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The Money Multiplier in the Financial Crisis: a Quantitative Evaluation

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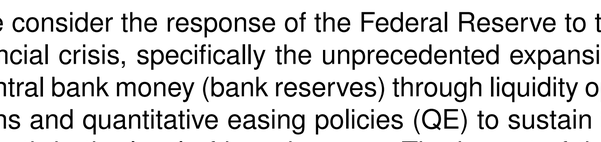
1. Abstract

We consider the response of the Federal Reserve to the financial crisis, specifically the unprecedented expansion of central bank money (bank reserves) through liquidity operations and quantitative easing policies (QE) to sustain trend growth in the level of broad money. The impact of the negative credit supply shock in 2008 pushed the policy rate to the zero lower bound but the use of bank reserves allowed some stabilization policy to continue. We compare the impact in a model of money and banking from changes in central bank money to a change in the policy rate and show a broadly equivalent ability to stabilize the economy, albeit with a different transmission mechanism. We show that active QE policies conducted by the central bank also succeed in stabilizing broad money.

2. Introduction

MULTIPLIERS have fallen dramatically since the crisis, i.e. increases in narrow money have not given rise to increases in broad money.

US Multiplier



2.1 Motivation

Is the multiplier dead as a useful concept? The way we model the multiplier and its role in monetary transmission doesn't help

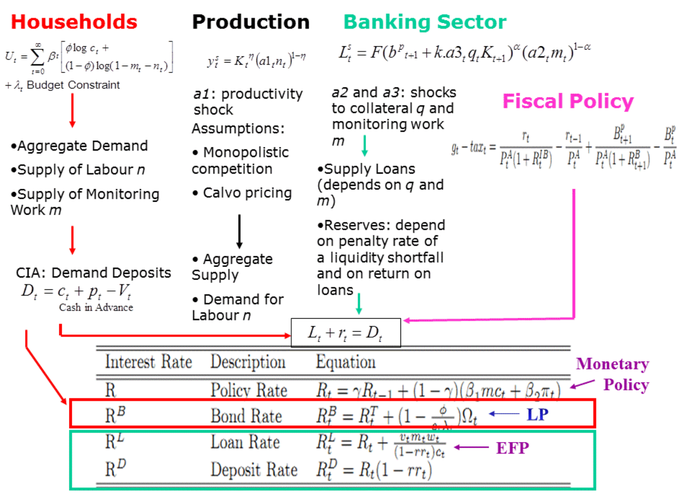
- Fixed
  - Banks get new reserves and use these to extend lending
  - Disproved by data: Policy instrument is interest rate
- Quantity of narrow money used to determine rates
  - Unrealistic for practitioners
  - Disyatat (2008) shows that this amounts to reverse causality
  - Monetary aggregates should reflect prevailing interest rates, not determine them
- Broad money has remained relatively robust
  - Has the expansion of narrow money offset a contraction in credit money?

2.2 Our Contribution

Model the multiplier as an optimal decision by banks between narrow money and credit money

- We show that this can explain even current movements in the multiplier
- Include a more realisitic representation of monetary policy
  - CB set IR on providing funds and provides them perfectly elastically
  - Narrow money is demand determined
  - Include open market operations
- Approximate welfare to show that a flexible money multiplier can be welfare enhancing
- Model endogenously quantitative easing with a new rule for the central bank

3. The Model



3.1 The Banking Sector

Banks' role is to meet deposit demand of households

- It does this through two assets, narrow money (reserves) and credit money (loans)

$$L_t + r_t = D_t$$

- Broad money is determined in part by the central bank but mostly by the banking system
- $\frac{D}{r}$ therefore represents the money multiplier
- Banks maximise profit subject to prevailing interest rates in the economy and a constraint around reserve management

$$\max_{r_t} \Pi_t = R_t^L L_t - R_t r_t - R_t^D D_t,$$

$$\text{s.t. } C_t = \frac{1}{2} R_t^T (\bar{r} - r_t)^2 + \tau_t(\bar{r} - r_t).$$

Reserves/Narrow Money

- Solving this problem for reserves gives optimal reserve demand schedule of banks

$$\hat{r}_t = \frac{\hat{\tau}_t}{\hat{R}_t^T} - \left[\frac{\hat{R}_t + \hat{R}_t^L}{\hat{R}_t^T} \right] + \bar{r}$$

- Positive function of the probability of a bank being short its obligated level of reserves
- Negative function of cost of obtaining narrow money $\hat{R}_t$, and the foregone return on credit money, $\hat{R}_t^L$

Loans/Credit Money

Credit money originates from banks in the form of loans

- Created via a loan production function

$$L_t/P_t^A = F(\gamma b_{t+1} + A3_t k q_t K_{t+1})^{\alpha}(A2_t m_t)^{1-\alpha} \quad 0 < \alpha < 1,$$

- Through the CIA constraint this explicitly links the quantity of loans and level of economic activity

$$c_t = v_t \frac{F(\gamma b_{t+1} + A3_t k q_t K_{t+1})^{\alpha}(A2_t m_t)^{1-\alpha}}{P_t^A(1-rr_t)}.$$

Note:

- rr_t is the fraction of deposits which is generated by loan creation
- As $rr = \frac{1}{MM}$ suggests MM has a role in affecting the real economy

$$\frac{c_t}{v_t} = \left[\frac{F(\gamma b_{t+1} + A3_t k q_t K_{t+1})^{\alpha}(A2_t m_t)^{1-\alpha}}{P_t^A} + \frac{\tau_t - R_t - R_t^L}{R_t^T P_t^A} + \bar{r} \right]$$

3.2 Monetary Policy

Monetary policy sets interest rate it will charge for borrowing reserves by banks and supplies reserves perfectly elastically at this rate

- Build in an open market operation (OMO) in which reserves are swapped for an asset (bonds).
- Total bond holdings are the sum of private sector and central bank bond holdings

$$b_t = b_t^{CB} + b_t^P$$

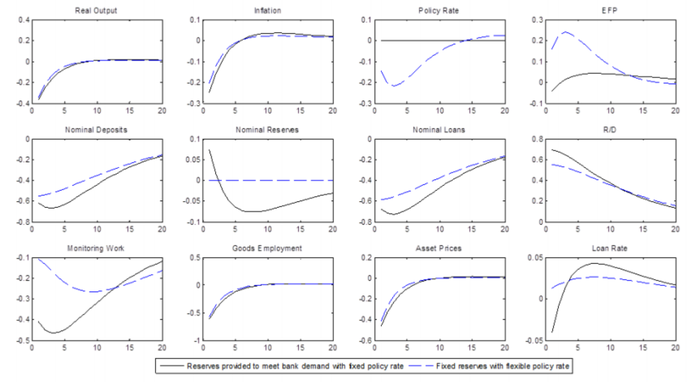
- Central bank bond holdings must equal reserves, so we can substitute and re-arrange to give the log linear relationship

$$b^p \hat{b}_t^p = b\hat{b}_t - r\hat{r}_t$$

4. Quantitative Analysis

4.1 Collateral Shock

IRF for shock to bank collateral with fixed and flexible reserves



4.2 Quantitative Easing

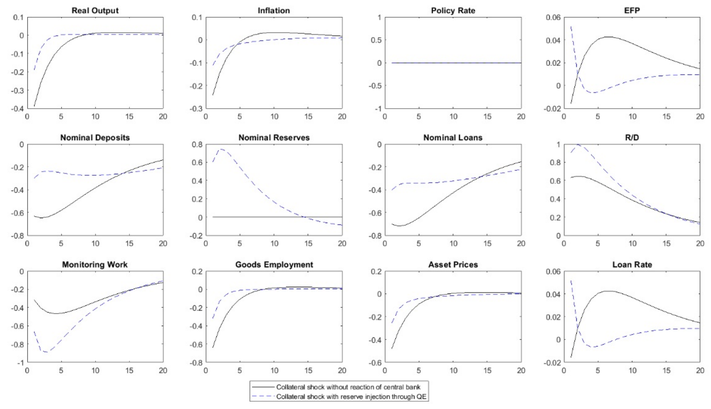
Model QE by abstracting from bank's optimal reserve demand

- Central bank balance sheet as an active policy instrument at the ZLB
- Purchases of assets from the private sector financed by central bank
- Adopt a policy rule for bank reserves (size of QE)

$$r_t = \bar{r}_t(r_{t-1})^{\rho_r} \left(\frac{y_t}{y} \right)^{\psi_y(1-\rho_r)} \left(\frac{\pi_t}{\pi} \right)^{\psi_\pi(1-\rho_r)}$$

- Changes in bank reserves reacting to output and inflation

IRF for shock to bank collateral without QE and with QE



5. Welfare Analysis

Second order approximation to utility

$$U_t - U = -\frac{1}{2} E_0 \sum_{t=0}^{\infty} \beta^t L_t + O3$$

$$\text{with } L_t = \frac{1}{2} \begin{bmatrix} \sigma_c^2 + \frac{\theta}{\chi}\left[\frac{\frac{n}{c}-\frac{w}{c}}{1-\eta}\right]\sigma_\pi^2 - \\ \frac{w}{c}\sigma_w^2 - \frac{n}{c}\sigma_n^2 + \frac{mc}{c}\sigma_{mc}^2 \end{bmatrix}$$

Who Determines Reserves	Welfare Loss
Fixed Money Multiplier CIR	10.921
Fixed Money Multiplier	7.829
Flexible Money Multiplier CIR	4.293
Flexible Money Multiplier	3.908

6. Conclusions

The manner we model the banking sector allows for a fuller and more realistic mechanism for monetary policy

- The multiplier can be framed as an optimal decision for banks between meeting deposit demand with narrow or credit money
- With this in place, changes in the MM, even such as those observed since 2009, may be explained by optimal behaviour
- Active QE policies by the central bank have also helped to stabilize broad money
- The increase in narrow money offsets the contraction in credit money and supports broad money whilst lowering the multiplier

So, rumours of the death of the multiplier may be (greatly) exaggerated

[1] *The views expressed in this research poster are those of the authors and do not necessarily reflect the views of the NIESR, the Bank of England or the European Central Bank. Tobias Schuler has conducted this research while being at the ifo Institute in Munich.*

EABCN/NBP conference, Challenges in Understanding the Monetary Transmission Mechanism - 21/22 March, 2019, Warsaw, Poland