Comments by Rafael Repullo on

Stop Believing in Reserves

Sriya Anbil, Alyssa Anderson, Ethan Cohen, Romina Ruprecht

ECB Conference on Money Markets

Frankfurt, 9 November 2023

Introduction (i)

- Since Global Financial Crisis central banks have combined
 - → Conventional interest rate tools
 - → Unconventional quantitative tools (QE and QT)

Introduction (i)

- Since Global Financial Crisis central banks have combined
 - → Conventional interest rate tools
 - → Unconventional quantitative tools (QE and QT)
 - → Going from scarce to ample reserves regime
 - → Policy rate becomes interest rate on reserve balances

Introduction (ii)

- Paper addresses key issue for monetary policy implementation
 - → What are the effects (and the limits) of QT?
 - → How do they compare with increases in the policy rate?

Introduction (ii)

- Paper addresses key issue for monetary policy implementation
 - → What are the effects (and the limits) of QT?
 - → How do they compare with increases in the policy rate?
- Paper incorporates institutional features of US financial system
 - → Banks and non-banks (MMFs)

Introduction (ii)

- Paper addresses key issue for monetary policy implementation
 - → What are the effects (and the limits) of QT?
 - → How do they compare with increases in the policy rate?
- Paper incorporates institutional features of US financial system
 - → Banks and non-banks (MMFs)
- Paper incorporates institutional features of Fed monetary policy
 - → Interest rate on reserve balances (IORB) for banks
 - → Overnight reverse repo facility (ONRRP) for non-banks

Main results

- For given policy rates and ample reserves
 - → QT mainly affects reserves on non-banks

Main results

- For given policy rates and ample reserves
 - → QT mainly affects reserves on non-banks
 - → Limits of QT depend on holdings of reserves by non-banks
 - → "Stop believing in (bank) reserves"

Main results

- For given policy rates and ample reserves
 - → QT mainly affects reserves on non-banks
 - → Limits of QT depend on holdings of reserves by non-banks
 - → "Stop believing in (bank) reserves"
- Switch to scarce reserves regime depends on policy rates
 - → More QT with higher rates

Structure of paper

- Aggregate time series evidence
- Theoretical model
- Calibration of model
- Discussion of results

- Ambitious paper on important topic for central banks
 - → Surprisingly little research so far

- Ambitious paper on important topic for central banks
 - → Surprisingly little research so far
- Paper seems work in progress
 - → But results are very promising

- Ambitious paper on important topic for central banks
 - → Surprisingly little research so far
- Paper seems work in progress
 - → But results are very promising
- Theoretical model has too many peculiar features
 - → Focus of my discussion

- Ambitious paper on important topic for central banks
 - → Surprisingly little research so far
- Paper seems work in progress
 - → But results are very promising
- Theoretical model has too many peculiar features
 - → Focus of my discussion
- Aggregate time series evidence does not add anything
 - → Visual correlations of endogenous variables

Part 1 Theoretical model

- Two periods and five types of private agents
 - → Households, firms, banks, non-banks, and dealers
 - → Plus government and central bank

- Two periods and five types of private agents
 - → Households, firms, banks, non-banks, and dealers
 - → Plus government and central bank
- Households with an initial endowment
 - → Invest in bank and non-bank deposits

- Two periods and five types of private agents
 - → Households, firms, banks, non-banks, and dealers
 - → Plus government and central bank
- Households with an initial endowment
 - → Invest in bank and non-bank deposits
- Firms produce and sell consumption good to households
 - → Households can only pay firms with bank deposits

- Banks funded with households' deposits (no equity capital)
 - → Invest in reserves and loans to other (unnamed) agents

- Banks funded with households' deposits (no equity capital)
 - → Invest in reserves and loans to other (unnamed) agents
 - → Subject to linear balance sheet costs
 - → Subject to a reserve requirement

- Banks funded with households' deposits (no equity capital)
 - → Invest in reserves and loans to other (unnamed) agents
 - → Subject to linear balance sheet costs
 - → Subject to a reserve requirement
- Non-banks funded with households' deposits
 - → Invest in reserves and loans to dealers
 - → Subject to linear balance sheet costs

- Banks funded with households' deposits (no equity capital)
 - → Invest in reserves and loans to other (unnamed) agents
 - → Subject to linear balance sheet costs
 - → Subject to a reserve requirement
- Non-banks funded with households' deposits
 - → Invest in reserves and loans to dealers
 - → Subject to linear balance sheet costs
- Dealers funded by non-banks
 - → Invest in government debt

- Central bank sets
 - → Total amount of reserves held by banks and non-banks

- Central bank sets
 - → Total amount of reserves held by banks and non-banks
 - \rightarrow Interest on reserves by banks r_B
 - \rightarrow Interest on reserves by non-banks r_N , with $r_N < r_B$

Comments on model: peculiar features

- Two types of goods
 - → General good produced by government and central bank
 - → Special good produced by firms

Comments on model: peculiar features

- Two types of goods
 - → General good produced by government and central bank
 - → Special good produced by firms
- Bilateral bargaining to set bank deposit rates and quantities

Comments on model: peculiar features

- Two types of goods
 - → General good produced by government and central bank
 - → Special good produced by firms
- Bilateral bargaining to set bank deposit rates and quantities
- Exogenously fixed loan spread

Comments on model: unnecessary elements

- Dealers funded by non-banks and investing in debt
 - → Non-banks could directly invest in government debt

Comments on model: unnecessary elements

- Dealers funded by non-banks and investing in debt
 - → Non-banks could directly invest in government debt
- Banks' reserve requirement
 - → Does not play any role
 - → Calibrated to a very high level: 13% (September 2019)

Comments on model: missing elements

- Lending to banks by non-banks
 - → Important adjustment mechanism not in the model

Comments on model: missing elements

- Lending to banks by non-banks
 - → Important adjustment mechanism not in the model
- Leverage constraint for banks
 - → Limit borrowing by banks from non-banks

Comments on model: missing elements

- Lending to banks by non-banks
 - → Important adjustment mechanism not in the model
- Leverage constraint for banks
 - → Limit borrowing by banks from non-banks
 - \rightarrow Avoid arbitrage opportunity implied by $r_B r_N > 0$
 - → Otherwise non-banks would not keep any reserves

What am I going to do next?

• Sketch simpler theoretical model that yields similar results

What am I going to do next?

- Sketch simpler theoretical model that yields similar results
- Ingredients of model
 - → Conventional central bank
 - → Households with bank deposits in utility function
 - → Local monopoly banks setting loan and deposit rates
 - → Competitive non-banks

Part 2 Alternative model

- Two periods and four types of private agents
 - → Households, firms, banks, and non-banks
 - → Plus government and central bank

- Two periods and four types of private agents
 - → Households, firms, banks, and non-banks
 - → Plus government and central bank
- Households with initial endowment
 - → Invest in bank and non-bank deposits

- Two periods and four types of private agents
 - → Households, firms, banks, and non-banks
 - → Plus government and central bank
- Households with initial endowment
 - → Invest in bank and non-bank deposits
- Firms borrow from banks to produce output

- Banks are monopolists with respect to households and firms
 - → Borrow from households and (possibly) non-banks

- Banks are monopolists with respect to households and firms
 - → Borrow from households and (possibly) non-banks
 - → Invest in reserves and loans to firms
 - → Subject to leverage ratio (upper bound on asset size)

- Banks are monopolists with respect to households and firms
 - → Borrow from households and (possibly) non-banks
 - → Invest in reserves and loans to firms
 - → Subject to leverage ratio (upper bound on asset size)
- Non-banks are competitive
 - → Borrow from households
 - → Invest in reserves, government debt, and loans to banks

- Banks are monopolists with respect to households and firms
 - → Borrow from households and (possibly) non-banks
 - → Invest in reserves and loans to firms
 - → Subject to leverage ratio (upper bound on asset size)
- Non-banks are competitive
 - → Borrow from households
 - → Invest in reserves, government debt, and loans to banks
- Focus on ample reserves regime

Balance sheet of non-banks

Reserves R_N D_N Deposits

Govt. bonds BLoans to banks F

Balance sheet of non-banks

Reserves	R_N	D_N	Deposits
Govt. bonds	В		
Loans to banks	F		

• If $R_N > 0$ zero profit condition implies

Reserves	R_B	D_B	Deposits
Loans to firms	L	F	Loans by non-banks

_			
Reserves	R_B	D_B	Deposits
Loans to firms	L	ig F	Loans by non-banks

- If $r_B > r_N$ upper bound on asset size will be binding
 - → Otherwise there would be an arbitrage opportunity

Reserves	R_B	D_B	Deposits
Loans to firms	L	F	Loans by non-banks

- If $r_B > r_N$ upper bound on asset size will be binding
 - → Otherwise there would be an arbitrage opportunity
 - \rightarrow Banks borrow F from non-banks at rate r_N
 - \rightarrow Spread $r_B r_N$ implies a subsidy to banks

• Interest on reserves r_B is opportunity cost of loans

- Interest on reserves r_B is opportunity cost of loans
 - → Equilibrium loan rate

$$r_L = \arg\max[(r_L - r_B)L(r_L)]$$

 \rightarrow where $L(r_I)$ is the firms' demand for loans

- Interest on reserves r_B is opportunity cost of loans
 - → Equilibrium loan rate

$$r_L = \arg\max[(r_L - r_B)L(r_L)]$$

- \rightarrow where $L(r_I)$ is the firms' demand for loans
- Interest on reserves r_B is marginal revenue of deposits

- Interest on reserves r_B is opportunity cost of loans
 - → Equilibrium loan rate

$$r_L = \arg\max[(r_L - r_B)L(r_L)]$$

- \rightarrow where $L(r_I)$ is the firms' demand for loans
- Interest on reserves r_B is marginal revenue of deposits
 - → Equilibrium deposit rate

$$r_D = \arg\max[(r_B - r_D)D(r_D, r_N)]$$

 \rightarrow where $D(r_D, r_N)$ is the households' supply of deposits

Effect of QT on banks

• Loan rates and loan quantities only depend on the interest on bank reserves r_B

Effect of QT on banks

- Loan rates and loan quantities only depend on the interest on bank reserves r_B
- Deposit rates and deposit quantities depend on the interest on bank reserves r_R and the interest on non-bank reserves r_N

Effect of QT on banks

- Loan rates and loan quantities only depend on the interest on bank reserves r_B
- Deposit rates and deposit quantities depend on the interest on bank reserves r_R and the interest on non-bank reserves r_N
 - → QT does not have any effect on banks

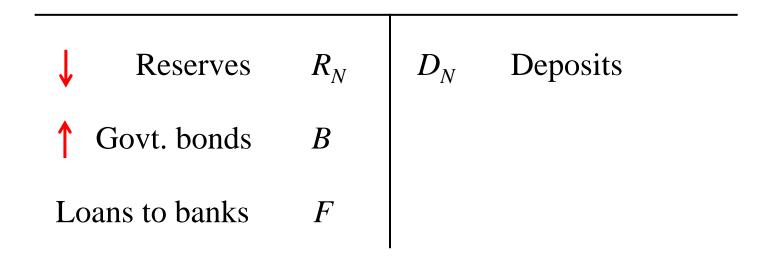
Effect of QT on non-banks

• QT only affects the size of the balance sheet of non-banks

Reserves	R_N	D_N	Deposits
↑ Govt. bonds	В		
Loans to banks	F		

Effect of QT on non-banks

• QT only affects the size of the balance sheet of non-banks



- → No change in household deposits or in loans to banks
- \rightarrow QT is neutral: it has no real effects

Limits of QT

- Given policy rates, r_B and r_N , QT can proceed as long as $R_N > 0$
 - → Same result as in paper

Limits of QT

- Given policy rates, r_B and r_N , QT can proceed as long as $R_N > 0$
 - → Same result as in paper
 - → Limits of QT depend on holdings of reserves by non-banks
 - → "Stop believing in (bank) reserves"

Effect of increase in ONRRP (i)

• By previous results: If $R_N > 0$ zero profit condition implies

Effect of increase in ONRRP (i)

• By previous results: If $R_N > 0$ zero profit condition implies

- Effects of an increase in r_N (for fixed r_B)
 - → Increase in deposit rate offered by non-banks
 - → Shift from bank to non-bank deposits

Effect of increase in ONRRP (i)

• By previous results: If $R_N > 0$ zero profit condition implies

- Effects of an increase in r_N (for fixed r_R)
 - → Increase in deposit rate offered by non-banks
 - → Shift from bank to non-bank deposits
 - → Increase in non-bank lending to banks
 - → Reduction in bank profits

Effect of increase in ONRRP (ii)

Balance sheet of non-banks

Reserves	R_N	D_N	Deposits ↑
Govt. bonds	B		
↑ Loans to banks	F		

 \rightarrow No change in reserves R_N or in holdings of govt. bonds B

Effect of increase in ONRRP (ii)

Balance sheet of banks

Reserves	R_B	D_B	Deposits	↓
Loans to firms	L	F	Loans by non-bank	KS 1

 \rightarrow No change in reserves R_B or in bank lending L

Effect of increase in IORB (i)

• By previous results

$$\frac{dr_L}{dr_B} > 0$$
 and $\frac{dr_D}{dr_B} > 0$

→ Increase in loan and deposit rates

Effect of increase in IORB (i)

• By previous results

$$\frac{dr_L}{dr_B} > 0$$
 and $\frac{dr_D}{dr_B} > 0$

- → Increase in loan and deposit rates
- → Reduction in bank loans and increase in bank deposits

Effect of increase in IORB (i)

• By previous results

$$\frac{dr_L}{dr_B} > 0$$
 and $\frac{dr_D}{dr_B} > 0$

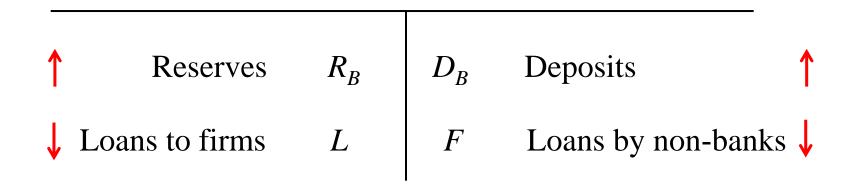
- → Increase in loan and deposit rates
- → Reduction in bank loans and increase in bank deposits
- → Increase in bank reserves (by upper bound on asset size)
- → Ambiguous effect on bank profits

Effect of increase in IORB (ii)

Reserves	R_B	D_B	Deposits	↑
↓ Loans to firms	L	F	Loans by non-bank	S

Effect of increase in IORB (ii)

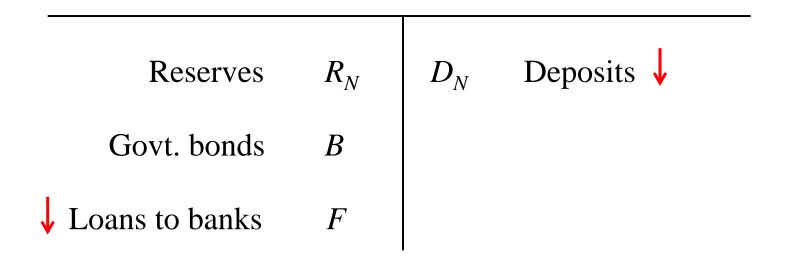
Balance sheet of banks



→ No change in size of balance sheet (by leverage constraint)

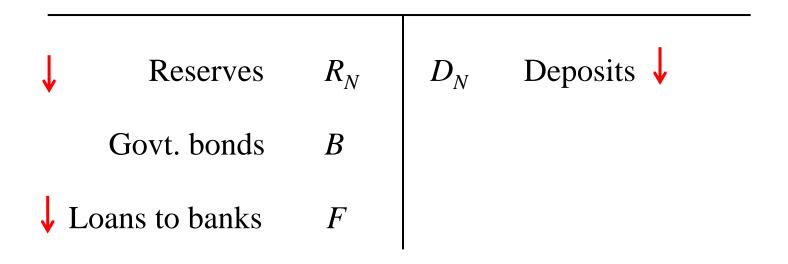
Effect of increase in IORB (iii)

Balance sheet of non-banks



→ Shift from non-bank to bank deposits

Effect of increase in IORB (iii)



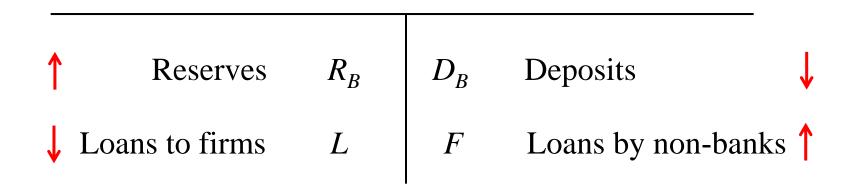
- → Shift from non-bank to bank deposits
- \rightarrow Reduction in reserves R_N (if total reserves are unchanged)

Effect of increases in IORB & ONRRP (i)

Reserves	R_B	D_B	Deposits	↓
↓ Loans to firms	L	F	Loans by non-banks	S

Effect of increases in IORB & ONRRP (i)

Balance sheet of banks



→ No change in size of balance sheet (by leverage constraint)

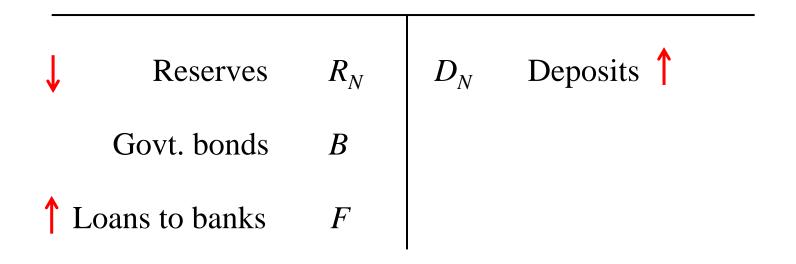
Effect of increases in IORB & ONRRP (ii)

Balance sheet of non-banks

Reserves	R_N	D_N	Deposits 1
Govt. bonds	B		
↑ Loans to banks	F		

→ Shift from bank to non-bank deposits

Effect of increases in IORB & ONRRP (ii)



- → Shift from bank to non-bank deposits
- \rightarrow Reduction in reserves R_N (if total reserves are unchanged)

Summing up

• Alternative model avoids shortcomings of model in the paper

Summing up

- Alternative model avoids shortcomings of model in the paper
- Alternative model yields some similar results
 - → Limits of QT depend on holdings of reserves by non-banks

Summing up

- Alternative model avoids shortcomings of model in the paper
- Alternative model yields some similar results
 - → Limits of QT depend on holdings of reserves by non-banks
- Alternative model yields some contrasting results
 - → Increasing IORB & ONRRP reduces non-bank reserves
 - → Less QT with higher rates

Concluding remarks

Concluding remarks (i)

- Paper addresses key issue from a novel perspective
 - → Incorporating institutional features of US financial system
 - → Incorporating institutional features of Fed monetary policy

Concluding remarks (i)

- Paper addresses key issue from a novel perspective
 - → Incorporating institutional features of US financial system
 - → Incorporating institutional features of Fed monetary policy
- Many interesting questions to be addressed
 - → Effects of equating IORB and ONRRP
 - → Interactions between monetary policy and bank regulation
 - → Differences with ECB's monetary policy implementation

Concluding remarks (ii)

- Much more research is needed
 - → Theoretical contributions would be especially welcome

Concluding remarks (ii)

- Much more research is needed
 - → Theoretical contributions would be especially welcome
- Richer models are needed
 - → Simple models cannot address Bernanke's conundrum

"The problem with quantitative easing [or tightening] is that it works in practice, but it doesn't work in theory"