Banking on Uninsured Deposits

Itamar Drechsler[1] Alexi Savov[2] Philipp Schnabl[2] Olivier Wang[2]

[1]Wharton [2]NYU Stern

September 2023

2023 regional bank crisis

Since early 2022, the Fed has raised short-term rates by 5.25%

- long-term rates are up 2.5%

Banks held $17T of long-term loans and securities with average duration 4 years

- implied loss of 0.025 x 4 x 17 = $1.7T
- very large compared to $2.2T bank equity

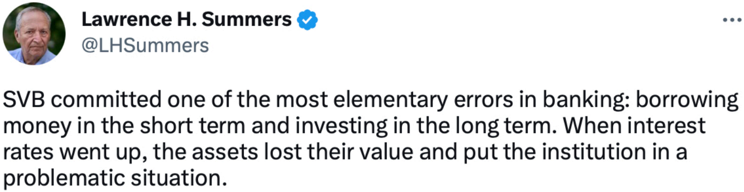
2023 regional bank crisis

Since early 2022, the Fed has raised short-term rates by 5.25%

- long-term rates are up 2.5%

Banks held $17T of long-term loans and securities with average duration 4 years

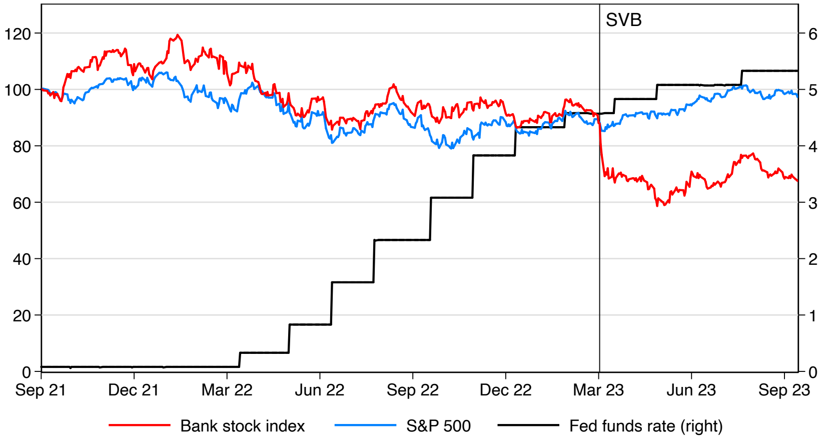
- implied loss of 0.025 x 4 x 17 = $1.7T
- very large compared to $2.2T bank equity
- **widespread insolvency?**



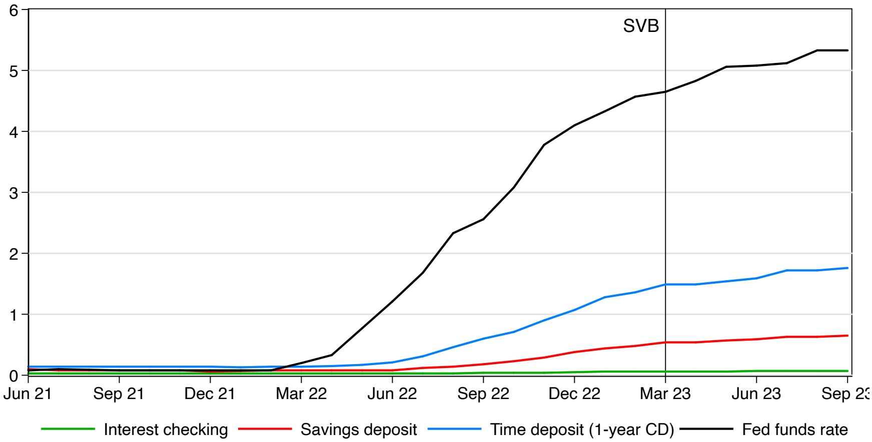
Lawrence H. Summers
@LHSummers

SVB committed one of the most elementary errors in banking: borrowing money in the short term and investing in the long term. When interest rates went up, the assets lost their value and put the institution in a problematic situation.

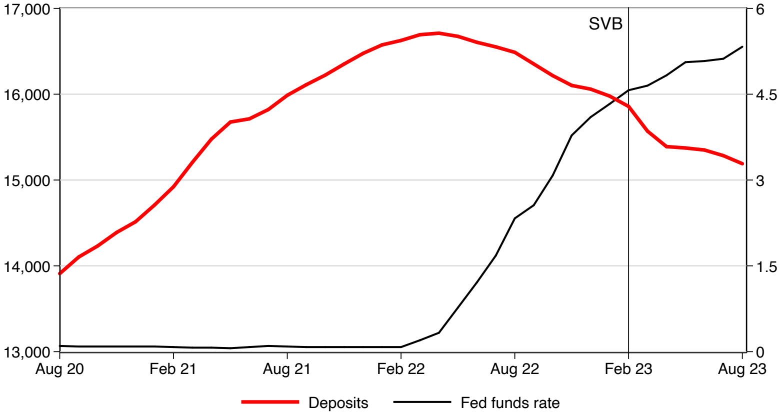
But why not earlier? Why not all banks?



A natural hedge: low deposit betas (DSS, 2021)



Deposit outflows



- Deposit outflows of 5% ($830 billlion) from Mar 22 until Feb 2023
- Additional outflows of 4% ($660 billion) from Mar 23 until Aug 2023

This paper

Deposit franchise hedges interest rate risk (DSS 2021)...

...**but only if depositors remain with the bank**

Hedge can be undermined by two kinds of deposit outflows:

- rate-driven outflows - "deposits channel of MP" (DSS, 2017)
- **runs on the uninsured deposit franchise**

Main results

1. Uninsured deposit franchise is a runnable asset

   $\rightarrow$ Diamond-Dybvig runs even if loans/securities are fully liquid

2. Deposit franchise value rises with rates + uninsured part is runnable

   $\rightarrow$ liquidity risk rises with rates

3. Risk management dilemma:

   - need long-term assets to hedge interest rate risk
   - need short-term assets to hedge run risk of uninsured deposits

   $\rightarrow$ cannot hedge both interest rate and liquidity risk

4. Solutions: options, "rate-cyclical" capital, lender of last resort

Model: deposit franchise with outflows

- Bank starts with assets A and deposit base $D_{-1} = D$.
- In period t, remaining deposits D_{t-1}
  - pay deposit rate $r_{d,t}$
  - require operating costs c per dollar
  - withdrawals $X_t = D_{t-1} - D_t$
- Date-0 bank value

$$V = A - L$$

where L is PV of liabilities

$$L = \underbrace{\sum_{t \geq 1} q_t D_{t-1} \left(r_{d,t} + c \right)}_{\text{interest expenses and costs}} + X_0 + \underbrace{\sum_{t \geq 1} q_t X_t}_{\text{withdrawals}}$$

Simplifying assumptions

- Initial interest rate $r_{-1} = r$. One-time shock to $r_0 = r_1 = \cdots = r'$.
  $\rightarrow$ Deposit rate $r'_d = \beta r'$
- $t \geq 1$: exogenous outflows

$$X_t = \delta D_{t-1}$$

  to capture natural decay of deposit base.

Deposit franchise value

Rewrite

$$V = A + \underbrace{DF - D}_{-L}$$

where

$$DF = \textbf{deposit franchise}$$

Proposition

Without runs,

$$DF(r') = D\left[\frac{(1-\beta)\,r' - c}{r' + \delta}\right]$$

Deposit franchise value

Rewrite

$$V = A + \underbrace{DF - D}_{-L}$$

where

$$DF = \textbf{deposit franchise}$$

Proposition

Without runs,

$$DF(r') = D\left[\frac{(1-\beta)\,r' - c}{r' + \delta}\right]$$

$$DF'(r) = D\left[\frac{c + (1-\beta)\delta}{(r+\delta)^2}\right] > 0$$

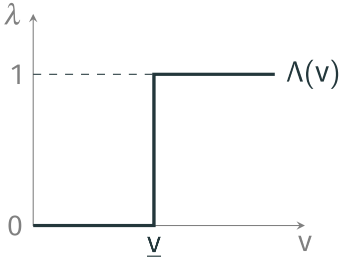
Adding uninsured deposits and runs

Exogenous share u of deposits uninsured: bank value

$$V = A - D + DF_I + \lambda DF_U$$

where λ: **endogenous** fraction of remaining uninsured depositors

$\lambda = \Lambda(v)$ increasing in $v = V/D$: earnings, stock price



Runs on the deposit franchise

Bank solvency ratio given λ: $$v(\lambda, r') = v(0, r') + \lambda \cdot u \overbrace{\frac{(1-\beta^U)r' - c^U}{r' + \delta}}^{= DF_U(r')/D}$$

Runs on the deposit franchise

Bank solvency ratio given λ: $$v(\lambda, r') = v(0, r') + \lambda \cdot u \overbrace{\frac{(1-\beta^U)r' - c^U}{r' + \delta}}^{=DF_U(r')/D}$$

Equilibrium given $A(r')$: $$\lambda \text{ s.t. } \boxed{\Lambda(v(\lambda, r')) = \lambda}$$

Runs on the deposit franchise

Bank solvency ratio given λ: $v(\lambda, r') = v(0, r') + \lambda \cdot u \overbrace{\frac{(1-\beta^U)r' - c^U}{r' + \delta}}^{= DF_U(r')/D}$

Equilibrium given $A(r')$: λ s.t. $\boxed{\Lambda(v(\lambda, r')) = \lambda}$

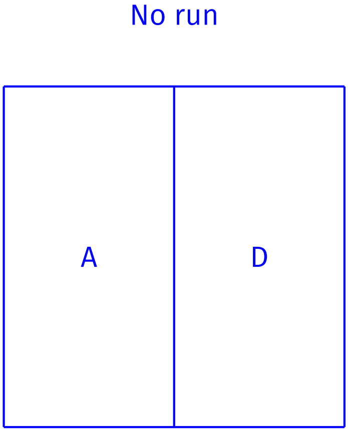
Proposition

- If $v(1, r) \geq \underline{v}$: run-free equilibrium $\lambda = 1$ exists
- If $v(0, r) < \underline{v}$: run equilibrium $\lambda = 0$ exists despite A fully liquid

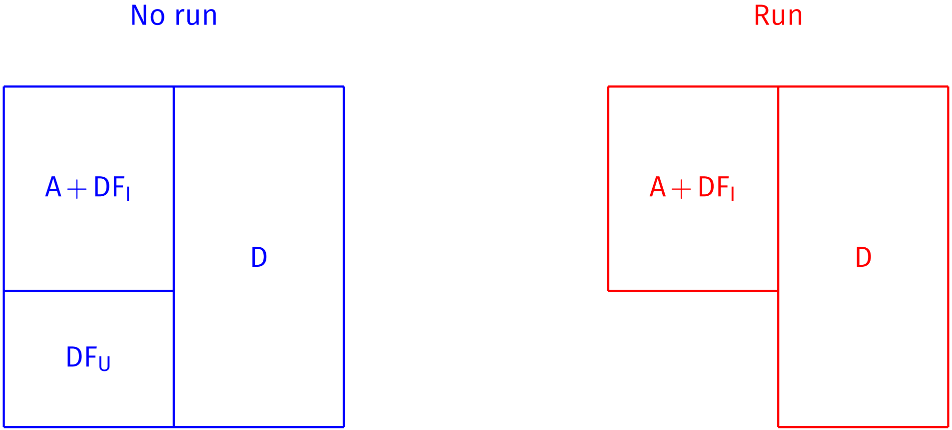
Given $v(1, r')$, run equilibrium more likely to exist when DF_U more profitable:

- the share of uninsured deposits u is higher
- the uninsured deposit beta β^U is lower
- **the interest rate r' is higher**

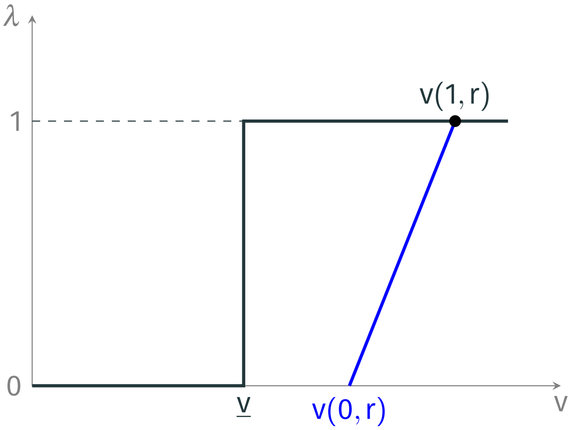
Balance sheet: unique equilibrium at r



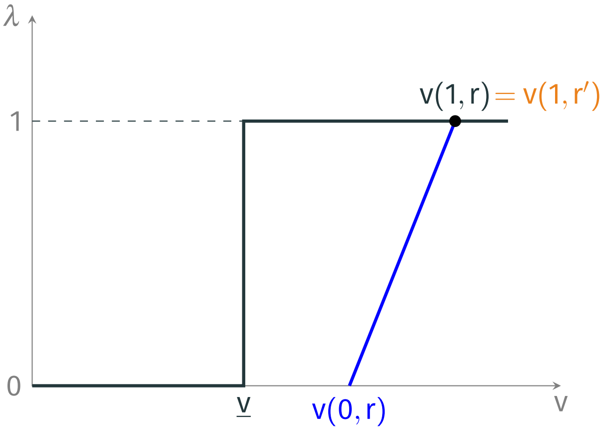
Balance sheet: two equilibria at $r' > r$



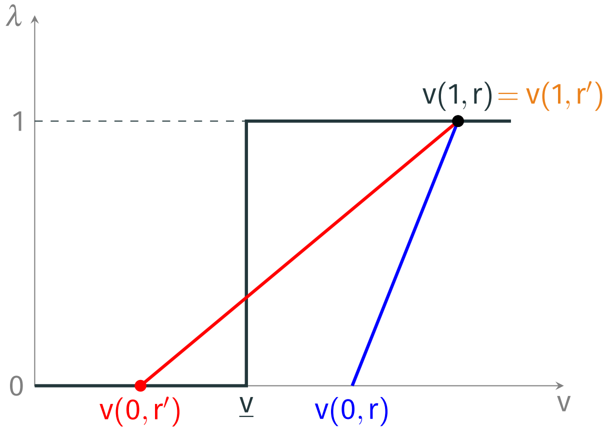
Liquidity risk increases with r



Liquidity risk increases with r



Liquidity risk increases with r



Optimal duration

Proposition

Hedging interest rate risk in no-run equilibrium requires:

$$T_A = (1-u)\frac{(1-\beta^I)\delta + c^I}{(r+\delta)^2} + u \times \frac{(1-\beta^U)\delta + c^U}{(r+\delta)^2}$$

Optimal duration

Proposition

Hedging interest rate risk in no-run equilibrium requires:

$$T_A = (1-u)\frac{(1-\beta^I)\delta + c^I}{(r+\delta)^2} + u \times \frac{(1-\beta^U)\delta + c^U}{(r+\delta)^2}$$

Hedging liquidity risk (preventing run equilibrium) requires:

$$T_A = (1-u)\frac{(1-\beta^I)\delta + c^I}{(r+\delta)^2}$$

Risk management dilemma

$$v(1, r') = v(0, r') + DF_U(r')$$

Hedging interest rate risk: stabilize $v(1, r')$

Hedging liquidity risk: maintain $v(0, r') \geq \underline{v}$

Risk management dilemma

$$v(1, r') = v(0, r') + DF_U(r')$$

$$\text{Hedging interest rate risk:} \quad \text{stabilize } v(1, r')$$

$$\text{Hedging liquidity risk:} \quad \text{maintain } v(0, r') \geq \underline{v}$$

Proposition

Suppose the bank perfectly hedges interest rate risk in the good equilibrium.

Then the run equilibrium exists for

$$r' > \bar{r} = \frac{c^U + \delta \frac{v^* - \underline{v}}{u}}{1 - \beta^U - \frac{v^* - \underline{v}}{u}}$$

Risk management dilemma

$$v(1, r') = v(0, r') + DF_U(r')$$

$$\text{Hedging interest rate risk:} \quad \text{stabilize } v(1, r')$$
$$\text{Hedging liquidity risk:} \quad \text{maintain } v(0, r') \geq \underline{v}$$

Proposition

Suppose the bank perfectly hedges interest rate risk in the good equilibrium. Then the run equilibrium exists for

$$r' > \bar{r} = \frac{c^U + \delta \frac{v^* - \underline{v}}{u}}{1 - \beta^U - \frac{v^* - \underline{v}}{u}}$$

No run equilibrium if $\beta^U \to 1$: dilemma caused by **low beta uninsured** (e.g., corporate checking), **not** wholesale funding

Why can't the bank just hedge liquidity risk?

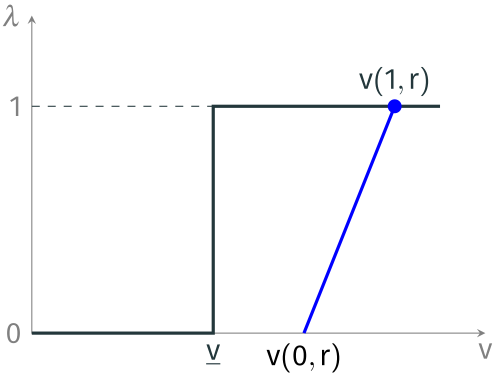
$A + DF_I$	D
DF_U	V

Why can't the bank just hedge liquidity risk?

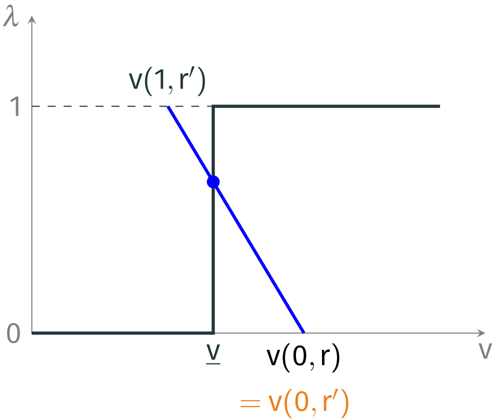
	$A + DF_I$	D
$r' < r$	DF_U	V

V exposed to interest rate risk when rates fall

Why can't the bank just hedge liquidity risk?



Why can't the bank just hedge liquidity risk?



Solution: Options

To hedge against liquidity risk when rates $\uparrow$ and interest rate risk when rates $\downarrow$ need

$$v(0, r') \geq \underline{v} \qquad \textbf{and} \qquad v(1, r') \geq v^* \text{ (initial level)}$$

Solution: Options

To hedge against liquidity risk when rates $\uparrow$ and interest rate risk when rates $\downarrow$ need

$$v(0, r') \geq \underline{v} \qquad \textbf{and} \qquad v(1, r') \geq v^* \text{ (initial level)}$$

Proposition

Banks must hold puttable LT bonds: combination of LT assets + call options on r':

$$A^*(r') = \underbrace{(1+v^*)D - DF_I\left(r'\right) - DF_U\left(\lambda = 1, r'\right)}_{\text{LT assets}} + \underbrace{\max\left\{0, DF_U\left(\lambda = 1, r'\right) - (v^* - \underline{v})D\right.}_{\text{payer swaptions}}$$

Solution: Options

To hedge against liquidity risk when rates $\uparrow$ and interest rate risk when rates $\downarrow$ need

$$v(0, r') \geq \underline{v} \qquad \textbf{and} \qquad v(1, r') \geq v^* \text{ (initial level)}$$

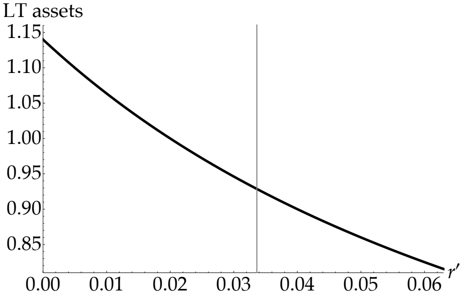
Proposition

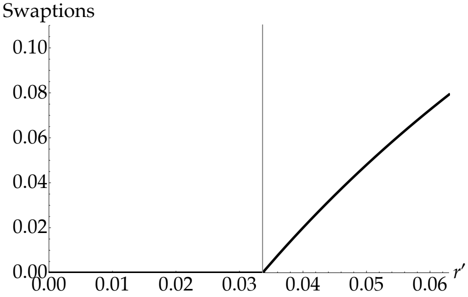
Banks must hold puttable LT bonds: combination of LT assets + call options on r':

$$A^*(r') = \underbrace{(1+v^*)D - DF_I(r') - DF_U(\lambda = 1, r')}_{\text{LT assets}} + \underbrace{\max\{0, DF_U(\lambda = 1, r') - (v^* - \underline{v})D}_{\text{payer swaptions}}$$

- Banks already hold swaptions to hedge MBS negative convexity...
  need more to hedge liquidity risk from uninsured DF
- Requires raising capital up-front: invest in options, not cash

Solution: Options





Conclusion

1. Low beta uninsured deposits create a runnable DF_U asset
2. Liquidity risk increases with interest rates
3. Risk management dilemma: banks need assets with
   - long duration to hedge interest rate risk
   - short duration to hedge liquidity risk
4. Solution: options or “rate-cyclical” capital