Comments by Rafael Repullo on

Stop Believing in Reserves

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Introduction (i)

• Since Global Financial Crisis central banks have combined

→ Conventional interest rate tools

→ Unconventional quantitative tools (QE and QT)

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    → 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?

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  → Banks and non-banks (MMFs)

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    → 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

  $\rightarrow$ QT mainly affects reserves on non-banks

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    → 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

Main comments

- Ambitious paper on important topic for central banks

    → Surprisingly little research so far

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- Paper seems work in progress

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• Paper seems work in progress

$\rightarrow$ But results are very promising

• Theoretical model has too many peculiar features

$\rightarrow$ Focus of my discussion

• Aggregate time series evidence does not add anything

$\rightarrow$ Visual correlations of endogenous variables

Part 1

Theoretical model

Model setup (i)

- Two periods and five types of private agents

    → Households, firms, banks, non-banks, and dealers

    → Plus government and central bank

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- Firms produce and sell consumption good to households

    → Households can only pay firms with bank deposits

Model setup (ii)

- Banks funded with households' deposits (no equity capital)

    $\rightarrow$ Invest in reserves and loans to other (unnamed) agents

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• Dealers funded by non-banks

→ Invest in government debt

Model setup (iii)

• Central bank sets

→ Total amount of reserves held by banks and non-banks

Model setup (iii)

- Central bank sets

    $\rightarrow$ 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

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• Bilateral bargaining to set bank deposit rates and quantities

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  → 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

    $\rightarrow$ Important adjustment mechanism not in the model

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- Leverage constraint for banks

    → Limit borrowing by banks from non-banks

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- Lending to banks by non-banks

  → Important adjustment mechanism not in the model

- Leverage constraint for banks

  → Limit borrowing by banks from non-banks

  → 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

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- 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

Model setup (i)

- Two periods and four types of private agents

    $\rightarrow$ Households, firms, banks, and non-banks

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- Firms borrow from banks to produce output

Model setup (ii)

- Banks are monopolists with respect to households and firms

    $\rightarrow$ Borrow from households and (possibly) non-banks

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    → Borrow from households

    → Invest in reserves, government debt, and loans to banks

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- Focus on ample reserves regime

Balance sheet of non-banks

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

Balance sheet of non-banks

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

- If $R_N > 0$ zero profit condition implies

Deposit rate = bond rate = loan rate = interest on reserves = r_N

Balance sheet of banks

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

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  → Otherwise there would be an arbitrage opportunity

  → Banks borrow F from non-banks at rate r_N

  → Spread $r_B - r_N$ implies a subsidy to banks

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- Interest on reserves r_B is opportunity cost of loans

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- Interest on reserves r_B is marginal revenue of deposits

  $\rightarrow$ 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

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- Deposit rates and deposit quantities depend on the interest on bank reserves r_B and the interest on non-bank reserves r_N

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- 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_B and the interest on non-bank reserves r_N

  $\rightarrow$ **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	B		
Loans to banks	F		

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	B		
	Loans to banks	F		

→ No change in household deposits or in loans to banks

→ **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 $R_N > 0$

    $\rightarrow$ Same result as in paper

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- Given policy rates, r_B and r_N, QT can proceed as long as $R_N > 0$

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  $\rightarrow$ Limits of QT depend on holdings of reserves by non-banks

  $\rightarrow$ "Stop believing in (bank) reserves"

Effect of increase in ONRRP (i)

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

  Deposit rate = bond rate = loan rate = interest on reserves = r_N

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  $\rightarrow$ Increase in deposit rate offered by non-banks

  $\rightarrow$ Shift from bank to non-bank deposits

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  $\rightarrow$ Increase in deposit rate offered by non-banks

  $\rightarrow$ Shift from bank to non-bank deposits

  $\rightarrow$ Increase in non-bank lending to banks

  $\rightarrow$ 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-banks	↑

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

Effect of increase in IORB (i)

- By previous results

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

$\rightarrow$ Increase in loan and deposit rates

Effect of increase in IORB (i)

- By previous results

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

→ Increase in loan and deposit rates

→ Reduction in bank loans and increase in bank deposits

Effect of increase in IORB (i)

- By previous results

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

→ 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)

Balance sheet of banks

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

Effect of increase in IORB (ii)

Balance sheet of banks

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

$\rightarrow$ No change in size of balance sheet (by leverage constraint)

Effect of increase in IORB (iii)

Balance sheet of non-banks

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

$\rightarrow$ Shift from non-bank to bank deposits

Effect of increase in IORB (iii)

Balance sheet of non-banks

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

→ Shift from non-bank to bank deposits

→ Reduction in reserves R_N (if total reserves are unchanged)

Effect of increases in IORB & ONRRP (i)

Balance sheet of banks

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

Effect of increases in IORB & ONRRP (i)

Balance sheet of banks

↑	Reserves	R_B	D_B	Deposits	↓
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Effect of increases in IORB & ONRRP (ii)

Balance sheet of non-banks

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→ Shift from bank to non-bank deposits

Effect of increases in IORB & ONRRP (ii)

Balance sheet of non-banks

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Summing up

- Alternative model avoids shortcomings of model in the paper

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- Alternative model yields some similar results

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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

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• 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

$\rightarrow$ Theoretical contributions would be especially welcome

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• 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"