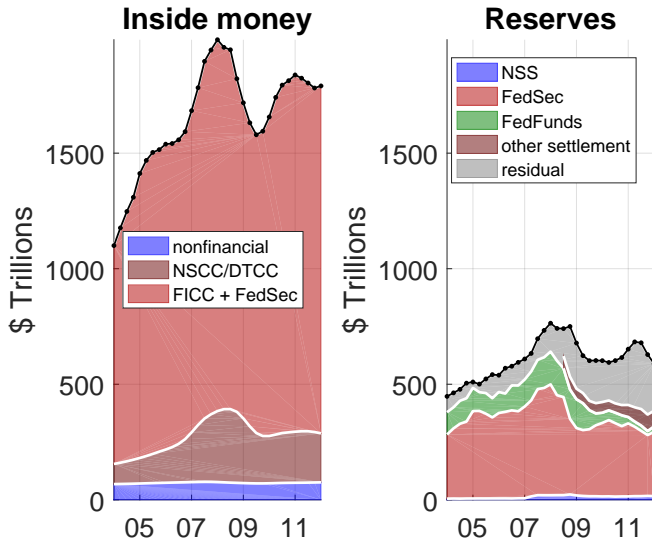


Payments, Credit & Asset Prices

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Luzern, June 2017

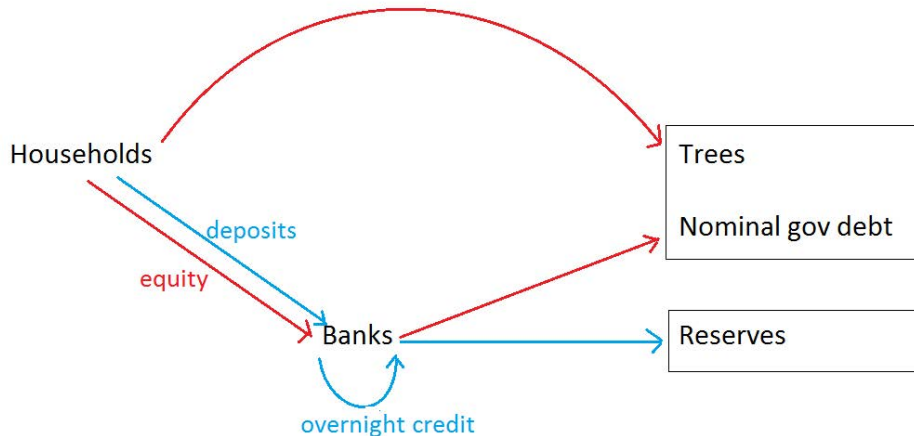
US dollar payments; quarterly at annual rates



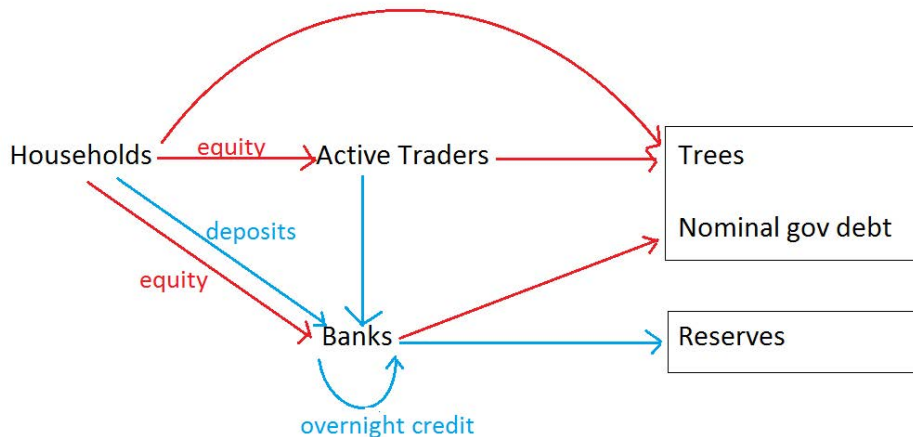
Simple model of payments & asset pricing

- Layered payment system with two media of exchange
 - ▶ banks handle payment instructions with reserves = outside money
 - cost of liquidity $i - i_R$, zero if reserves abundant
 - ▶ households & investors pay for goods & securities with inside money
 - cost of liquidity > 0 , depends on bank balance sheets
- Inside money demand from institutional investors
 - ▶ sensitive to cost of liquidity, asset market shocks
- Nominal price level & financial structure
 - ▶ higher if banks supply more inside money
 - ▶ lower if institutional investors absorb more inside money
- Intermediary asset pricing
 - ▶ securities back inside money → price reflects collateral value
 - ▶ inside money needed to trade securities → price reflects cost of liquidity
- Transmission of government policy
 - ▶ asset trades vs interest on reserves
 - ▶ nominal interest rate not enough to summarize policy stance

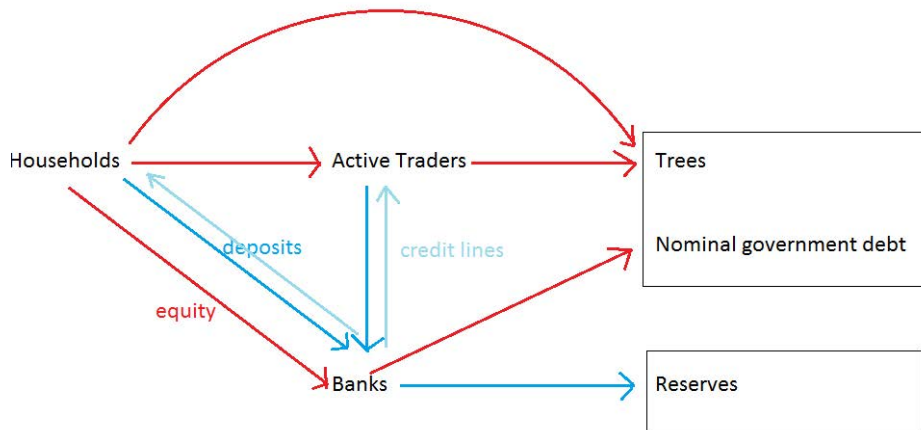
Model: only goods transactions require inside money



Model: asset trades also require inside money



Inside money: deposits & credit lines



Model summary

- Households
 - ▶ infinitely-lived, linear utility, averse to Knightian uncertainty
 - ▶ pay for goods with inside money
- Financial institutions: banks & active traders
 - ▶ maximize shareholder value, freely adjust equity, constant returns
 - ▶ idiosyncratic liquidity shocks require payments
 - ★ banks pay with reserves (possibly borrowed)
 - ★ active traders pay with inside money
 - ▶ bank leverage cost = resources used when commitments made
 - ★ increases with inside money, Fed funds borrowing
 - ★ declines with value & safety of bank assets
- Government
 - ▶ interest rate on reserves, paths for debt & reserves
- Competitive equilibrium with flexible prices and constant output
 - inside money supply, nominal price level & real asset prices

Optimal bank choices

Assets	Liabilities
Reserves	Deposits
Fed funds lending	Fed funds borrowing
Gov debt	Equity
Trees	

- Choose positions to equate MC equity = MB assets = MC debt
- Determine two key ratios, same for all banks

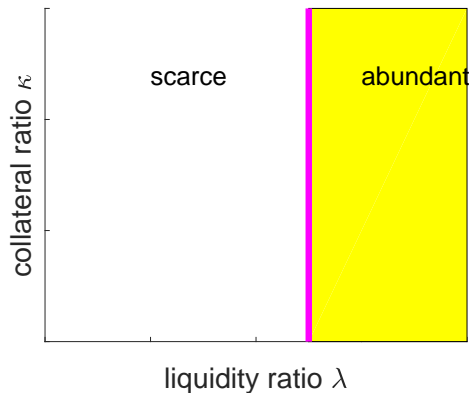
liquidity ratio $\lambda := \frac{\text{reserves}}{\text{deposits}} = \frac{1}{\text{money multiplier}}$

collateral ratio $\kappa := \frac{\text{risk-weighted assets}}{\text{debt}} = \frac{1}{\text{leverage}}$

- related via balance sheet (for example, narrow bank: $\kappa = \lambda$)
- summarize banking system by (λ, κ)

Scarce vs abundant reserves

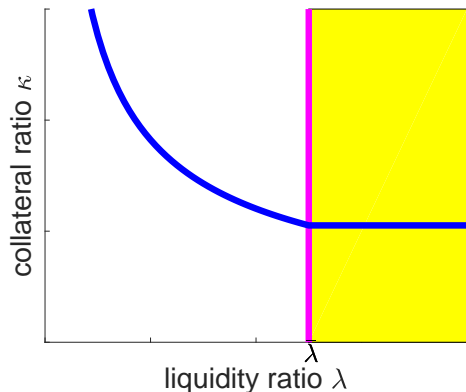
- Plot liquidity and collateral ratio
- bounded liquidity shocks, two regions



- abundant reserves
= banks never borrow
- scarce reserves
= banks borrow
if large liquidity shock

Liquidity management curve

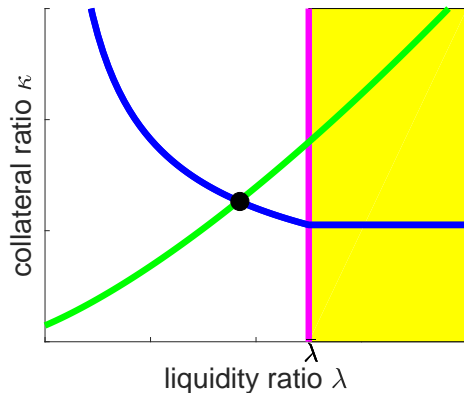
- Optimal capital structure responds to liquidity ratio
 - ▶ “how much collateral is optimal at liquidity ratio λ ?”
 - ▶ slopes down: hi $\lambda \Rightarrow$ borrow overnight less often \Rightarrow lo κ ok
 - ▶ abundant reserves: never borrow, no further reduction in κ



- “money demand”:
 - = high collateral ratio
 - = high interest rate
 - = high cost of liquidity
 - = low liquidity ratio
- “liquidity trap” for high λ

Capital structure curve

- Balance sheet relates liquidity ratio λ and collateral ratio κ
 - ▶ given other collateral available to banks, what λ needed to achieve κ ?
 - ▶ curve slopes up: to get more collateral, add reserves



- equilibrium = intersection of curves
- reserves can be scarce or abundant
- curves shift with policy, asset market shocks

Inside money, nominal price level, and real asset prices

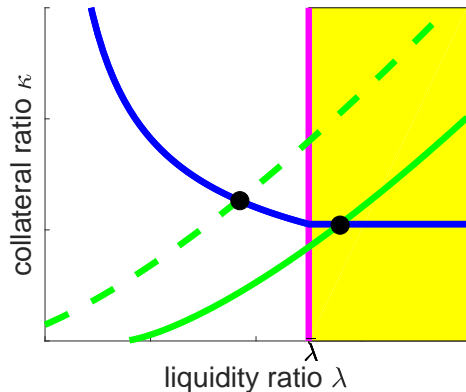
- Inside money cheaper if λ, κ higher since lower leverage cost for banks
- Intermediary asset pricing & endogenous market segmentation
 - ▶ banks value assets as collateral \rightarrow higher prices, lower returns
 - ★ short bonds priced only by banks, not held by households
 - ▶ active traders perceive low uncertainty on trees, need inside money
 - ★ prices of trees held by active traders higher if inside money cheaper
- Nominal price level

$$\underbrace{\text{nominal output } PY = \frac{M}{\text{reserves}} \frac{1}{\lambda}}_{\text{inside money}} \underbrace{\left(1 - \frac{\alpha(\lambda, \kappa)}{\text{active trader deposit share}} \right)}_{\text{velocity}}$$

- ▶ only money circulating in goods market matters for price level
- ▶ velocity low if inside money cheap, but also in asset market booms

Tighter money: central bank asset sale

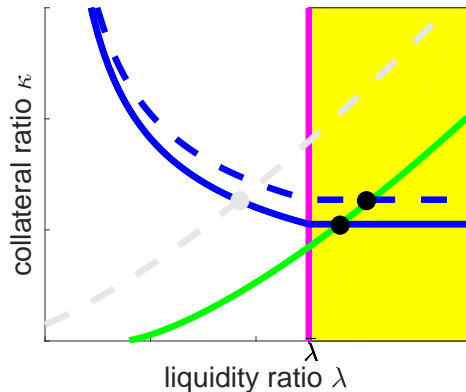
- Sell bonds to banks in exchange for reserves
- More collateral other than reserves available to banks
- Lower λ needed to achieve any collateral ratio κ : CS shifts left



- bank ratios
 - ▶ lower λ
 - ▶ higher κ , real rate
- deflationary
 - ▶ fewer reserves
 - ▶ higher money multiplier
- stronger effect if
 - ▶ sale large enough to move to scarcity
 - ▶ less interbank netting

Tighter money: higher interest on reserves

- Higher ROA \rightarrow maintain return on equity at lower leverage
- Banks choose higher collateral ratio at any λ : LM shifts up
- Here: same κ and short rate as after bond sale



- bank ratios
 - ▶ higher κ
 - higher λ , real rate
- deflationary
 - ▶ lower money multiplier
 - ▶ more deposit demand by active traders
- stronger effect if
 - ▶ more active traders
 - ▶ less nominal collateral

Summary of results

- Policy transmission depends on financial structure
 - ▶ interest on reserves
 - ★ changes profitability of bank assets, optimal leverage
 - ★ inflation response depends on exposure of bank assets
 - ▶ government asset trades
 - ★ change amount of collateral available to back inside money
 - ★ inflation & interest rate responses depend on interbank netting
 - ▶ short nominal interest rate does not summarize policy stance
- Interaction payments system & securities markets
 - ▶ asset market shocks → nominal price level
 - ★ money supply: value of bank assets ↓, money multiplier ↓, deflationary
 - ★ money demand from asset markets ↓ ~ velocity ↑, inflationary
 - ▶ monetary policy → (real) asset prices
 - ★ supply: asset purchases make bank assets more scarce, prices ↑
 - ★ demand: asset purchases increase cost of liquidity, prices ↓