

# Inefficient Liquidity Creation

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*Disclaimer: Does not necessarily reflect the views of the Federal Reserve System.*

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# Motivation

- **Empirical fact:** Continuing shift from traditional banking to market-based activities (including shadow banking)
- **This paper:** Theoretical guidance on the optimal composition of different intermediation models
- Particular focus on **liquidity creation** by intermediaries (safe debt)
- Implications for **macroprudential regulation**

# Findings

1. Theory of coexistence of intermediary business models:
  - Hold-to-maturity banking: issue equity
  - Market-based intermediation: sell risky assets in downturns
2. Too much market-based intermediation, excessive fire sales in downturns
  - Contracting frictions induces pecuniary externalities
  - Inefficient liquidity creation: **excessive** or **insufficient**
3. Optimal regulation targets **business models** of intermediation
  - Restrict market-based liquidity creation
  - Standard regulatory tools (equity / liquidity regulation) only effective if liquidity creation is excessive
  - If regulatory arbitrage (shadow banking): Subsidy for traditional banking

# Contribution

- Liquidity-benefit literature: “Banks are special”
  - Van den Heuvel (2008, 2016), Stein (2012), DeAngelo and Stulz (2015), Gorton and Winton (2016), Hellwig (2015, 2016), Diamond (2019)
- General equilibrium models with financial frictions & fire sales
  - Caballero and Krishnamurthy (2003), Lorenzoni (2008), Dávila and Korinek (2018)
  - Stein (2012), Bolton, Santos and Scheinkman (2011)
- Regulatory arbitrage and shadow banking
  - Hanson et al. (2015), Plantin (2015), Xiao (2018), Luck and Schempp (2014)

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**1** Framework

2 Equilibrium and Constrained-Efficient Allocation

3 Regulation

# Framework

- Three dates,  $t = 0, 1, 2$
- Three types of risk neutral agents:
  - households
  - intermediaries
  - late investors

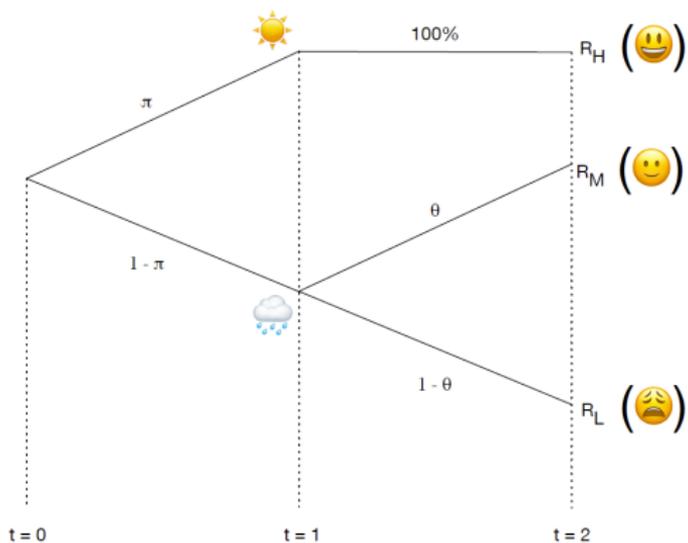
## Households

- Initial endowment, “risk neutral”, but:
- **Liquidity benefit**  $\gamma$  (“safety premium”) per unit of safe claims

## Intermediaries

- Cashless, invest on behave of households
- Two types of financial contracts:
  - **Safe debt**, associated with liquidity benefit
  - **Outside equity** (or risky junior debt)

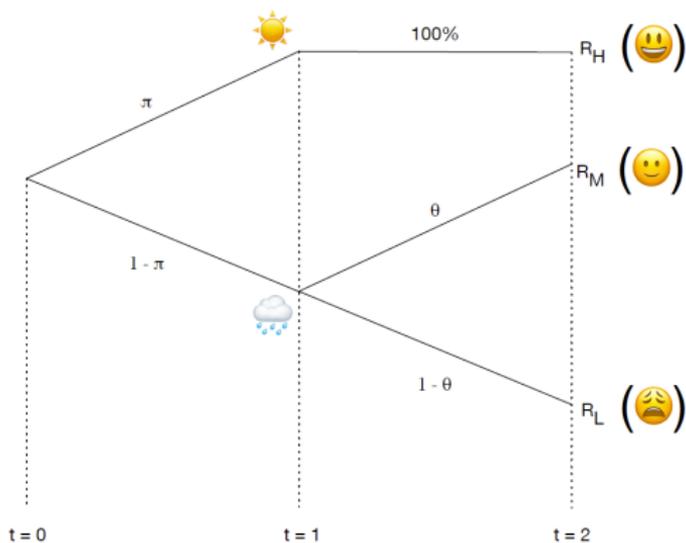
## Assets with macro risk: optimistic or pessimistic news at date 1



“Recovery friction”: Recovering funds in downturns requires “expertise”

- Intermediaries can decide to become “recovery experts”, cost  $F$
- Non-experts can only recover  $\rho R_L$  (also applies for buyers!)
- Compare: Bolton and Freixas (2000)

## Assets with macro risk: optimistic or pessimistic news at date 1



“**Recovery friction**”: Recovering funds in downturns requires “expertise”

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# Separation of intermediary business models

## *Preliminary insight*

The fixed cost of becoming a recovery expert induces separation:

- **Hold-to-maturity intermediaries** invest in the recovery technology,  $\mu_i = 0$
- **Market-based intermediaries** do not become experts  $\mu_i = 1$

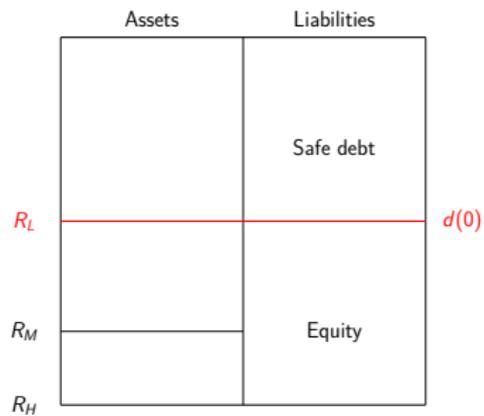
Size of market-based banking:  $\mu = \int \mu_i$

## Late investors

- Born at date 1
  - Limited endowed can be used...
    - to invest in a late production technology  $g(\cdot)$ , decreasing returns to scale
    - to purchase assets from intermediaries
  - **Key friction:** contracting at  $t = 0$  not possible  
*Holmström and Tirole 1998*
- ⇒ Spot market for assets at date 1, pecuniary externality

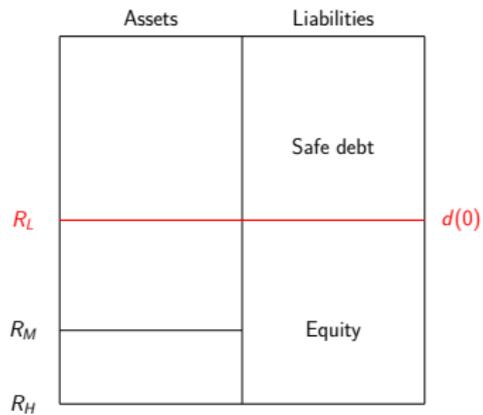
# Liquidity Creation

Hold-to-Maturity Banking:  $\mu = 0$

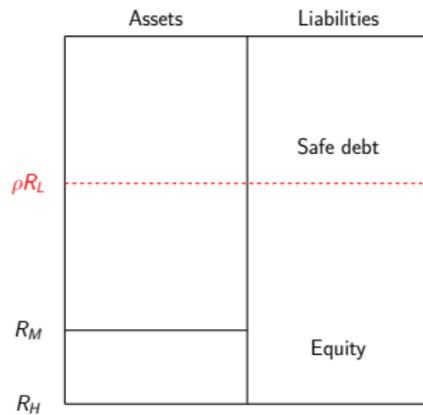


# Liquidity Creation

Hold-to-Maturity Banking:  $\mu = 0$

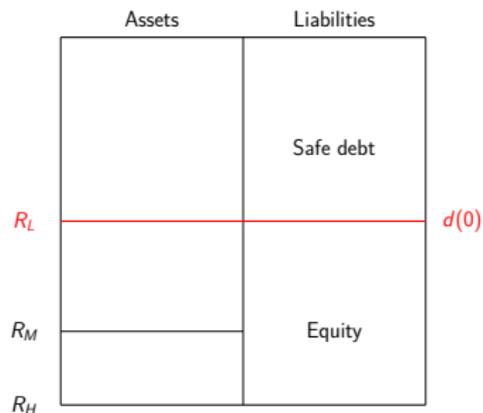


Market-Based Banking:  $\mu = 1$

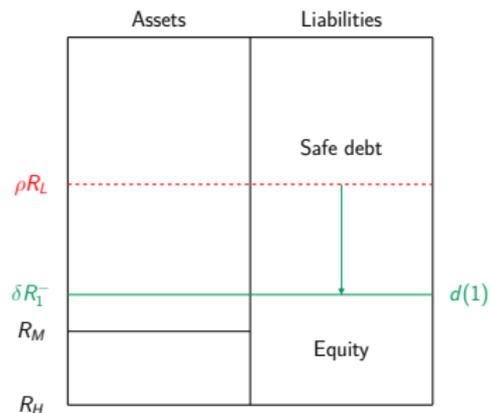


# Liquidity Creation

Hold-to-Maturity Banking:  $\mu = 0$



Market-Based Banking:  $\mu = 1$



Individual liquidity creation:

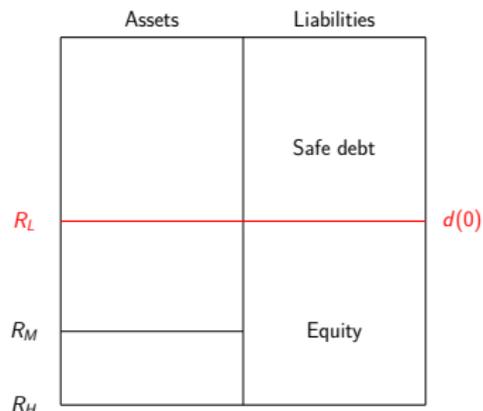
$$d(\mu) = (1 - \mu)R_L + \mu\delta R_1^-$$

Aggregate liquidity creation:

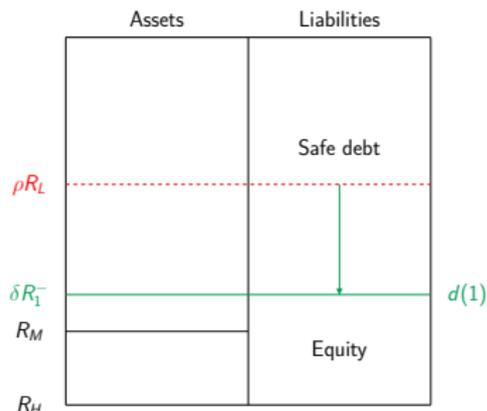
$$D(\mu) = (1 - \mu)R_L + \underbrace{\mu\delta R_1^-}_{M(\mu)}$$

# Liquidity Creation

Hold-to-Maturity Banking:  $\mu = 0$



Market-Based Banking:  $\mu = 1$



Individual liquidity creation:

$$d(\mu) = (1 - \mu)R_L + \mu\delta R_1^-$$

Aggregate liquidity creation:

$$D(\mu) = (1 - \mu)R_L + \underbrace{\mu\delta(\mu)R_1^-}_{M(\mu)}$$

## Asset market: Fire sales

Market clearing:

$$\underbrace{M(\mu)}_{\text{funds used to buy assets}} = \underbrace{\mu}_{\text{assets sold}} \cdot \underbrace{\delta(\mu)}_{\text{fire-sale discount factor}} \cdot \underbrace{R_1^-}_{E[R|\text{ bad news}]}$$

Market discount factor determined by late investors' to outside option:

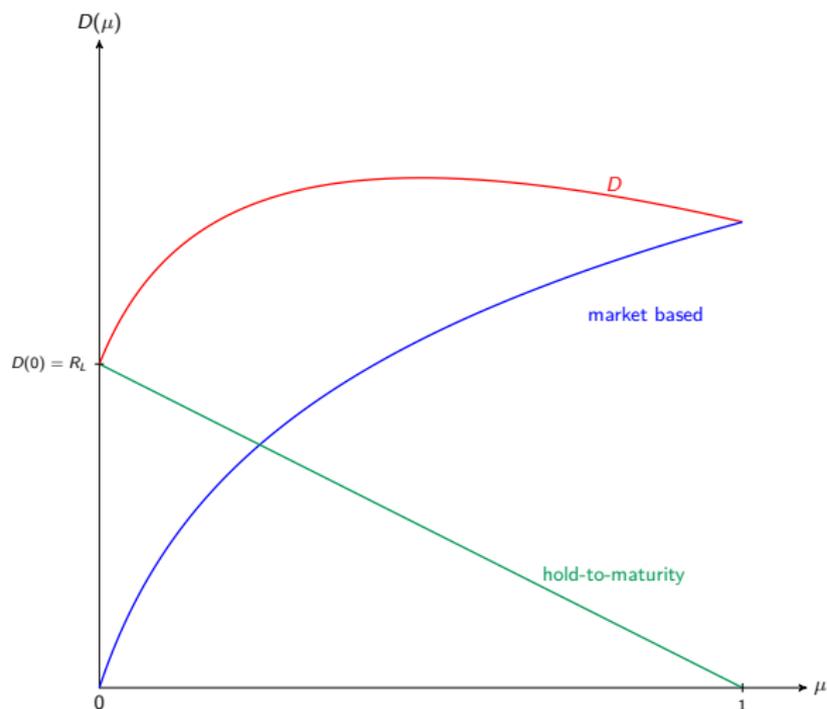
$$\delta = \frac{1}{g'(W - M)}$$

- $g'$  is a measure of the fire-sale discount
- Fire sales are costly because of profitable outside options (e.g., Lorenzoni 2008, Diamond and Rajan 2011, Stein 2012)

More fire sales...

- increase the fire-sale discount,  $g'$  increases
- imply that investors use more funds (more asset sale revenue):  $M'(\mu) > 0$

## Liquidity Creation: The composition of Safe Debt



- $D'(\mu)$  can become negative, potential “liquidity destruction”
- Non-monotonicity of liquidity creation is due to  $R_L > 0$

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## Fire sales & Investment

### Proposition

*There is excessive reliance on market-based liquidity creation in the laissez-faire equilibrium too little investment in recovery technology, leading to excessive fire sales.*

- Friction: Financial constraint that depends on market prices
- Excessive fire sales in line with Lorenzoni (2008), Stein (2012), Dávila and Korinek (2018)

## Profit and Welfare

Bank profits:

$$\Pi_i(\mu_i = 0) = \pi R_H + (1 - \pi)R_1^+ - 1 - F + \gamma R_L,$$

$$\Pi_i(\mu_i = 1) = \pi R_H + (1 - \pi)\delta R_1^- - 1 + \gamma\delta R_1^-.$$

Welfare:

$$\begin{aligned} \mathcal{W}(\mu, M) = & (1 - \pi) [(1 - \mu)R_1^+ + \mu R_1^-] - (1 - \mu)F \\ & + \gamma \underbrace{[(1 - \mu)R_L + M]}_{D = \int d_i d_i} + (1 - \pi)[g(W - M) + M]. \end{aligned}$$

subject to

$$M(\mu) = \mu\delta(\mu)R_1^- = \mu \frac{R_1^-}{g'(W - M(\mu))}$$

## Laissez-Faire Equilibrium and Constrained-Efficient Allocation

- Severity of the fire-sale discount is measured by  $\delta^{-1} = g'(W - M)$

**Equilibrium:** Fire-sale discount that makes intermediaries indifferent is

$$g'(W - M^*) = \frac{(1 - \pi + \gamma)R_1^-}{(1 - \pi)R_1^+ + \gamma R_L - F}.$$

Wedge between equilibrium and **constrained-efficient allocation:**

$$g'(W - M^{**}) = \underbrace{g'(W - M^*)}_{\text{fire sale discount in equilibrium}} + \underbrace{\frac{[\gamma R_L + (1 - \pi)(R_1^+ - R_1^-) - F] M^{**} g''(W - M^{**})}{(1 - \pi)R_1^+ + \gamma R_L - F}}_{<0 \text{ pecuniary externality}}$$

- Fire-sale discount is too high in equilibrium

# Liquidity creation

## Proposition

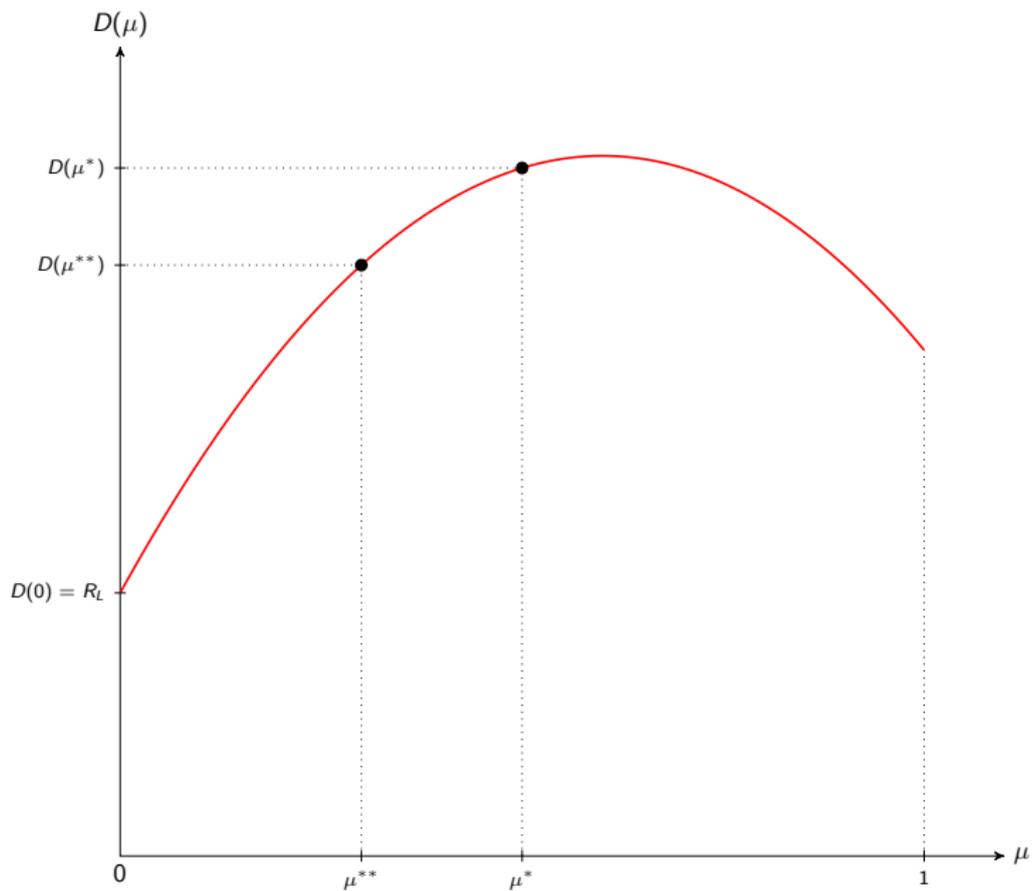
*The equilibrium level of safe debt (“liquidity creation”) can be excessive, but it can also be insufficiently low.*

- Different result than, e.g., Lorenzoni (2008), Stein (2012) and Dávila and Korinek (2018)
- “Safe-debt constraint”  $\neq$  “collateral constraint”

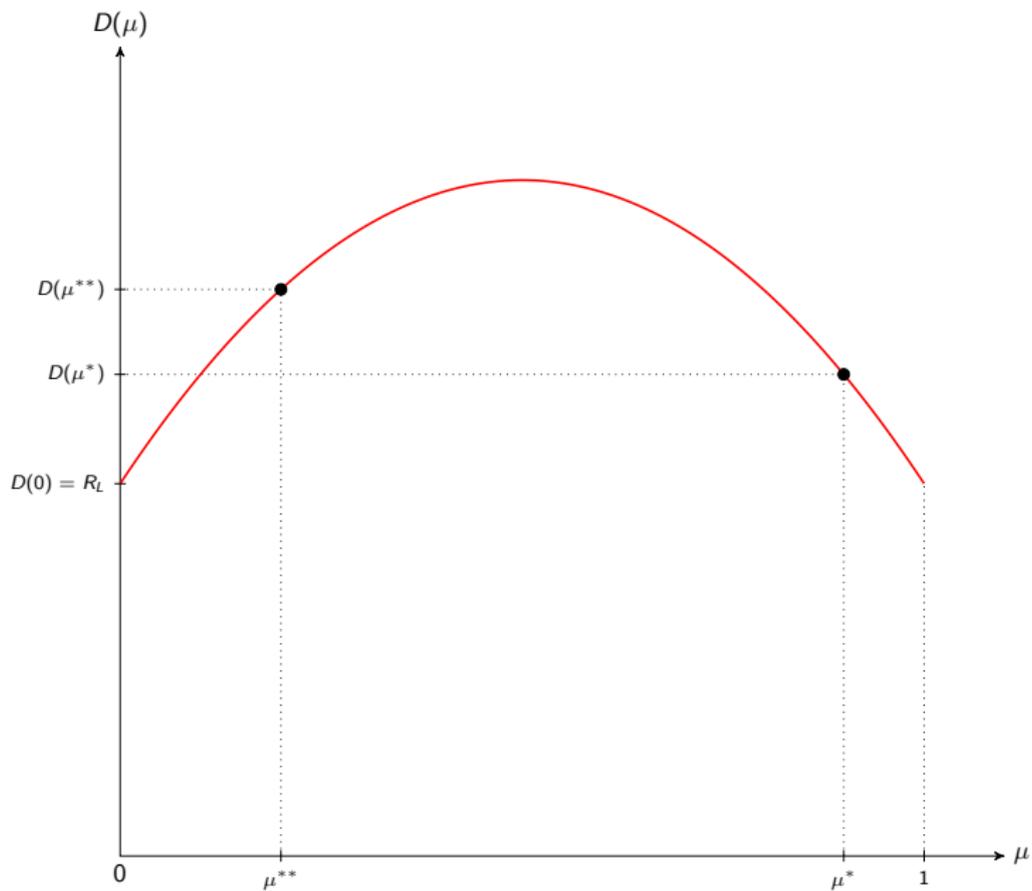
## Intuition:

- Market-based intermediation relies on outsiders bringing liquidity into the system by purchasing assets.
- But: By selling assets, we give up safe payoff on the balance sheet.

# Example I



## Example II



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# Macroprudential Regulation

Why “**macroprudential**”?

- There is no problem on the individual bank level.
- The fire sales and its pecuniary externality is a “systemic risk” problem.

Optimal regulation aims at limiting the “contribution to systemic risk”.

- The “vulnerability” or “exposure to systemic risk” is not an issue (like in stress tests).

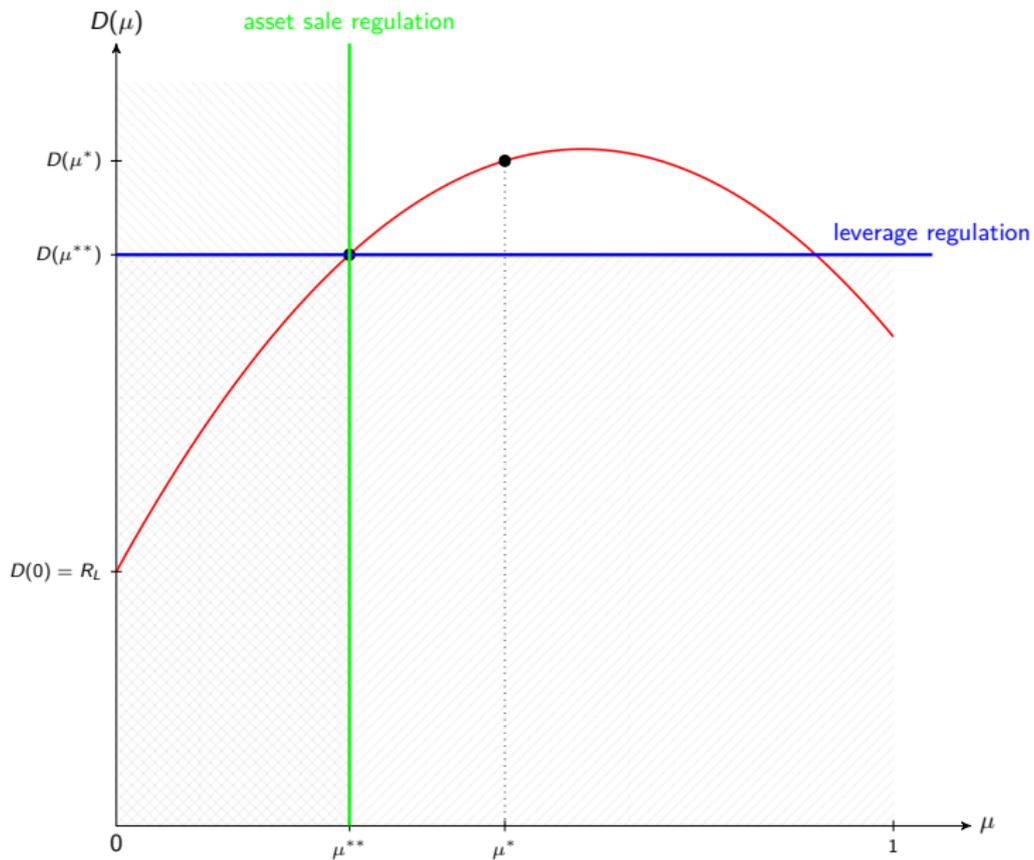
# Macroprudential Regulation

## Proposition

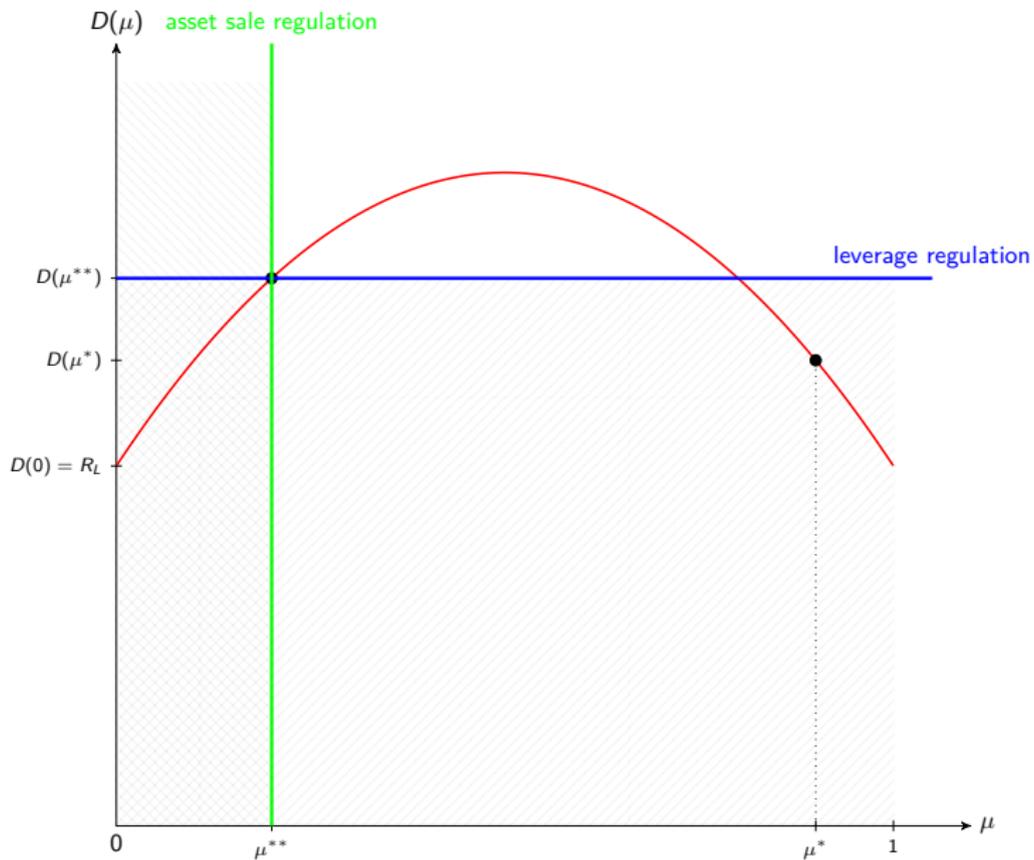
*A macroprudential policy targeting the total amount of economy-wide safe debt can implement the constrained-efficient **only if liquidity creation is excessive.***

- Why?  $D(\mu)$  is non-monotonic and thus not invertible.
- Macroprudential reserve requirement like in Stein (2012) may not work.

# Example I



## Example II



# Direct Regulation

## Proposition

*A regulator can implement the constrained-efficient allocation by targeting the aggregate reliance on market-based banking directly.*

### Tools:

- Price regulation: Tax on asset sales
- Quantity regulation: Permits for market-based banking, cap-and-trade approach

### Problems:

- Feasibility in practice?
- Time consistency?
- Limit deleveraging in a crisis?

# Shadow banking and Regulatory Arbitrage

- What if regulatory arbitrage is a threat?
- Standard macroprudential regulation becomes ineffective!
- By trying to limit fire sales, regulation pushes intermediation “into the shadow”.

## Proposition

*A subsidy for the traditional hold-to-maturity banking business is immune to regulatory arbitrage.*

*If liquidity creation is excessive, a **subsidy for bank equity** is an optimal policy.*

## Tools

- Plain subsidies (politically feasible?)
- Under-priced deposit insurance
- Bail-out expectations

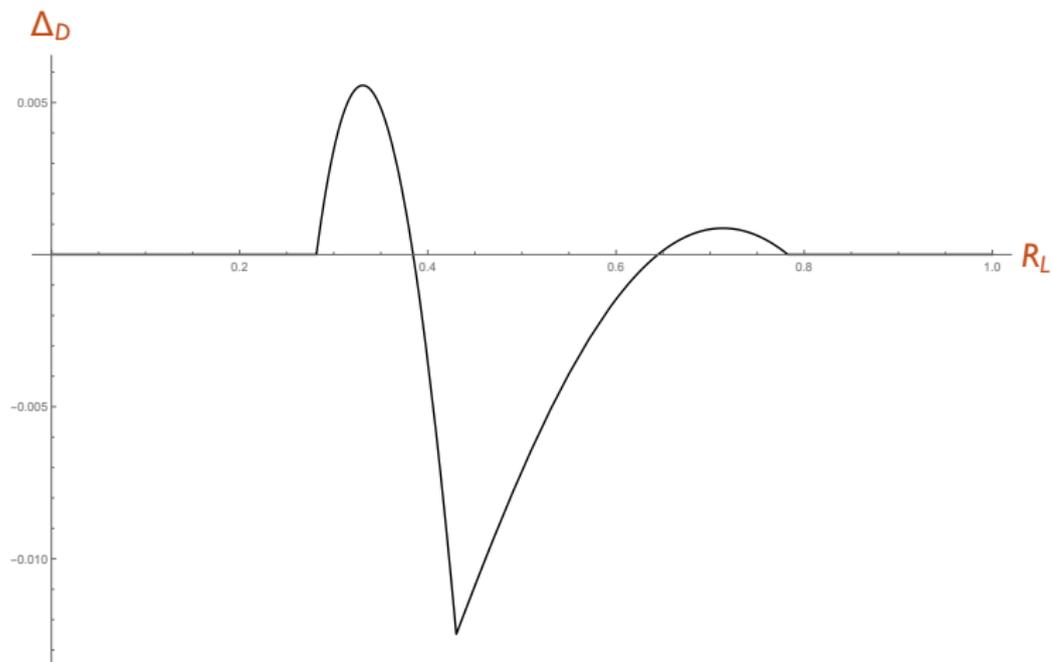
## Conclusion

1. Pecuniary externality leads to excessive market-based banking & fire sales
  - **But:** Liquidity creation can be **excessive** OR **insufficient**
2. Standard tools of banking regulation do not work if liquidity creation is insufficient
  - ⇒ Direct targeting of business models is necessary
3. Regulatory arbitrage can be addressed with subsidies for “traditional banking”

## Comparative Statics & Extensions

# Is liquidity creation excessive or insufficient?

“Excess liquidity” in the competitive equilibrium



## Insufficient liquidity creation

### Proposition

*Insufficient liquidity creation occurs only for intermediate values of  $R_L$ .*

Why?

- Remember: Sales volume always weakly too high!

Low  $R_L$ :

- Liquidity destruction is (technically) not possible at  $R_L = 0$ , asset sales are the only way to create liquidity.

High  $R_L$ :

- Little uncertainty after pessimistic news ( $R_L \approx R_M$ ), assets sales are unattractive (privately **and** socially).
- The first unit of assets sold must create liquidity (no extensive margin).

## Extensions and Robustness: Commitment & Discipline

- What happens if intermediaries cannot commit to a liquidation policy?
- Market-based intermediaries have incentives **not** to liquidate
- Short-term debt serves as a disciplining device

This matches the experience from the last financial crisis:

- Withdrawals from market-based intermediaries (MMFs, ABCP conduits)
- Hold-to-maturity banking was substantially less affected

# Extensions and Robustness

## Variable Investment Scale

- What if we allow intermediaries to choose their investment amount?
  - Two possible scenarios:
    - Excessive investment AND excessive fire sales
    - Undistorted investment, but excessive fire sales
- ⇒ All of our effects can also prevail in a variable-investment model!

## Idiosyncratic Risk

- Until now, we had only aggregate risk
- Market-based banking allows intermediaries to partially insure
- Still, hold-to-maturity banking can create liquidity as long as lower bound is  $R_L > 0$