Easy Money:
The Inefficient Supply of Inside Liquidity

Alessio Galluzzi[1]

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[1]The University of Sydney

This Paper

- Inside liquidity dominates modern markets
- Privately issued liabilities can dry up quickly
- Model with
  - Fiat currency
  - Privately issued liabilities that are occasionally defaulted upon

Results:

- Monetary policy controls aggregate liquidity
- Yet, there is inefficient issuance of liquidity
- Liquidity requirements cannot restore efficiency
- Capital requirements are not effective either

Related Literature

- New Monetarist: Lagos, Wright (2005), Lagos and Rocheteau (2008), Gu et al. (2013), Gu, Mattesini and Wright (2016), Geromichalos and Herrenbrueck (2016), Andolfatto, Berentsen and Waller (2016)
- Demand for liquidity: Eisfeldt (2006), Adrian and Shin (2009), Krishnamurthy and Vissing-Jørgensen (2012), Carlson et al. (2014), Bigio (2015), Bianchi and Bigio (2016), Arseneau, Rappoport and Vardoulakis (2017), Benigno and Robatto (2019), Piazzesi and Schneider (2018)
- Excessive Credit and Lack of Safe Assets: Caballero (2006), Lorenzoni (2008), Caballero and Farhi (2017), Moreira and Savov (2017)

Roadmap

Model

Equilibrium

Welfare

Liquidity and Capital Requirements

Timing and Agents

- Time $t = 0, 1, 2$
- Agents:
  - Representative Household
  - Intermediaries
- Production technologies:
  - Safe: A_1 at $t = 1$ and A_2 at $t = 2$
  - Risky: at $t = 1$ only

$$A_1^r = \begin{cases} A_h & \text{with probability } 1 - \pi \\ 0 & \text{with probability } \pi \end{cases}$$

Refer to the A_h realization as the high state

Assets

- Capital K
  - Fixed supply $\bar{K}$ held by intermediaries
  - Productivity A_t
  - Output $Y_t = A_t \bar{K}$, non storable
  - Full depreciation at $t = 1$ if used in the risky technology
  - Otherwise, full depreciation at $t = 2$
- Fiat currency M_t
  - Issuer: central bank in amount $\bar{M}$
  - Holder: household
- Short term liabilities B_t and equity N_t
  - Issuers: intermediaries
  - Holder: household

Household's Problem

- Maximize expected utility

$$E\left[\log c_1 + \beta c_2\right]$$

- Portfolio choice:
  - Fiat currency M: safe and liquid
  - Safe liabilities B^c: safe and liquid
  - Risky liabilities B^s: risky and occasionally illiquid
  - Equity N^c: illiquid

Household's Constraints

- $t = 0$ portfolio allocation

$$M^h + B^s + B^c + N^c = Q_0 \bar{K} + \bar{M}$$

- $t = 1$ cash-in-advance constraint

$$p_1 c_1 \leq M^h + (1 + r^c) B^c + (1 - \mathbb{I}) (1 + r^s) B^s$$

- Household also gets an additional endowment $\bar{Y}$ of consumption
- $t = 2$ final budget constraint

$$p_2 c_2 = W_1 + (1 + r^n) N^c - p_2 T_2$$

Where

$$W_1 = M + \left(1 + r^c_{t-1}\right) B^c + (1 - \mathbb{I}) \left(1 + r^s_{t-1}\right) B^s - p_1 c_1$$

Intermediaries

- Unit measure
- Free entry
- Raise liabilities or equity to acquire capital
- Choice between:
  1. Commercial banking
     - Operate the safe technology
     - Offer safe liabilities
     - Raise equity
  2. Shadow banking
     - Operate the risky technology
     - Offer risky liabilities
     - No equity

Commercial Banking

- Budget constraint

$$(1+\tau)\, Q_0 K^c = B^c + N^c$$

- Safe technology operating cost $\tau \geq 0$
- Safe liabilities constraint

$$p_1 A_1 K^c \geq (1+r^c)\, B^c$$

- Expected profits at $t = 0$

$$\Pi^c = (p_1 A_1 + \beta p_2 A_2)\, K^c - (1+r^c)\, B^c - (1+r^n)\, N^c$$

Shadow Banking

- Buy capital and issue liabilities, but no equity
- No regulatory cost
- Full default if the technology is unproductive
  - Default is mechanic, not strategic
- Because of limited liability

$$p_1 A_1^r K_t^s \geq (1 + r^s) B^s$$

- Expected profits

$$E\left[\Pi^s\right] = E\left[p_1 A_1^r\right] K^s - E\left[(1 + r_t^s)\right] b_t^s$$

Closing the Model

- Intermediaries choose

$$E\left[\Pi\right] = \max\left\{\Pi^c, E\left[\Pi^s\right]\right\}$$

- Monetary policy

$$\bar{M} = p_2 T_2 \text{ s.t. } p_2 = (1+\mu)\, p_1$$

- Market clearing

$$\begin{aligned} c_1 &= \bar{Y} + A_1 K^c + A_1^r K^s \\ c_2 &= A_2 K^c - T_2 \\ \bar{K} &= (1+\tau)\, K^c + K^s \\ M^h &= \bar{M} \end{aligned}$$

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Optimal Consumption

- κ : multiplier for the $t = 1$ cash in advance constraint
- Optimal morning consumption

$$c_1 = \frac{1 + \mu}{(1 + \mu)\,\kappa p_1 + \beta}$$

- First best if and only if the morning constraint is not binding

$$\kappa = 0 \Longleftrightarrow c_1 = \frac{1 + \mu}{\beta}$$

- Call $\kappa = 0$ full liquidity satiation
- Welfare ultimately depends on real liquidity across states

Monetary Policy Controls Aggregate Liquidity

- Take the money demand Euler equation
- The average $t = 1$ multiplier is

$$E[\kappa] = \bar{\kappa} = \lambda - \frac{\beta}{(1+\mu)\, p_1}$$

  Where λ is the multiplier of the $t = 0$ portfolio constraint
- That is

$$E\left[u'(c_1)\right] = \text{constant}$$

- Where the constant value is the opportunity cost of liquidity
- Monetary policy determines the aggregate liquidity allocation

Competitive Equilibrium

- Both bankers operate
- Liquidity is close to full satiation in the high state

$$c_1^h \to \frac{1+\mu}{\beta}$$

- Large difference between $t = 1$ consumption in the two states
- Price level $p_1 = \bar{M}/\bar{Y}$
- Conditions for existence:
  - The risky technology needs to have a large enough upside
  - Large A_h and/or small π

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Planner's Problem

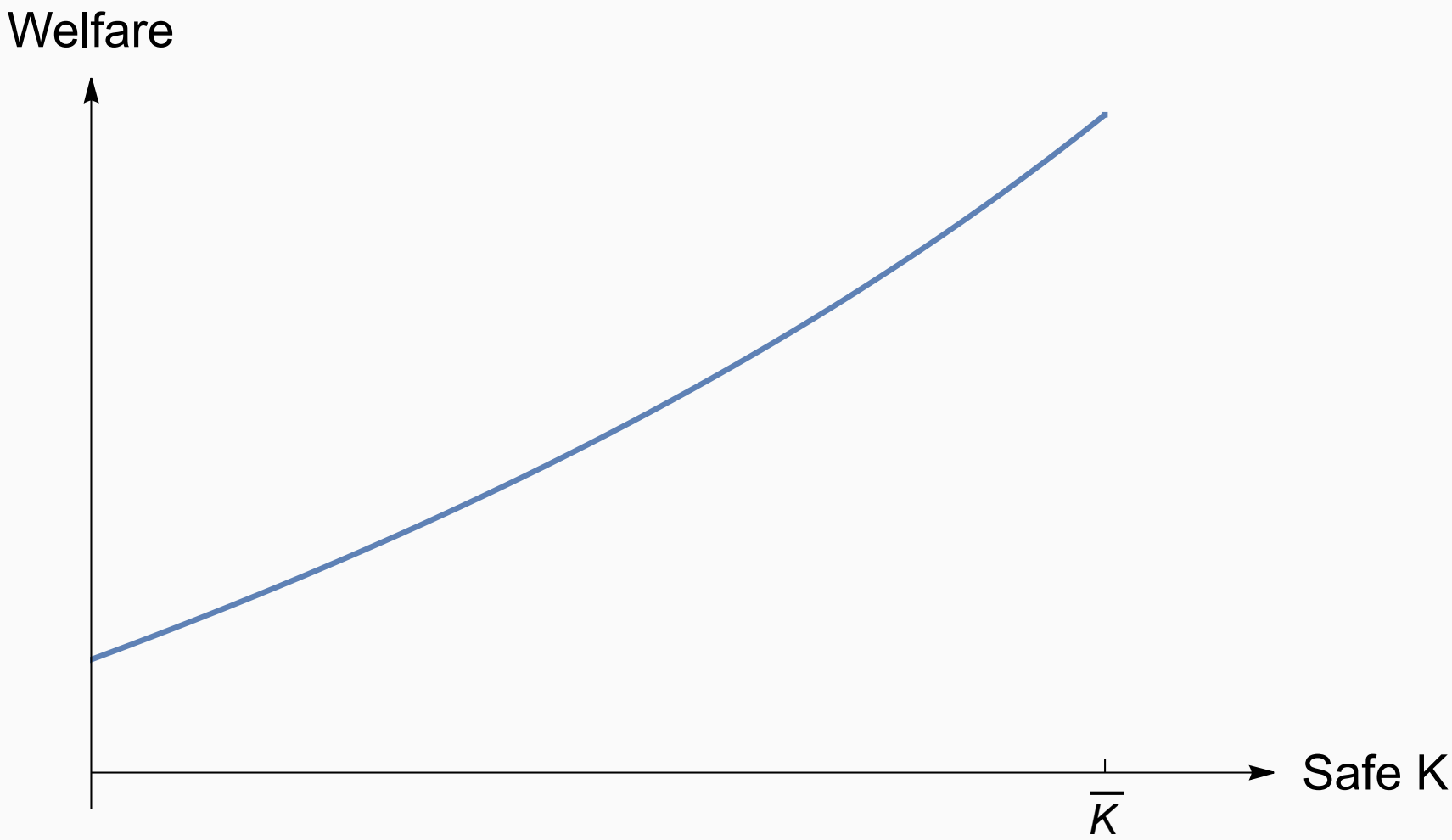
- Planner creates liquidity accounting for the production technologies
  - Allocate capital sectors
  - Loss from safe technology cost τ
- Objective: maximize household's expected utility
  - Given the household's demand functions
  - Given asset creation constraints
- The expected marginal value of liquidity must satisfy

$$E\left[u'\left(c_1\right)\right] = \text{constant}$$

Inefficient Supply of Liquidity

- Take inflation μ as given
- Main forces:
  - Equalize consumption across states from risk aversion
  - Consumption loss from regulatory cost τ
  - Inflation cost of holding currency from μ
- Risk aversion is the strongest force
- Planner equalizes $t = 1$ consumption across states
- The competitive equilibrium is inefficient

Illustration



Welfare with regulatory costs

Roadmap

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Liquidity and Capital Requirements

Liquidity Requirements

- Policy to mitigate the effects or the likelihood of default
- Liquidity requirements to cover short term obligations
- Basel III and the liquidity coverage ratio (LCR)
  - Level 1: cash, some government bonds
  - Level 2: GSE securities, investment grade debt
- In this model, force intermediaries to hold fiat currency

$$\frac{M^c}{B^c} \geq \delta^c \text{ and } \frac{M^s}{B^s} \geq \delta^s$$

Effects on Efficiency

- Efficient equilibrium: only the commercial banks operate
- The requirement is binding for both intermediaries
- Cannot implement the planner's solution:
  - If δ^c, δ^s are small, the inefficient equilibrium exists
  - If δ^c, δ^s are large, no equilibrium exists
- Intuition:
  - Money simply held by another agent
  - No significant shift in capital allocation
  - The cost of holding money can be too large for the intermediaries

Capital Requirements

- Policy to mitigate the likelihood of default
- Basel III:
  - Common Tier 1 capital greater than 4.5%
  - Tier 1 capital over risk weighted assets greater than 6%
- In the model, hold a minimum fraction of capital as equity

$$\frac{N^c}{QK^c} \geq \gamma^c \text{ and } \frac{N^s}{QK^s} \geq \gamma^s$$

- Holding equity = invest that K in the safe technology

Effects on Efficiency

- Efficient equilibrium: only the commercial banks operate
- Capital requirement is binding only for the shadow banks
- Improve on efficiency without achieving the planner's solution
- Intuition:
  - Holding equity is an additional cost for the shadow banks
  - Compensated by the lower return they offer on the risky securities
- Combination of policies may be necessary for efficiency

Conclusion

- Monetary policy indirectly governs aggregate liquidity
- Yet, there is inefficient issuance of liquidity
  - Too little liquidity in crises
- Liquidity requirements cannot implement the planner's solution
- Capital requirements are also insufficient