lagged controls

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
VARIABLES	log(ROW Off)	log(ROW Pri)	log(IF)	log(Banks)	log(PF)	log(IC)	log(SLG)
8Y Yield (ZC)	4.73*	11.26***	12.93***	16.98***	3.72*	9.37***	8.15**
	(2.46)	(4.29)	(2.04)	(4.04)	(1.91)	(2.64)	(3.52)
Observations	79	79	79	79	79	79	79
Controls	**Lagged X and Lagged W**	**Lagged X and Lagged W**	**Lagged X and Lagged W**	**Lagged X and Lagged W**	**Lagged X and Lagged W**	**Lagged X and Lagged W**	**Lagged X and Lagged W**
Anderson-Rubin Wald test (p-val)	0.11	0.00	0.00	0.00	0.08	0.00	0.08
Underidentification LM stat (p-val)	0.05	0.06	0.06	0.06	0.06	0.06	0.06

Note: This table reports the coefficients of the second-stage regression specified in Equation (5) using PCA 1 (JK MP, BRW, KSX) as an instrument for yields. The difference between this table and the Panel (a) of Table 4 is that we use lag all control variables by one quarter. The sample period is between 2004q3 and 2024q2. Anderson-Rubin test has the null hypothesis that the estimated coefficient is equal to zero. The underidentification test has the null hypothesis that the model is underidentified. Standard errors are robust to arbitrary heteroskedasticity and autocorrelation with the lag structure automatically selected using the Newey and West (1994) procedure. *** p<0.01, ** p<0.05, * p<0.1.

IA.III3 Robustness checks - second stage: using the PCA of JK MP, BRW, KSX and NS surprises as instruments

In this section, we use the PCA 1 (JK MP, BRW, KSX, NS) as an instrument for yields. The first-stage estimation using this instrument corresponds to the last column of the first-stage regressions in Table 2.

Table IA.15: Second stage: using the PCA of JK MP, BRW, KSX and NS surprises as instruments

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
VARIABLES	log(ROW Off)	log(ROW Pri)	log(IF)	log(Banks)	log(PF)	log(IC)	log(SLG)
8Y Yield (ZC)	6.32	23.43**	22.94***	31.42***	4.93**	16.60***	0.48
	(5.27)	(9.22)	(3.69)	(6.80)	(2.29)	(2.78)	(6.22)
Observations	73	73	73	73	73	73	73
Anderson-Rubin Wald test (p-val)	0.22	0.00	0.00	0.00	0.04	0.00	0.94
Underidentification LM stat (p-val)	0.09	0.09	0.09	0.09	0.09	0.09	0.09

Note: This table reports the coefficients of the second-stage regression specified in Equation (5) using PCA 1 (JK MP, BRW, KSX, NS) as an instrument for yields. The sample period is between 2004q3 and 2022q3 (due to unavailability of the NS shocks after 2022q3). Anderson-Rubin test has the null hypothesis that the estimated coefficient is equal to zero. The underidentification test has the null hypothesis that the model is underidentified. Standard errors are robust to arbitrary heteroskedasticity and autocorrelation with the lag structure automatically selected using the Newey and West (1994) procedure. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

IA.III4 Robustness checks - second stage: using the residuals from the regression of the PCA 1 (JK MP, BRW, KSX) on JK Central Bank Information Shocks

In this section, we use the residuals from the regression of PCA 1 (JK MP, BRW, KSX) on JK Central Bank Information shocks as an instrument for yields.

Table IA.16: Second stage:second stage: using the residuals from the regression of the PCA 1 (JK MP, BRW, KSX) on JK Central Bank Information Shocks

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
VARIABLES	log(ROW Off)	log(ROW Pri)	log(IF)	log(Banks)	log(PF)	log(IC)	log(SLG)
8Y Yield (ZC)	0.99	17.76*	21.69***	32.39***	10.91*	11.91***	0.67
	(7.24)	(9.75)	(6.94)	(11.55)	(5.88)	(3.73)	(9.51)
Observations	80	80	80	80	80	80	80
Anderson-Rubin Wald test (p-val)	0.89	0.05	0.00	0.00	0.05	0.00	0.94
Underidentification LM stat (p-val)	0.06	0.06	0.06	0.06	0.06	0.06	0.06

Note: This table reports the coefficients of the second-stage regression specified in Equation (5) using the residuals from the regression of the PCA 1 (JK MP, BRW, KSX) on JK Central Bank Information Shocks as an instrument for yields. The sample period is between 2004q3 and 2024q2. Anderson-Rubin test has the null hypothesis that the estimated coefficient is equal to zero. The underidentification test has the null hypothesis that the model is underidentified. Standard errors are robust to arbitrary heteroskedasticity and autocorrelation with the lag structure automatically selected using the Newey and West (1994) procedure. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

IA.III5 Robustness checks - second stage: two principal components as instruments

In Table IA.17, we report the results of the second stage when we instrument for yields with the first two principal componets of all monetary policy surprises instead of only the first one reported in the baseline regressions. The results are similar.

Table IA.17: Second stage: The first two principal components as instruments

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
VARIABLES	log(ROW Off)	log(ROW Pri)	log(IF)	log(Banks)	log(PF)	log(IC)	log(SLG)
8Y Yield (ZC)	8.49*	25.36**	25.59***	34.31***	8.78*	18.51***	4.80
	(4.81)	(10.87)	(4.96)	(9.28)	(4.62)	(7.10)	(9.19)
Observations	80	80	80	80	80	80	80
Controls	**X and W**	**X and W**	**X and W**	**X and W**	**X and W**	**X and W**	**X and W**
Anderson-Rubin Wald test (p-val)	0.00	0.00	0.00	0.01	0.13	0.00	0.23
Underidentification LM stat (p-val)	0.16	0.16	0.14	0.16	0.16	0.03	0.16
Hansen J stat (p-val)	0.19	0.19	0.33	0.68	0.29	0.11	0.18

Note: This table reports the coefficients of the second-stage regression specified in Equation (5) using PCA 1 (JK MP, BRW, KSX) and PCA 2 (JK MP, BRW, KSX) as instruments for yields. The sample period is between 2004q3 and 2024q2. Anderson-Rubin test has the null hypothesis that the estimated coefficient is equal to zero. The underidentification test has the null hypothesis that the model is underidentified. Hansen J-statistic test has the null hypothesis that the model is overidentified. Standard errors are robust to arbitrary heteroskedasticity and autocorrelation with the lag structure automatically selected using the Newey and West (1994) procedure. *** p<0.01, ** p<0.05, * p<0.1.

IA.III6 Robustness checks - second stage: Alternative valuation adjustments

In this section, we report the results of the baseline regressions when we assume a modified duration of 5 (Table IA.18) and 10 (Table IA.19) in the holdings of sectors when we make valuation adjustments to the left-hand side variables of the second stage.

Table IA.18: Second stage: Valuation adjustments with 5 year

VARIABLES	(1) log(ROW Off)	(2) log(ROW Pri)	(3) log(IF)	(4) log(Banks)	(5) log(PF)	(6) log(IC)	(7) log(SLG)
8Y Yield (ZC)	-0.21	17.69*	20.18***	30.81***	9.13*	10.65***	-0.28
	(6.40)	(9.21)	(5.96)	(10.73)	(4.92)	(3.46)	(8.89)
Observations	80	80	80	80	80	80	80
Controls	**X and W**	**X and W**	**X and W**	**X and W**	**X and W**	**X and W**	**X and W**
Anderson-Rubin Wald test (p-val)	0.97	0.03	0.00	0.00	0.05	0.00	0.97
Underidentification LM stat (p-val)	0.06	0.06	0.06	0.06	0.06	0.06	0.06

Note: This table reports the coefficients of the second-stage regression specified in Equation (5) using PCA 1 (JK MP, BRW, KSX) as an instrument for yields. The difference between this table and the Panel (a) of Table 4 is that we assume a modified duration of 5 in the portfolios while making the valuation adjustments. The sample period is between 2004q3 and 2024q2. Anderson-Rubin test has the null hypothesis that the estimated coefficient is equal to zero. The underidentification test has the null hypothesis that the model is underidentified. Standard errors are robust to arbitrary heteroskedasticity and autocorrelation with the lag structure automatically selected using the Newey and West (1994) procedure. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table IA.19: Second stage: Valuation adjustments with 10 year

VARIABLES	(1) log(ROW Off)	(2) log(ROW Pri)	(3) log(IF)	(4) log(Banks)	(5) log(PF)	(6) log(IC)	(7) log(SLG)
8Y Yield (ZC)	2.28	19.96*	22.85***	33.64***	11.57*	13.16***	2.29
	(7.42)	(10.48)	(7.25)	(11.79)	(6.38)	(4.17)	(9.73)
Observations	80	80	80	80	80	80	80
Controls	**X and W**	**X and W**	**X and W**	**X and W**	**X and W**	**X and W**	**X and W**
Anderson-Rubin Wald test (p-val)	0.76	0.03	0.00	0.00	0.06	0.00	0.81
Underidentification LM stat (p-val)	0.06	0.06	0.06	0.06	0.06	0.06	0.06

Note: This table reports the coefficients of the second-stage regression specified in Equation (5) using PCA 1 (JK MP, BRW, KSX) as an instrument for yields. The difference between this table and the Panel (a) of Table 4 is that we assume a modified duration of 10 in the portfolios while making the valuation adjustments. The sample period is between 2004q3 and 2024q2. Anderson-Rubin test has the null hypothesis that the estimated coefficient is equal to zero. The underidentification test has the null hypothesis that the model is underidentified. Standard errors are robust to arbitrary heteroskedasticity and autocorrelation with the lag structure automatically selected using the Newey and West (1994) procedure. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

IA.III7 Robustness checks - second stage: Alternative yields

In this section, we report the results of the baseline regressions when we use 5-year zero-coupon yields (Table IA.20) and 10-year zero-coupon yields (Table IA.21) to estimate elasticities. The results remain similar.

Table IA.20: Second stage: using 5 year yield

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
VARIABLES	log(ROW Off)	log(ROW Pri)	log(IF)	log(Banks)	log(PF)	log(IC)	log(SLG)
5Y Yield (ZC)	1.09	13.78*	15.73***	23.38***	7.74**	8.86***	1.08
	(4.99)	(7.22)	(4.65)	(7.50)	(3.95)	(2.57)	(6.70)
Observations	80	80	80	80	80	80	80
Controls	**X and W**	**X and W**	**X and W**	**X and W**	**X and W**	**X and W**	**X and W**
Anderson-Rubin Wald test (p-val)	0.83	0.03	0.00	0.00	0.05	0.00	0.87
Underidentification LM stat (p-val)	0.05	0.05	0.05	0.05	0.05	0.05	0.05

Note: This table reports the coefficients of the second-stage regression specified in Equation (5) using PCA 1 (JK MP, BRW, KSX) as an instrument for yields. The difference between this table and the Panel (a) of Table 4 is that we use the 5-year zero-coupon yield on the right-hand side instead of the 8-year zero-coupon yield in Table 4. The sample period is between 2004q3 and 2024q2. Anderson-Rubin test has the null hypothesis that the estimated coefficient is equal to zero. The underidentification test has the null hypothesis that the model is underidentified. Standard errors are robust to arbitrary heteroskedasticity and autocorrelation with the lag structure automatically selected using the Newey and West (1994) procedure. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table IA.21: Second stage: using 10 year yield

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
VARIABLES	log(ROW Off)	log(ROW Pri)	log(IF)	log(Banks)	log(PF)	log(IC)	log(SLG)
10Y Yield (ZC)	1.87	23.61*	26.95***	40.06**	13.27*	15.18***	1.84
	(8.60)	(12.36)	(8.99)	(15.69)	(7.55)	(5.10)	(11.52)
Observations	80	80	80	80	80	80	80
Controls	**X and W**	**X and W**	**X and W**	**X and W**	**X and W**	**X and W**	**X and W**
Anderson-Rubin Wald test (p-val)	0.83	0.03	0.00	0.00	0.05	0.00	0.87
Underidentification LM stat (p-val)	0.07	0.07	0.07	0.07	0.07	0.07	0.07

Note: This table reports the coefficients of the second-stage regression specified in Equation (5) using PCA 1 (JK MP, BRW, KSX) as an instrument for yields. The difference between this table and the Panel (a) of Table 4 is that we use the 10-year zero-coupon yield on the right-hand side instead of the 8-year zero-coupon yield in Table 4. The sample period is between 2004q3 and 2024q2. Anderson-Rubin test has the null hypothesis that the estimated coefficient is equal to zero. The underidentification test has the null hypothesis that the model is underidentified. Standard errors are robust to arbitrary heteroskedasticity and autocorrelation with the lag structure automatically selected using the Newey and West (1994) procedure. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

IA.III8 Robustness checks - second stage: Alternative yields and valuation adjustments

In this section, we report the results of the baseline regressions when we use 5-year zero-coupon yields and valuation adjmustments (Table IA.22) and 10-year zero-coupon yields and valuation adjustments (Table IA.23) to estimate elasticities. The results remain similar.

Table IA.22: Second stage: using 5 year yield and valuation adjustments

VARIABLES	(1) log(ROW Off)	(2) log(ROW Pri)	(3) log(IF)	(4) log(Banks)	(5) log(PF)	(6) log(IC)	(7) log(SLG)
5Y Yield (ZC)	-0.15	12.62*	14.40***	21.99***	6.52**	7.60***	-0.20
	(4.57)	(6.66)	(3.99)	(6.95)	(3.29)	(2.29)	(6.35)
Observations	80	80	80	80	80	80	80
Controls	**X and W**	**X and W**	**X and W**	**X and W**	**X and W**	**X and W**	**X and W**
Anderson-Rubin Wald test (p-val)	0.97	0.03	0.00	0.00	0.05	0.00	0.97
Underidentification LM stat (p-val)	0.05	0.05	0.05	0.05	0.05	0.05	0.05

Note: This table reports the coefficients of the second-stage regression specified in Equation (5) using PCA 1 (JK MP, BRW, KSX) as an instrument for yields. The difference between this table and the Panel (a) of Table 4 is that we use the 5-year zero-coupon yield on the right-hand side instead of the 8-year zero-coupon yield in Table 4 and do the valuation adjustments based on a 5-year duration rather than 8-year duration. The sample period is between 2004q3 and 2024q2. Anderson-Rubin test has the null hypothesis that the estimated coefficient is equal to zero. The underidentification test has the null hypothesis that the model is underidentified. Standard errors are robust to arbitrary heteroskedasticity and autocorrelation with the lag structure automatically selected using the Newey and West (1994) procedure. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table IA.23: Second stage: using 10 year yield and valuation adjustments

VARIABLES	(1) log(ROW Off)	(2) log(ROW Pri)	(3) log(IF)	(4) log(Banks)	(5) log(PF)	(6) log(IC)	(7) log(SLG)
10Y Yield (ZC)	2.79	24.41*	27.94***	41.13**	14.14*	16.09***	2.80
	(9.12)	(12.99)	(9.52)	(16.12)	(8.23)	(5.53)	(11.93)
Observations	80	80	80	80	80	80	80
Controls	**X and W**	**X and W**	**X and W**	**X and W**	**X and W**	**X and W**	**X and W**
Anderson-Rubin Wald test (p-val)	0.76	0.03	0.00	0.00	0.06	0.00	0.81
Underidentification LM stat (p-val)	0.07	0.07	0.05	0.07	0.07	0.07	0.07

Note: This table reports the coefficients of the second-stage regression specified in Equation (5) using PCA 1 (JK MP, BRW, KSX) as an instrument for yields. The difference between this table and the Panel (a) of Table 4 is that we use the 10-year zero-coupon yield on the right-hand side instead of the 8-year zero-coupon yield in Table 4 and do the valuation adjustments based on a 10-year duration rather than 8-year duration. The sample period is between 2004q3 and 2024q2. Anderson-Rubin test has the null hypothesis that the estimated coefficient is equal to zero. The underidentification test has the null hypothesis that the model is underidentified. Standard errors are robust to arbitrary heteroskedasticity and autocorrelation with the lag structure automatically selected using the Newey and West (1994) procedure. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

IA.III9 Robustness checks: QE/QT asymmetry

In this section, we report the robustness checks for the comparison of coefficients during increasing and decreasing share of the central bank in the government bond market.

Table IA.24: Second stage results with $\Delta CB\ Share$ interactions with a post-GFC dummy

VARIABLES	(1) log(ROW Off)	(2) log(ROW Pri)	(3) log(IF)	(4) log(Banks)	(5) log(PF)	(6) log(IC)	(7) log(SLG)
$8Y\ Yield\ (ZC) \times \Delta\ CB\ Share \geq 0$	4.96	15.20	28.11***	42.15***	13.08	19.65**	-4.81
	(7.36)	(10.57)	(10.69)	(13.52)	(8.77)	(8.37)	(10.33)
$8Y\ Yield\ (ZC) \times \Delta\ CB\ Share < 0$	8.28	5.00	38.97**	57.71**	18.17	31.35**	-19.25
	(10.09)	(22.30)	(19.11)	(24.79)	(15.95)	(15.02)	(17.66)
$\Delta\ CB\ Share < 0$	-0.10	0.25	-0.29	-0.47	-0.17	-0.34*	0.37
	(0.10)	(0.39)	(0.29)	(0.44)	(0.20)	(0.21)	(0.36)
Observations	80	80	80	80	80	80	80
Controls	**X and W**	**X and W**	**X and W**	**X and W**	**X and W**	**X and W**	**X and W**
Equal coefficients (p-val)	0.35	0.43	0.34	0.34	0.53	0.20	0.31
Anderson-Rubin Wald test (p-val)	0.64	0.03	0.00	0.00	0.13	0.00	0.35
Underidentification LM stat (p-val)	0.14	0.14	0.15	0.14	0.14	0.13	0.14

Note: This table reports the coefficients of the second-stage regression specified in Equation (7) in using PCA 1 (JK MP, BRW, KSX) as an instrument for yields. The sample period is between 2004q3 and 2024q2. The $\Delta CB\ Share \geq 0$ and $\Delta CB\ Share < 0$ are dummy variables which are 1 if the central bank share in the government bond market increased or decreased from the previous quarter, respectively. Controls also include a post-GFC dummy, which is one after 2008q4. Equal coefficients row reports the p-values of the hypothesis test whether the coefficients for the interaction terms are equal. Anderson-Rubin test has the null hypothesis that the estimated coefficient is equal to zero. The underidentification test has the null hypothesis that the model is underidentified. Standard errors are robust to arbitrary heteroskedasticity and autocorrelation with the lag structure automatically selected using the Newey and West (1994) procedure. *** p<0.01, ** p<0.05, * p<0.1.

Table IA.25: Second stage results with $\Delta CB\ Share$ interactions excluding QE1

VARIABLES	(1) log(ROW Off)	(2) log(ROW Pri)	(3) log(IF)	(4) log(Banks)	(5) log(PF)	(6) log(IC)	(7) log(SLG)
$8Y\ Yield\ (ZC) \times \Delta\ CB\ Share \geq 0$	7.92	19.15	28.33***	32.55**	17.98**	25.25	-7.56
	(9.83)	(12.12)	(9.98)	(13.55)	(7.62)	(17.17)	(12.47)
$8Y\ Yield\ (ZC) \times \Delta\ CB\ Share < 0$	12.74	18.54	39.33**	34.48*	28.35**	41.80	-21.95
	(15.15)	(18.35)	(15.90)	(19.67)	(13.18)	(25.66)	(18.44)
$\Delta\ CB\ Share < 0$	-0.12	-0.01	-0.27	-0.08	-0.31*	-0.45	0.36
	(0.17)	(0.26)	(0.23)	(0.26)	(0.17)	(0.30)	(0.36)
Observations	75	75	75	75	75	75	75
Controls	**X and W**	**X and W**	**X and W**	**X and W**	**X and W**	**X and W**	**X and W**
Equal coefficients (p-val)	0.45	0.94	0.30	0.83	0.19	0.19	0.32
Anderson-Rubin Wald test (p-val)	0.62	0.10	0.00	0.01	0.00	0.00	0.15
Underidentification LM stat (p-val)	0.12	0.12	0.12	0.12	0.12	0.14	0.12

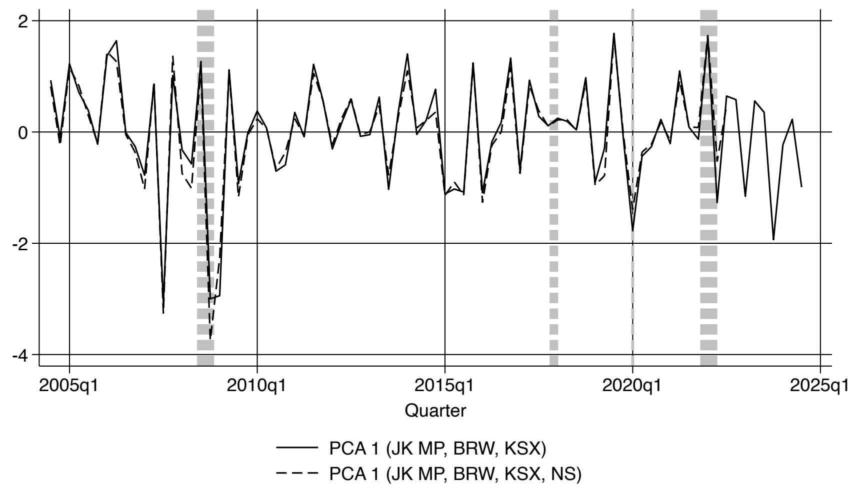
Note: This table reports the coefficients of the second-stage regression specified in Equation (7) in using PCA 1 (JK MP, BRW, KSX) as an instrument for yields. The sample period is between 2004q3 and 2024q2, but it excludes the QE1 period (i.e. between March 2009 and March 2010) since the Federal Reserve's first Treasury purchases were in 2009q1. The $\Delta CB\ Share \geq 0$ and $\Delta CB\ Share < 0$ are dummy variables which are 1 if the central bank share in the government bond market increased or decreased from the previous quarter, respectively. Equal coefficients row reports the p-values of the hypothesis test whether the coefficients for the interaction terms are equal. Anderson-Rubin test has the null hypothesis that the estimated coefficient is equal to zero. The underidentification test has the null hypothesis that the model is underidentified. Standard errors are robust to arbitrary heteroskedasticity and autocorrelation with the lag structure automatically selected using the Newey and West (1994) procedure. *** p<0.01, ** p<0.05, * p<0.1.

IA.IV Principal components analysis

In this section, we report further details of the principal components analysis. In Figure IA.4, we report the time series of the first principal components of different constructs used in the analysis, i.e. PCA 1 (JK MP, BRW, KSX) for the baseline and also PCA 1 (JK MP, BRW, KSX, NS). We standardize both of them in the analysis to have a mean zero and a standard deviation of one. As we show in Table IA.26, these two measures are indeed highly correlated with each other. In Table IA.27, we report the eigenvalues and the explained percentages of all of the series used in our baseline measure PCA 1 (JK MP, BRW, KSX). In our baseline case, the first principal component explains 46% of the variation and the second principal component explains another 23% of the variation. Finally, in Table IA.28, we report the eigenvectors. The PCA 1 (JK MP, BRW, KSX), which we use in our baseline regressions, has a high loading on monetary policy shocks that primarily measure the responses at the longer-end of the yield curve such as the shocks from

Bu et al. (2021) and the 10-year shocks from Kearns et al. (2022). This is reassuring that our measure does capture shocks about the conduct of balance sheet policies, which alter the supply of government bonds available.

Figure IA.4: US monetary policy surprises - PCA 1 (JK MP, BRW, KSX) and PCA 1 (JK MP, BRW, KSX, NS)



Note: The figure shows the first principal components of alternative quarterly monetary policy surprises (all standardized). The solid line is the first principal component of the monetary policy surprise series taken from the monetary policy shock of Jarociński and Karadi (2020), Bu, Rogers and Wu (2021) and Kearns, Schrimpf and Xia (2022) with the sample period between 2004Q3 and 2024Q2. The dashed line is the first principal component when we also include the Nakamura and Steinsson (2018) shocks with the sample period of 2004Q3 and 2022Q3.

Table IA.26: Cross-correlation table

Variables	PCA 1 (JK MP, BRW, KSX)	PCA 1 (JK MP, BRW, KSX, NS)
PCA 1 (JK MP, BRW, KSX)	1.00	
PCA 1 (JK MP, BRW, KSX, NS)	0.98	1.00

Table IA.27: Eigenvalues and explained percentages of PCA (JK MP, BRW, KSX)

	Eigenvalue	Difference	Proportion	Cumulative
Comp1	2.301727	1.127223	0.4603	0.4603
Comp2	1.174504	.4153932	0.2349	0.6952
Comp3	.7591112	.334702	0.1518	0.8471
Comp4	.4244091	.0841613	0.0849	0.9320
Comp5	.3402479	.	0.0680	1.0000

Table IA.28: Eigenvectors of PCA (JK MP, BRW, KSX)

	Comp1	Comp2	Comp3	Unexplained
KSX (3M)	.3490953	.6583496	-.274312	.1533147
KSX (2Y)	.3627327	.4031607	.7860286	.0372381
KSX (10Y)	.5045395	-.4091914	.1085793	.2084663
BRW	.49149	-.4705517	.053696	.1817429
JK MP	.5004348	.1232097	-.5405916	.1838951

IA.V Additional results for investment funds

While we group investment funds together for our analysis, there are substantial differences among them. It is important to differentiate them when we draw policy implications. Open-ended mutual funds are the largest holder among all investment funds with the market values of their holdings exceeding $1.5 trillion at its peak. The value of holdings of exchange-traded funds is close to $500 billion, while the total holdings of closed-ended funds are lower than $50 billion. It is quite intuitive that the yield elasticity estimate we obtain for investment funds overall is primarily driven by open-ended mutual funds, whereas those for ETFs and closed-end funds are statistically indistinguishable from zero.

In Figure IA.5, we report the time series of the total market value of the holdings of different types of investment funds. In Table IA.29, we report the elasticity estimates. These results suggest that our results in the baseline regressions for investment funds are mostly driven by mutual funds as the most yield-elastic type.

Figure IA.5: Total market value of the holdings of different types of investment funds

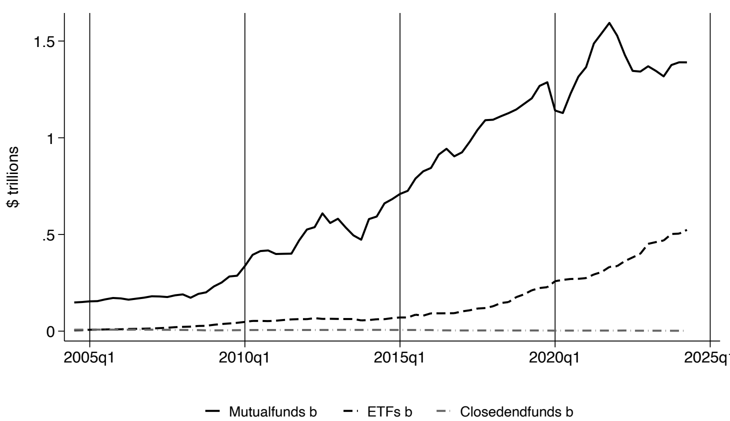


Table IA.29: Yield elasticity estimates for different types of investment funds

	(1)	(2)	(3)
VARIABLES	ln(Mutual funds)	ln(ETFs)	ln(Closed-ended funds)
8Y Yield (ZC)	26.8278***	-11.7409	17.8835*
	(8.0165)	(9.1622)	(10.3490)
Observations	80	80	80
Controls	**X and W**	**X and W**	**X and W**
Sample	2004q3-2024q2	2004q3-2024q2	2004q3-2024q2
Anderson-Rubin Wald test (p-val)	0.00	0.19	0.06
Underidentification LM stat (p-val)	0.06	0.06	0.06

Note: This table reports the coefficients of the second-stage regression specified in Equation (5) using PCA 1 (JK MP, BRW, KSX) as an instrument for yields for mutual funds, ETFs and closed-ended funds. The sample period is between 2004q3 and 2024q2. Anderson-Rubin test has the null hypothesis that the estimated coefficient is equal to zero. The underidentification test has the null hypothesis that the model is underidentified. Standard errors are robust to arbitrary heteroskedasticity and autocorrelation with the lag structure automatically selected using the Newey and West (1994) procedure. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Open-ended mutual funds typically promise daily redemptions and operate with a certain degree of liquidity mismatch. These characteristics lead to a first mover advantage in redemptions and make these funds vulnerable to runs (Falato et al., 2021). If these funds hold a mix of illiquid assets combined with more liquid government bonds, they might sell more liquid bonds first to raise liquidity in the face of redemptions (Huang et al., 2021). This might generate an externality and add to selling pressure in the aggregate. Indeed, these risks materialized and were on display during the March 2020 market turmoil (e.g. Vissing-Jorgensen, 2021). Therefore, a greater overall footprint of open-ended mutual funds as quantitative tightening progresses implies a greater urgency to address the externalities in this sector.