A Framework for Evaluating Banks' Resilience in a Rising Interest Rate Environment

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The Purpose of this Paper

- We develop a framework to determine whether conditions exist for banks to experience runs.
- Modeling Strategy: Do uninsured depositors have an incentive to run?
  - Based on the current fair value of its assets, could a bank pay all of its depositors?
  - If not, all uninsured depositors run.
- With this framework, we estimate the leverage ratio for banks *after* all uninsured depositors have withdrawn their money.
  - If that leverage ratio is $<= 0$, uninsured depositors should run.
  - More generally, if that leverage ratio is below a certain threshold, the bank is at risk of a run.
    - Note: Our framework is consistent with standard models of bank runs - i.e. Goldstein and Pauzner (2005) extension of Diamond and Dybvig (1983) model

Bank Fragility Measures

- We use the leverage ratio from the model to assess how susceptible banks are to runs.
- What distinguishes our measure from other measures of bank fragility?
  - Conceptually: The key feature of our measure is that it combines, in one metric, the fair value of a bank's assets *and* the funding structure of its liabilities.
  - Empirically: Our measure identifies weak banks earlier and as accurately as alternative measures, and at much lower cost in terms of incorrectly identifying banks as weak.

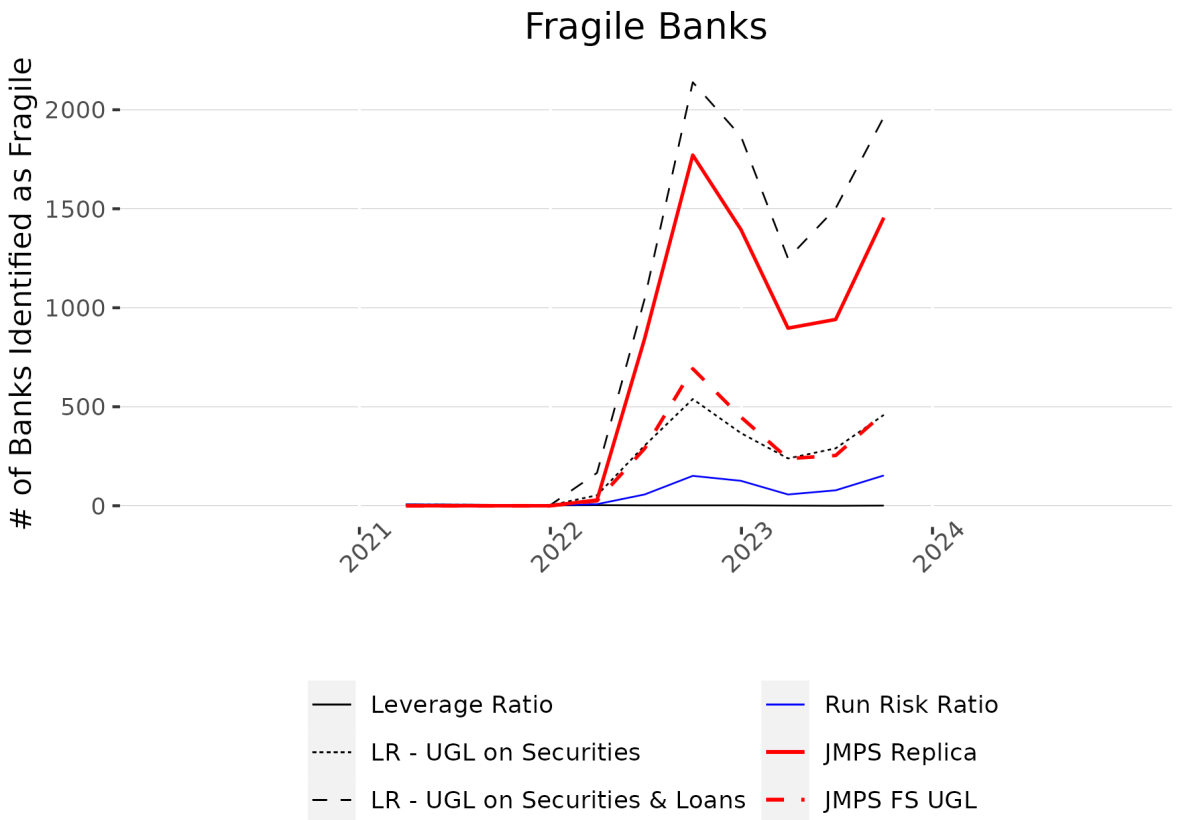
Overview of the Model

To calculate the our measure:

1. We assume all the uninsured depositors of a bank decide to withdraw their deposits.
2. The bank repays the uninsured depositors, starting with cash.
3. If cash is not sufficient, the bank sells STLA, AFS, HTM, and loans as needed until it has paid all of the uninsured depositors.
4. Once the uninsured depositors have been repaid, we calculate the fair value leverage ratio.
5. We call this ratio the *RunRisk*.

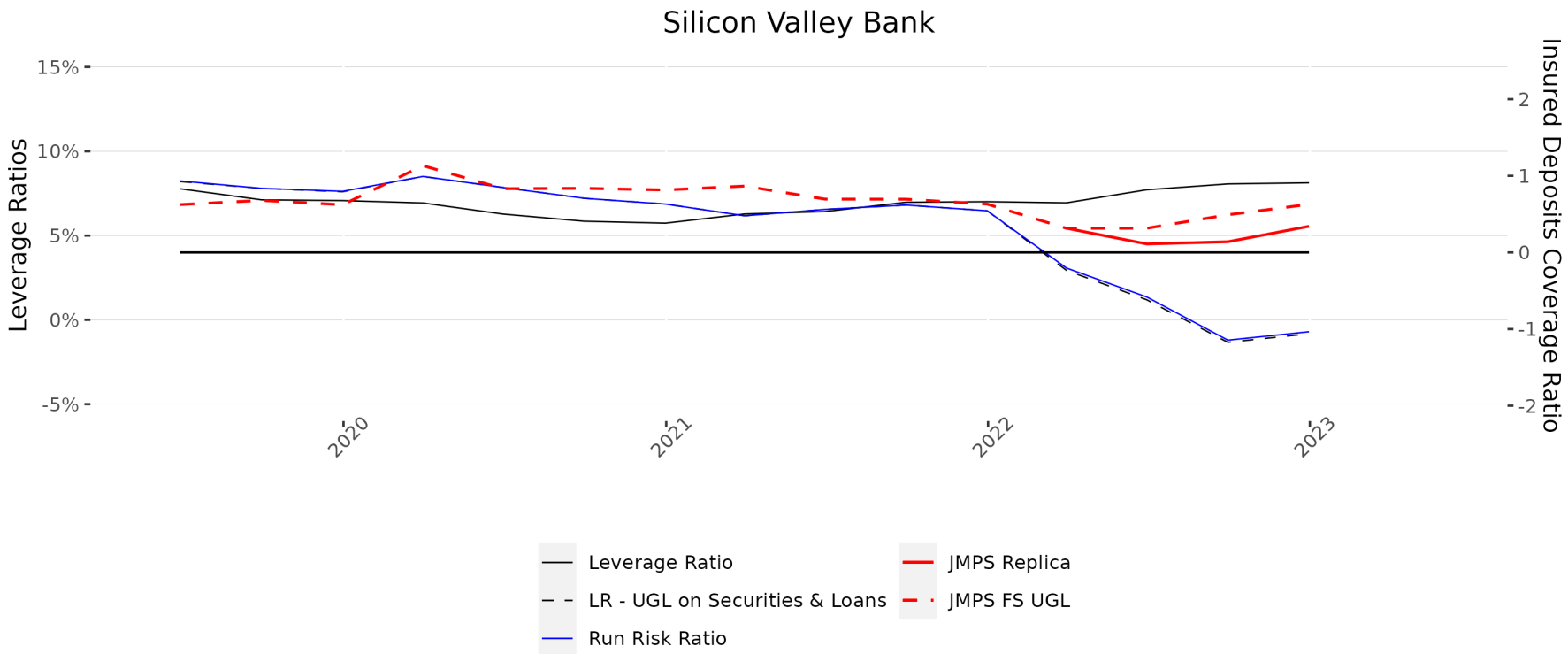
If the RunRisk ratio falls below 4%, the FDIC's undercapitalized level, we consider the bank at risk of a run.

Fragility Measures' Comparison - Recent Period

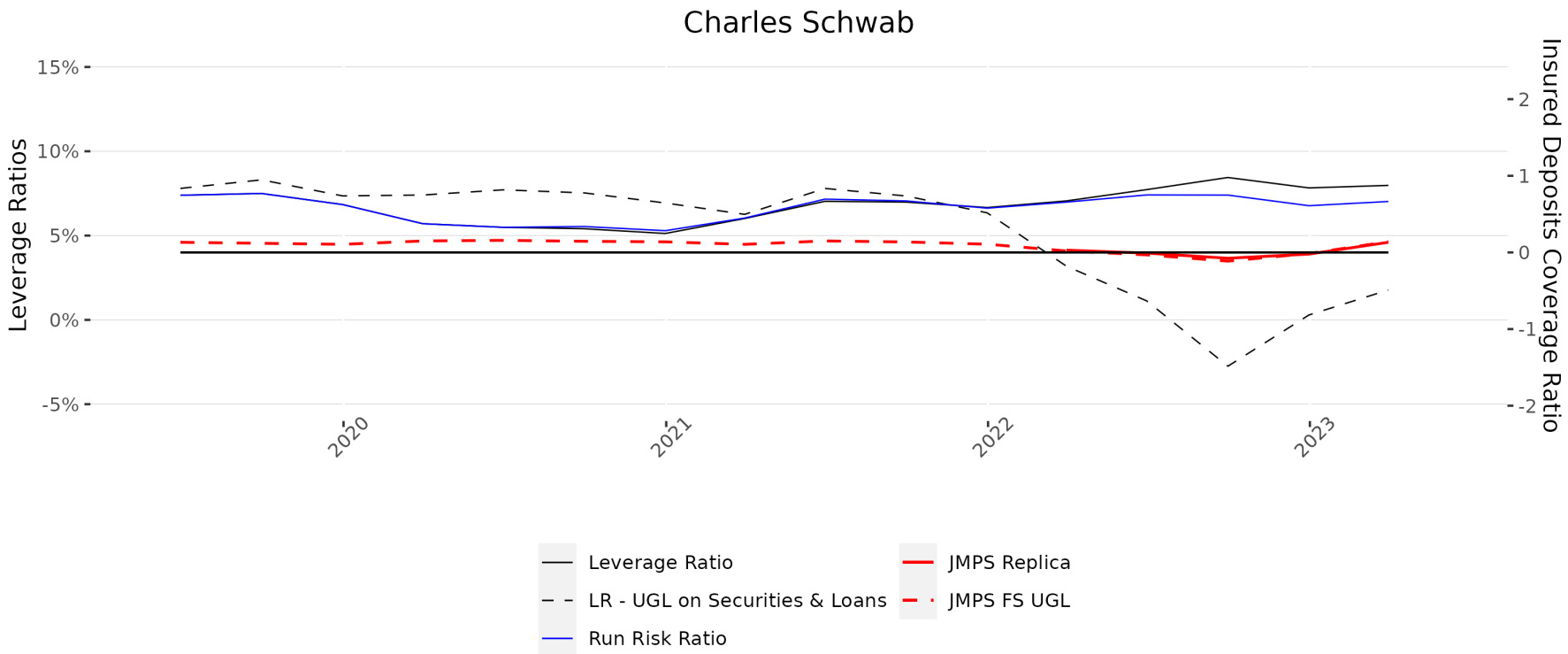


Our full sample is comprised of all institutions filing Call Reports over the period [1996:Q1-2023:Q3]

Silicon Valley Bank



Charles Schwab



Fragility Measures and Defaults

	Fragility Measure Indicator	Banks Unique	Defaults	True Positives	True Positive Ratio	False Positives	False Positive Ratio	Area Under Curve
All Banks	Regulatory LR	13,108	528	377	20.04%	577	1.49%	59.28
	LR - UGL Securities	13,108	528	390	48.10%	1,252	16.98%	65.56
	LR - UGL Securities & Loans	13,108	528	391	73.54%	2,935	39.66%	66.94
	Run Risk Ratio	13,108	528	385	73.00%	809	8.83%	82.08
	JMPS Replica	4,825	5	1	0.03%	1,830	9.77%	45.13
	JMPS FS UGL	13,108	528	7	0.16%	744	2.90%	48.63
	Deposit Repricing	13,108	528	168	80.31%	11,153	90.31%	45.00
IR-only	Regulatory LR	2,097	6	2	0.37%	100	1.44%	49.47
	LR - UGL Securities	2,097	6	3	39.24%	267	17.74%	60.75
	LR - UGL Securities & Loans	2,097	6	4	78.54%	759	40.94%	68.80
	Run Risk Ratio	2,097	6	4	78.54%	241	9.30%	84.62
	JMPS Replica	1,091	3	0	0.00%	334	8.29%	45.85
	JMPS FS UGL	2,097	6	0	0.00%	94	2.59%	48.71
	Deposit Repricing	2,097	6	4	99.63%	1,863	90.79%	54.42

Fragility Measures Costs

	Fragility Measure Indicator	Positives	Small Banks	Medium Banks	Large Banks	Equity Gap ($Bn)	Mean Lev R Gap	Mean Stable Liabilities Gap
2022:Q4	Regulatory LR	2	2	0	0	0.000	0.08%	
	LR - UGL Securities	367	297	57	13	53.394	1.39%	
	LR - UGL Securities & Loans	1,866	1,349	432	85	207.943	1.93%	
	Run Risk Ratio	126	47	60	19	25.364	1.52%	1.65%
	JMPS Replica	1,395	1,163	219	13	61.720	3.63%	
	JMPS FS UGL	448	397	46	5	11.771	1.78%	

Run Risk Ratio and Defaults

	Bank Default			
	Complementary Log-Log			Logit
	(1)	(2)	(3)	(4)
Run Risk I	5.942^{***}	3.003^{***}	2.924^{***}	2.475^{***}
	(0.000)	(0.000)	(0.000)	(0.000)
Leverage Ratio		-9.965^{**}	-13.562^{***}	-32.784^{***}
		(0.040)	(0.000)	(0.000)
BHC Controls	No	Yes	Yes	Yes
Quarter FE	No	No	Yes	Yes
N	799,101	736,572	736,572	736,572
Pseudo R^2_{McF}	0.376	0.500	0.553	0.568
Pseudo R^2_{Nag}	0.381	0.505	0.558	0.573

$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$

Run Risk Ratio, Size, and Interest Rates

	Bank Default	
	Complementary Log-Log	
	(1)	(2)
Run Risk I	2.840***	2.854***
	(0.000)	(0.000)
Run Risk I * Rising Interest Rates	0.947***	
	(0.000)	
Large Bank I		−1.596***
		(0.000)
Run Risk I * Large Bank I		2.036***
		(0.000)
BHC Controls	Yes	Yes
Quarter FE	Yes	Yes
N	699,530	736,572
Pseudo R^2_{McF}	0.558	0.555
Pseudo R^2_{Nag}	0.562	0.560

$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$

Run Risk Ratio, Z-Scores, and Probabilities of Default

	Ordinary Least Squares			
	Z-Score		Merton PD	
	(1) 4Q	(2) 12Q	(3) 4Q	(4) 12Q
Run Risk I	-21.595^{***}	-9.502^{***}	0.090^{***}	-0.003
	(0.000)	(0.000)	(0.000)	(0.351)
Leverage Ratio	258.155^{***}	79.743^{***}	-0.026^{***}	-0.017^{***}
	(0.000)	(0.000)	(0.000)	(0.000)
BHC Controls	Yes	Yes	Yes	Yes
Bank FE	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes
N	703,210	623,197	703,209	623,196
Adj R^2	0.283	0.452	0.142	0.168

$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$

We develop a flexible framework for identifying banks that are susceptible to bank runs. Our RunRisk measure:

- Identifies weak banks earlier and more accurately than alternative measures.
- Allows banks to avoid the conditions that could lead to bank runs.
- Generates comparable numbers of true positives with fewer false positives, which means the cost of using this measure would be lower for banks and banking supervisors.
    - Potential costs of incorrectly identifying banks as fragile include the direct costs of increased capital and indirect costs associated with heightened supervisory attention.

- Provides options to banks for meeting the minimum threshold – increase capital and/or change the structure of liabilities.
  - Banks below the threshold could determine the most cost-effective way to increase the ratio.
- Our paper focuses on interest rate risk, but the framework can apply equally well to losses from any risk.
  - Incorporate into the estimate of the fair value of the bank's assets
- The tradeoff between true and false positives can be used to operationalize our framework. For example:
  - To identify more of the truly weak banks, increase the threshold from 4% to 5%. This will result in more true positives, but also more false positives.
  - To reduce the costs to banks and bank supervisors of incorrectly identifying banks as weak, reduce the threshold to 3%. This will result in fewer false positives, but also identify fewer truly weak banks.