Quantitative Tightening: The Bank Liquidity - Duration Nexus

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Motivation

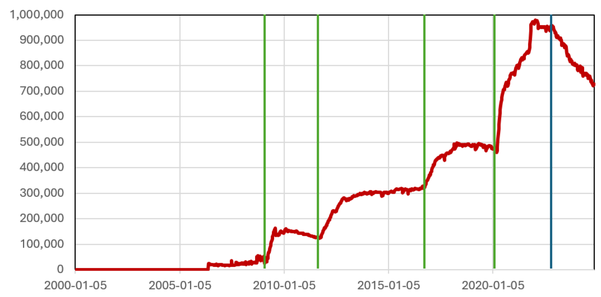


Figure 1. Stock of UK Central Bank Reserves

Research Questions

- How does Quantitative Tightening affect bank lending?
- What is the role of banks' liquidity and interest rate risk management?

In a Nutshell: The Bank Liquidity - Duration Nexus

- When the central bank shrinks its bond holdings, banks mechanically **lose reserves.**
- In response, banks **cut lending** and rebalance towards more liquid assets and stickier funding.
- Yet, simultaneously banks **extend the maturity of remaining assets** with the same liquidity risk.
- Findings reconciled in a model where **banks jointly manage liquidity and interest rate (duration) risk.**

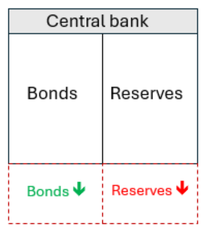
Contributions

- Impact of QT more ambiguous than existing (mostly QE) literature suggests:
  1. Novel QT impact on credit supply and maturity transformation driven by interaction of liquidity and interest rate risk management, rather than reserve requirements (Bernanke & Blinder, 1992), deposit markets (Drechsler, Savov, & Schnabl, 2021), or interbank market (Bianchi & Bigio, 2022).
  2. QE/QT affects allocation of duration risk between banks and borrowers, not only its quantity in the private sector (Vayanos & Villa, 2021).
  3. Banks neutralise effect on liquidity risk → QE does not need to lead to risk ratcheting up (Acharya et al., 2023). But lower liquidity risk might entail higher interest rate risk.
  4. Access to Central bank liquidity (i.e. STR/ILTR) relaxes banks' need to hold large liquid asset buffers for liquidity risk management.

Empirical laboratory: Post Covid UK (2020 - 2024)

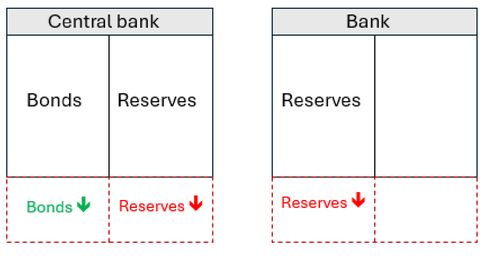
- BoE amongst the first CBs to start QT since February 2022
- Time period allows for distinguishing between QE (2020 - 2021) and QT (2022 - 2024)
- **QT Motivation:** Not to tighten monetary policy, but to avoid ratcheting up in CB balance sheet over time.
- Benefits for identification:
  - Loan-level data (mortgages) → control for demand
  - Monthly data on maturity and type of liability and assets → understand mechanism
  - No leverage requirement on reserves → focus on liquidity effects and not capital (Diamond et al., 2024)
  - All banks subject to Liquidity Coverage Ratio, unlike pre-Covid US (Acharya et al., 2023)

Mechanical Effect: Central Bank



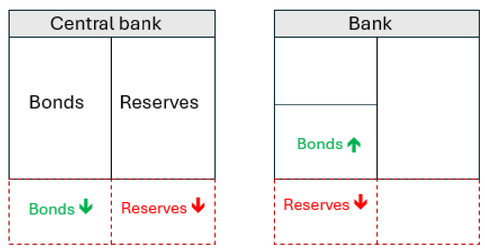
- Central bank sells bonds against reserves. Reserves are destroyed.

Mechanical Effect: Commercial Bank



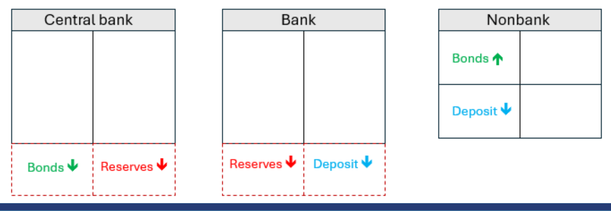
- Banks' reserves holdings inevitably shrink one-for-one. (Only banks can hold reserves.)
- Net effect for banks depends on who buys bonds.

Scenario I: Bank Buys Bonds



- Not the dominant scenario: QE/QT auctions dominated by NBFIs, not banks (Kaminska et al., 2025).

Scenario II: Nonbank Buys Bonds



Theory

- Start from a model of bank liquidity management a la Sundaresan and Xiao (2024).
- Add (i) QT and (ii) a role for interest rate risk management.
- Key insights:
  - When QT worsens banks' liquidity ratios, to restore liquidity banks reduce lending and therefore balance sheet size.
  - This pushes banks below their preferred total interest rate risk exposure.
  - In response, they extend the maturity of their remaining assets.
- Model predictions:
  - Effects only materialise if flightiness of deposits drained by QT meets critical thresholds (i.e. outflow ratio $< 100\%$).
  - Effects weaker for banks with stronger initial Liquidity Ratios.
  - Effects weaker for banks with greater access to Central Bank Reserves.

Empirical Approach

$$Spread_{i,l,t} = \beta \cdot \Delta(Reserves)_{i,t} + \gamma \cdot \Delta(Reserves)_{i,t} \times Maturity_{i,l,t} + B \cdot Controls + \varepsilon_{i,l,t}$$

where $Spread_{i,l,t}$ denotes bank i's rate for loan l in month t net of the maturity-matched-risk-free (OIS) rate.

Challenge: isolate variation in $\Delta(Reserves)_{i,t}$ that is plausibly unrelated to lending.

Three-Pillar Empirical Approach:
Pillar I: Shift-share instrumental variable:

$$Predicted(\Delta(Reserves_{i,t})) = \Delta(\text{Agg. Reserves}_t) \times \text{Bank Exposure}_{i,t}$$

- Change in BoE reserves supply over last year → should be exogenous to any individual bank.
- Share of reserves held by bank i over last year → captures the extent to which a bank is exposed to QT for pre-determined reasons (e.g. exposure to NBFI clients).

Pillar II: Fixed Effects in loan-level regressions to control for unobserved changes in loan demand. Postcode-month FE; Borrower type-month FE; Mortgage type-month FE.

Pillar III: A comprehensive set of Controls designed to address threats to the exclusion restriction.

Main Results

- When a bank's reserve holdings fall by 10%, its loan spreads increase by around 4.4 basis points. However, this effect diminishes with mortgage maturity.

Estimator:	(1) OLS	(2) IV (Stage 1)	(3)	(4)	(5) IV (Stage 2)	(6)	(7)
Dependent variable:	$Spread_{i,l,t}$	$\Delta(Reserves)_{i,t}$	$Spread_{i,l,t}$	$Spread_{i,l,t}$	$Spread_{i,l,t}$	$Spread_{i,l,t}$	$Spread_{i,l,t}$
$\Delta(Reserves)_{i,t}$	-0.110*		-0.274**	-0.244*	-0.411**	-0.442***	-0.658***
	(0.0621)		(0.132)	(0.125)	(0.154)	(0.132)	(0.153)
$Predicted(\Delta(Reserves)_{i,t})$		7.182***					
		(0.671)					
$\Delta(Reserves)_{i,t} \times Maturity_{i,l,t}$							0.0637**
							(0.0331)
Observations	2,078,542	1,985,418	1,985,418	1,985,418	1,984,445	1,944,640	1,939,453
R^2	0.608	0.766	0.00973	0.149	0.0457	0.0132	0.0133
Kleibergen-Paap			114.7	114.8	30.40	37.73	17.48
Bank Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Loan Controls	No	No	No	Yes	Yes	Yes	Yes
Month Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Product x Month Fixed Effects	No	No	No	No	Yes	Yes	Yes
Product x Bank Fixed Effects	No	No	No	No	Yes	Yes	Yes
Location x Month Fixed Effects	No	No	No	No	No	Yes	Yes
Borrower Type x Month Fixed Effects	No	No	No	No	No	Yes	Yes

Robustness:

- Alternative dataset: monthly loan volumes and maturity
- Change measurement of $\Delta Reserves_{i,t}$: 3-month changes, lagged by a month
- Modifications of IV: lag Bank Exposure$_{i,t}$ by 1+ year, measure it at fixed point(s) in the past (e.g. sample start; start of QE/QT); measure $\Delta Agg.Reserves_t$ through changes in the size of the Asset Purchase Facility.
- Extra interactions w/Bank Exposure (high frequency MP shocks)
- Extra interactions w/Δ Agg. reserves (size, ROA, capitalisation, gilt holdings); as well as Big 6 × Time FE

Balance Sheet Rebalancing

- Banks pivot towards more liquid assets and stable funding.
- Banks pivot towards longer maturity funding.
- Within the same liquidity risk, banks pivot towards longer-maturity loans and securities.
- LCR effect if neutralised, but duration gap increases:

$$\Delta(Risk)_{i,t} = \beta \cdot \Delta(Reserves)_{i,t} + B \cdot Controls + \epsilon_{i,t}$$

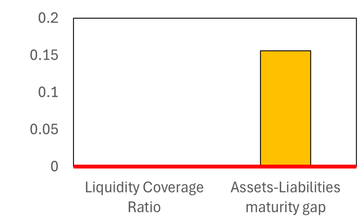


Figure 2. IV parameter estimate for -β.

Testing the Model Predictions

- Lending effect is stronger when initial liquidity risk is higher:

$$\Delta(Loan)_{i,t} = \beta \cdot \Delta(Reserves)_{i,t} + \gamma \cdot \Delta(Reserves)_{i,t} \times Liquidity\ Risk_{i,t=0} + B \cdot Controls + \epsilon_{i,t}$$

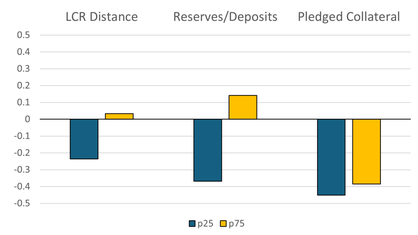


Figure 3. IV parameter estimate for -($\beta + \gamma \times LiquidityRisk$) for the 25th and 75th percentile bank.

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