Bank Bailouts, Bail-ins, or No Regulatory Intervention? A Dynamic Model and Empirical Tests of Optimal Regulation

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Regulatory Resolution Regimes and Other Prudential Regulatory Tools

- The failure of large financial institutions (e.g., Lehman Brothers) can cause or worsen a financial crisis and threaten the entire financial system.
- Regulators design resolution regimes for handling the potential failure of large bank holding companies (BHCs) that pose such systemic threats:
  - Bailouts (government provides capital)
  - Bail-ins (private sector provides capital)
  - No Regulatory Intervention (let them go bankrupt)
- Regulators also employ other prudential regulatory tools to preempt the likelihood of distress:
  - Capital standards (backward-looking)
  - Stress Tests (forward-looking)

Regulatory Regimes in the US

- Prior to the financial crisis of 2007-2009, the largest U.S. BHCs likely expected that they were "too big to fail," and would be bailed out.
- During the crisis, their expectations of bailouts were realized.
  - Treasury injected more than $200 billion in preferred equity capital into banking organizations through TARP, with most of the funds going to the largest eight BHCs.

Regulatory Regimes in the US (cont.)

- After the crisis, the 2010 Dodd-Frank Act introduced a bail-in regime called the Orderly Liquidation Authority (OLA).
- OLA is triggered for a large BHC when regulators find that:

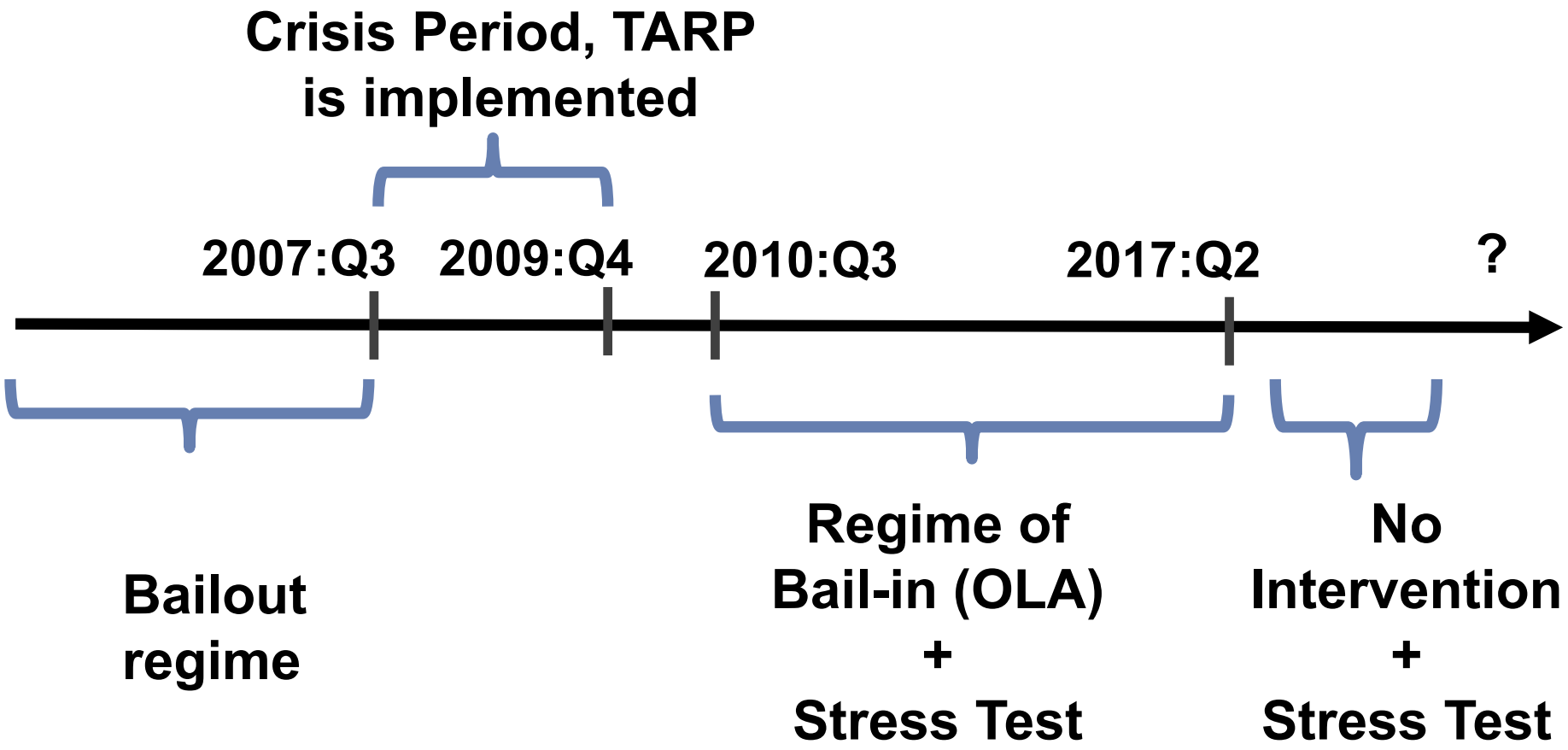
  "...the BHC is in default or danger of default, and its failure would have serious adverse financial stability consequences."

  - The FDIC temporarily takes over the BHC.
  - Shareholders are wiped out, management is fired and replaced.
  - The BHC subsidiaries, including the banks, continue to operate.
  - Subordinated debtholders, and potentially other junior debtholders have part of their debt claims turned into equity capital
  - The BHC is then returned to the private sector.
- The crisis also resulted in stress tests
  - Banks that Fails stress tests cannot pay dividends or buyback stock.

Regulatory Regimes in the US (cont.)

- In 2017, the U.S. House of Representatives voted for the Financial CHOICE Act.
  - This would replace the OLA bail-in with a no-regulatory-intervention regime
  - BHCs would go bankrupt under a new Chapter 14
  - The stress tests would remain.

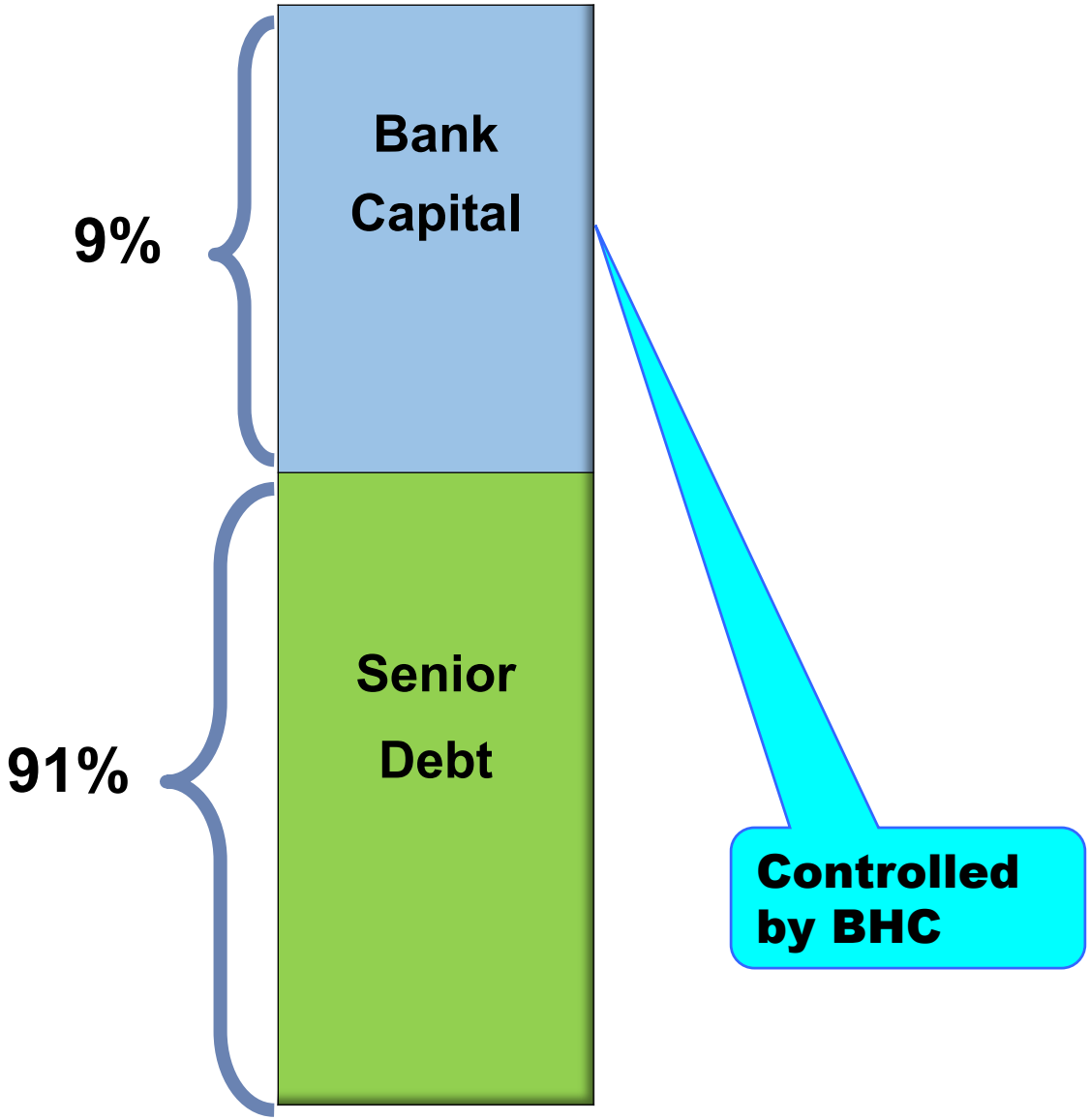
Bailout, Bail-in, No Intervention Regimes



This Paper

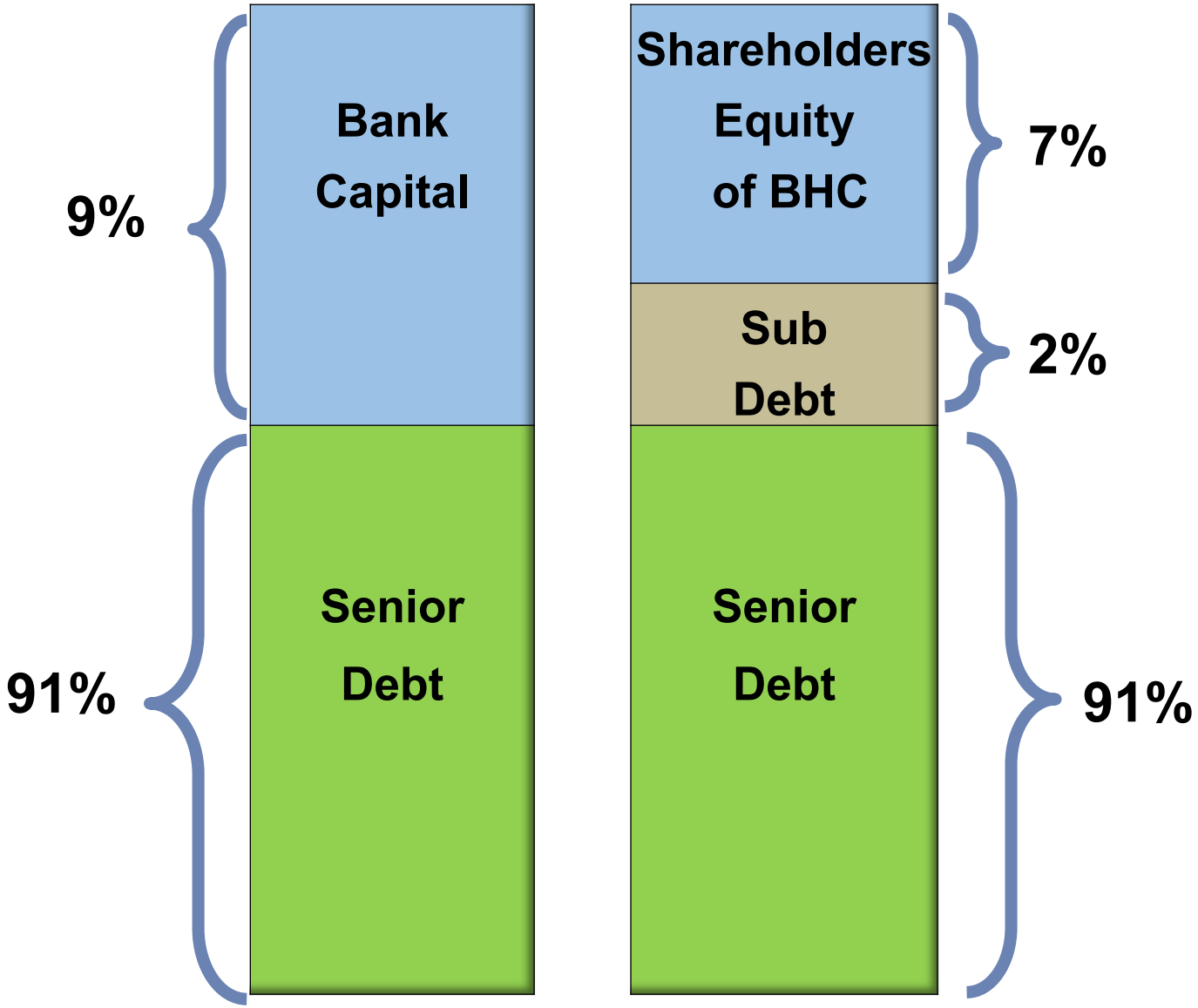
- We develop a dynamic model of the capital structure of BHC that operates under the three regimes of bailout, bail-in, and no regulatory intervention to address the following questions:
  - How does the anticipation of different regimes affect the *ex ante* capital structure decisions of the BHCs?
  - How should these regimes be optimally designed?
  - How aggressive should these regimes be in taking actions against distressed banks?
  - Which of the regimes is best?
- We conduct an empirical analysis to test the model predictions on how banks change their capital structures when shifting from expectations of bailout pre-crisis to expectations of bail-in post-crisis

Model: Capital Structure of BHC that Owns a Single Bank



Amalgam of the capital structure of the bank and the BHC in which the capital structure of the BHC is superimposed over the capital of the bank.

Model: Capital Structure of BHC that Owns a Single Bank



Amalgam of the capital structure of the bank and the BHC in which the capital structure of the BHC is superimposed over the capital of the bank.

Model: Bank's Asset Process with Jumps

- The value of the bank's assets **V** is described by a jump-diffusion process:

$$dV/V = (r - \alpha - \lambda \cdot k)dt + \sigma dW + dq,$$

- ***dq*** is infrequent large negative jumps (**k<0**) are due to the arrival of "big" negative events, such major financial crises.

- A jump can result in a bailout, bail-in, or bankruptcy.

Model: Bank's Asset Process with Jumps (cont.)

- The bank can issue equity and increase its capital and its assets **V** by any amount $\Delta\mathbf{V}$:

$$\boldsymbol{V_{t+} = V_{t-} + \Delta V}$$

- Equity issuance incurs fixed and variable transaction costs *TC*, which is a linear function of the amount issued, $\Delta\boldsymbol{V}$.

Model Time Line

- At time 0, the regulator announces the regime (bailout, bail-in or no regulatory intervention) and the critical capital ratio triggers for intervention $\theta_{intervention}$ (if there is intervention), as well the stress test critical capital ratios θ_{stress_test} at which dividends retained to rebuild capital (if there are stress tests).
- At time 0, BHC chooses initial capital structure that maximizes market value of shareholders' equity E_0, plus senior debt (depositors) D_0, plus subordinated debt C_0,

$$\max (E_0 + D_0 + C_0).$$

- Future recapitalization strategy is chosen to maximize value for the existing shareholders' equity,

$$\text{Max}_{\Delta V} [\, E(V_t, D_0, C_0), \mid \theta_{intervention}, \theta_{stress\ test} \,]$$

Optimal Terms of Regulatory Regimes

- For each regime, regulators choose the intervention trigger **θ** to optimize to maximize **social welfare function**:

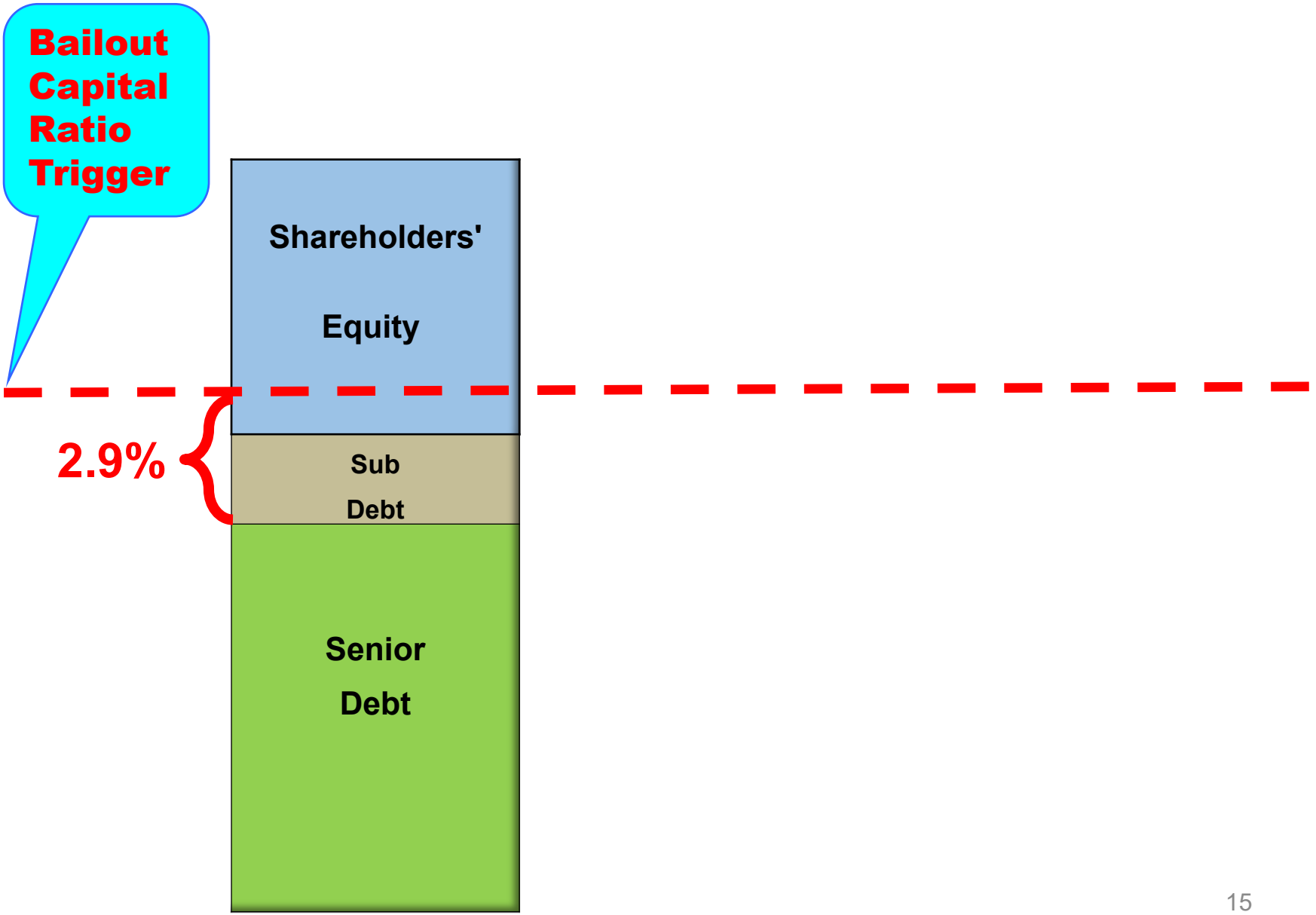
Max_{θ} {MV of Bank – Exp. Social Costs of Bank Default}

- **Exp. Social Costs of Bank Default** to the financial system and real economy are assumed to be equal to the expected private costs of default.
- Triggers for each regime:
  - Bailout capital ratio trigger, $\theta^*_{\text{bailout}}$
  - Bail-in capital ratio trigger, $\theta^*_{\text{bail-in}}$ and $\theta^*_{\text{stress\_tes}}$
  - Stress test critical capital ratio, $\theta^*_{\text{stress\_test}}$
- In each regime, we assume that the BHC optimizes its capital structure for the trigger points **θ*** enforced by the regulator, and the regulator sets the trigger points knowing how the BHC will react in choosing its privately optimal capital structure.

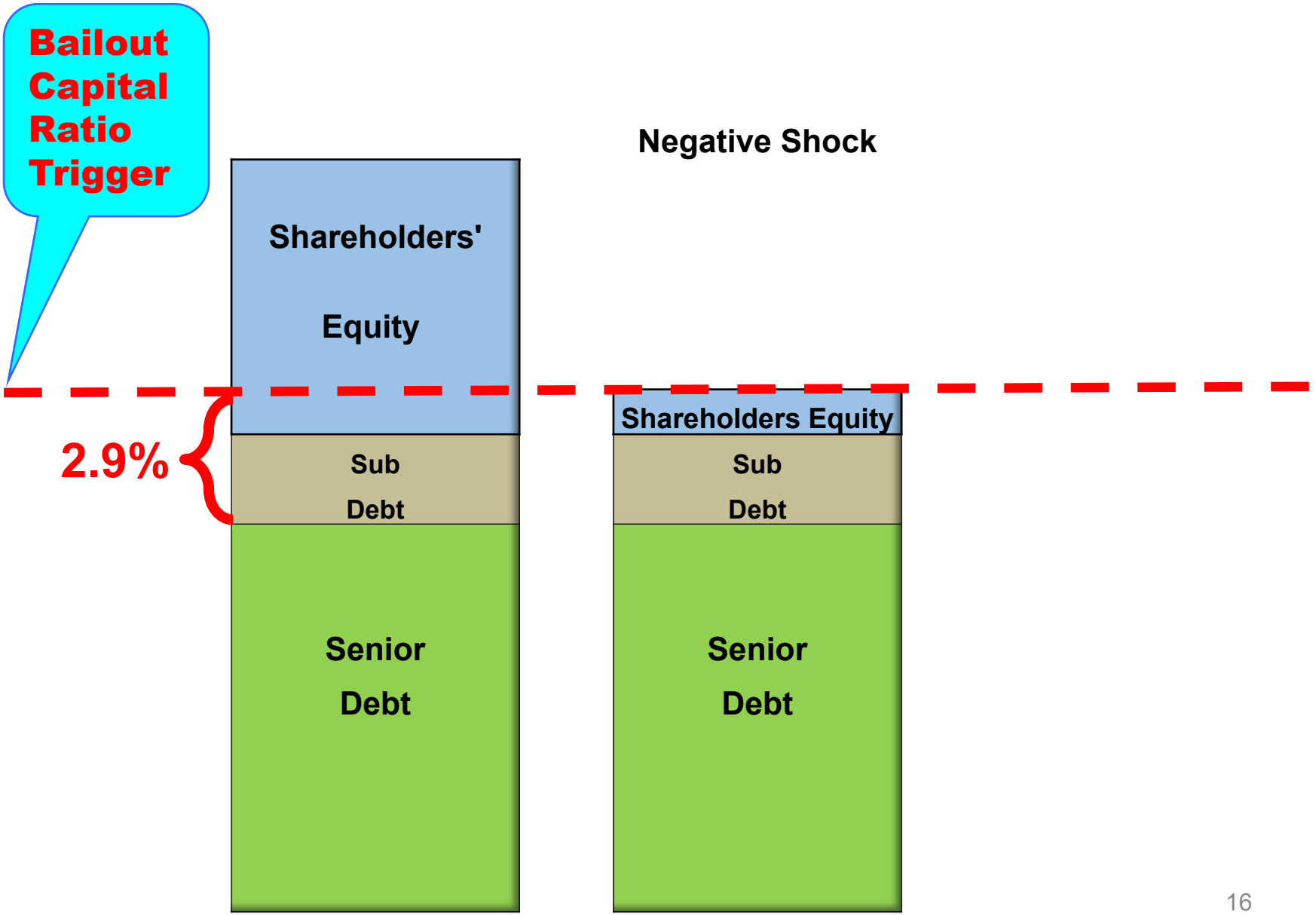
Numerical Solutions to the Model

- Model parameters are calibrated to data for large BHCs.
- We solve the model numerically for the different regimes and different trigger capital ratios

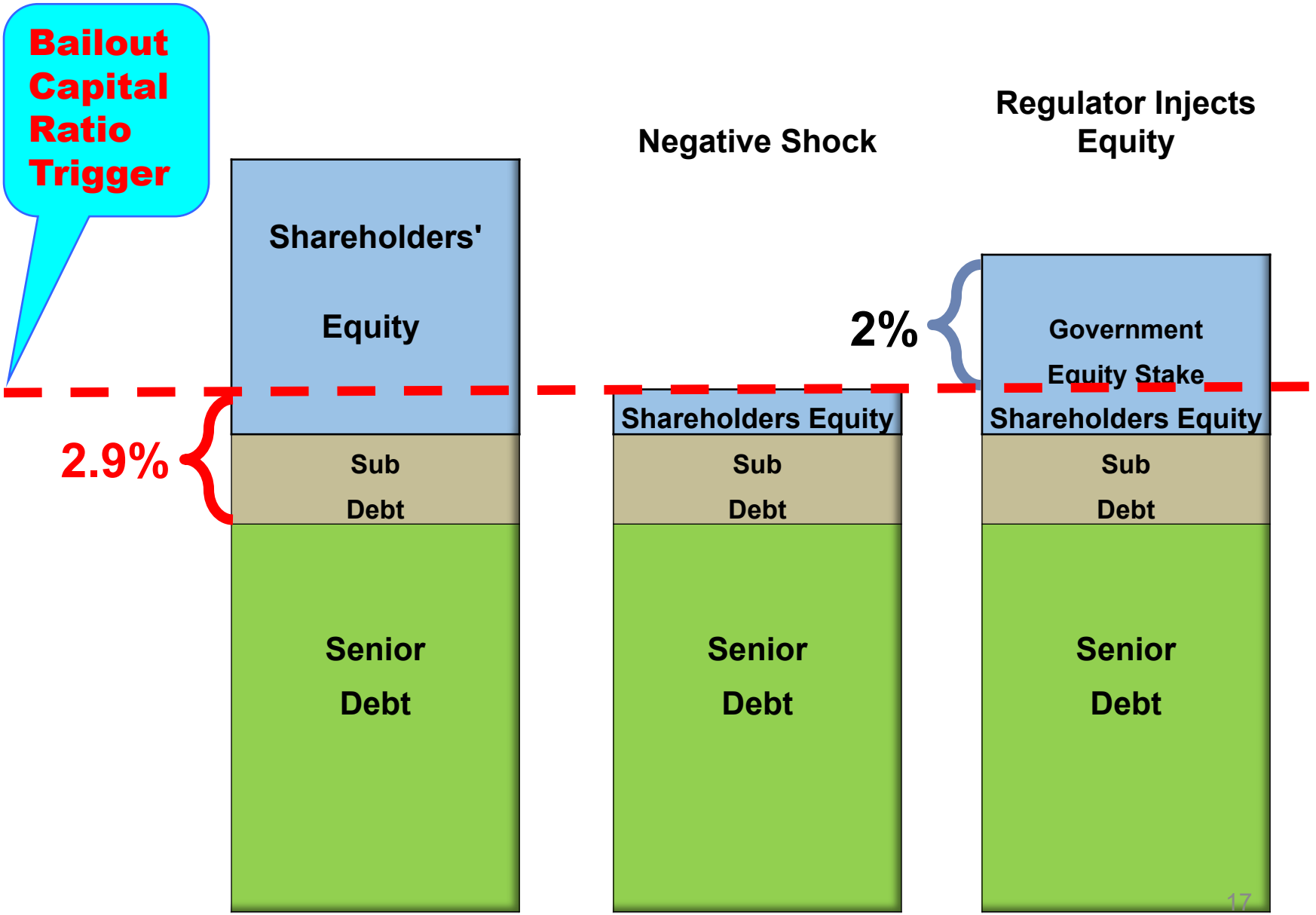
Bailout Regime



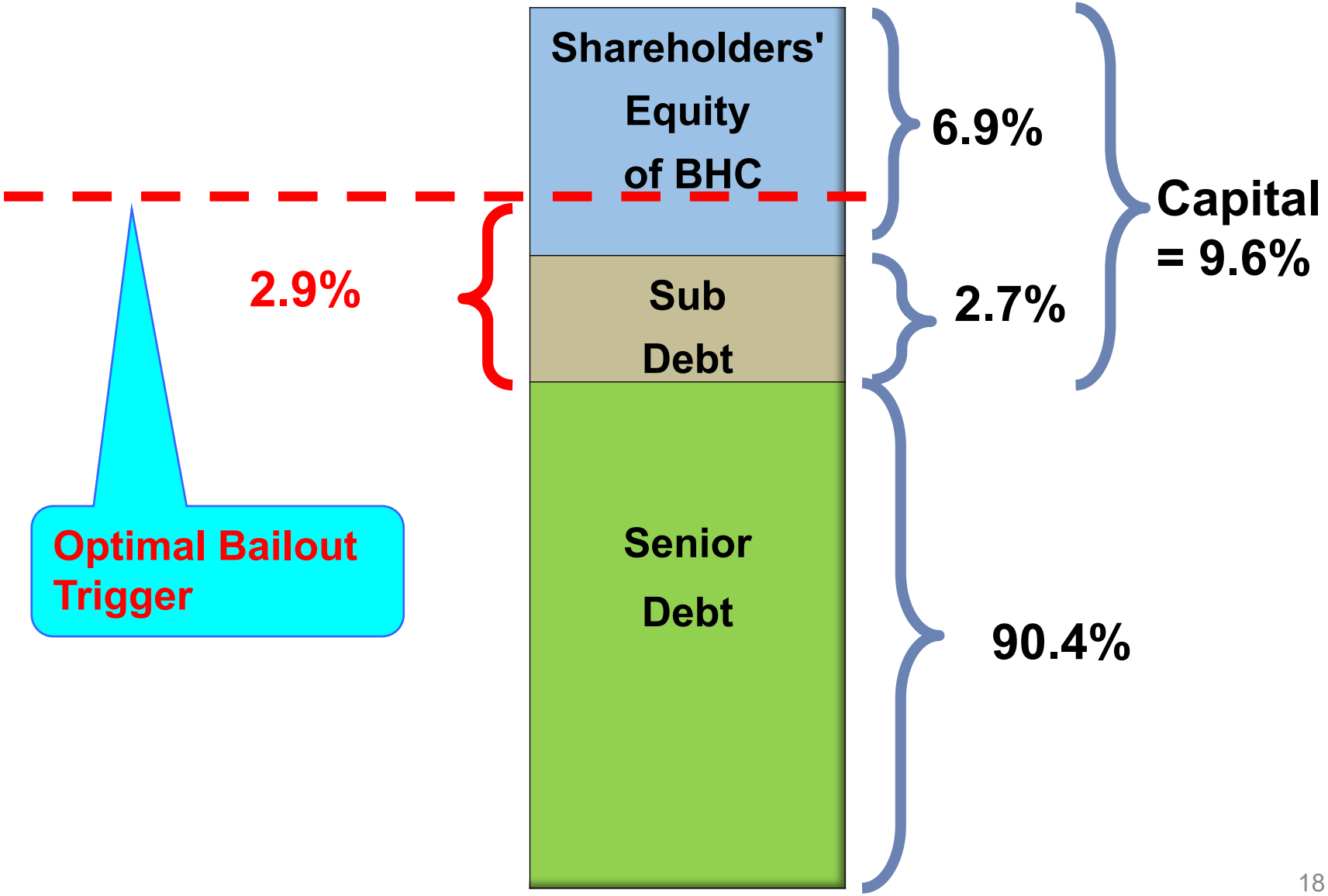
Bailout Regime (cont.)



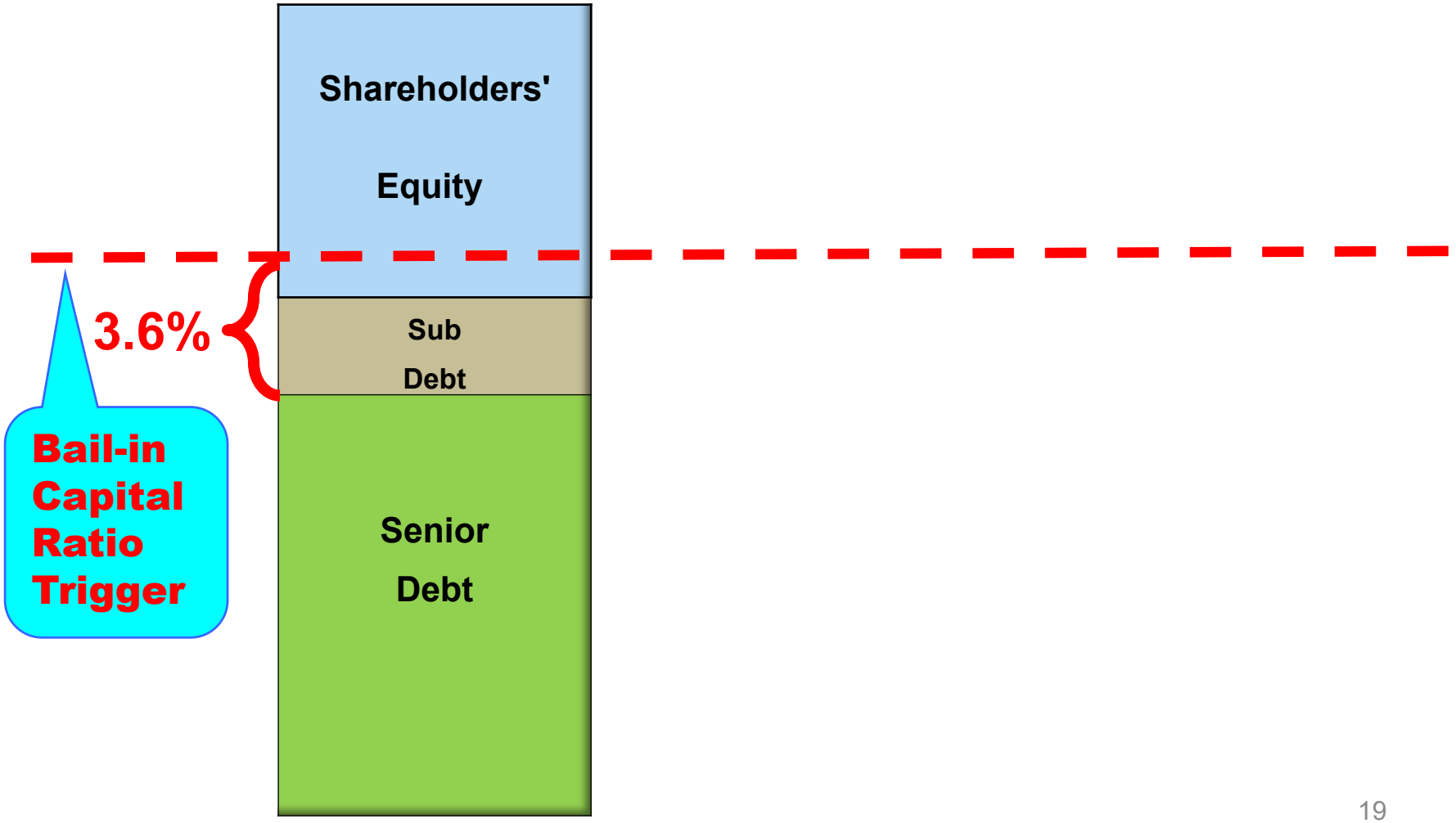
Bailout Regime (cont.)



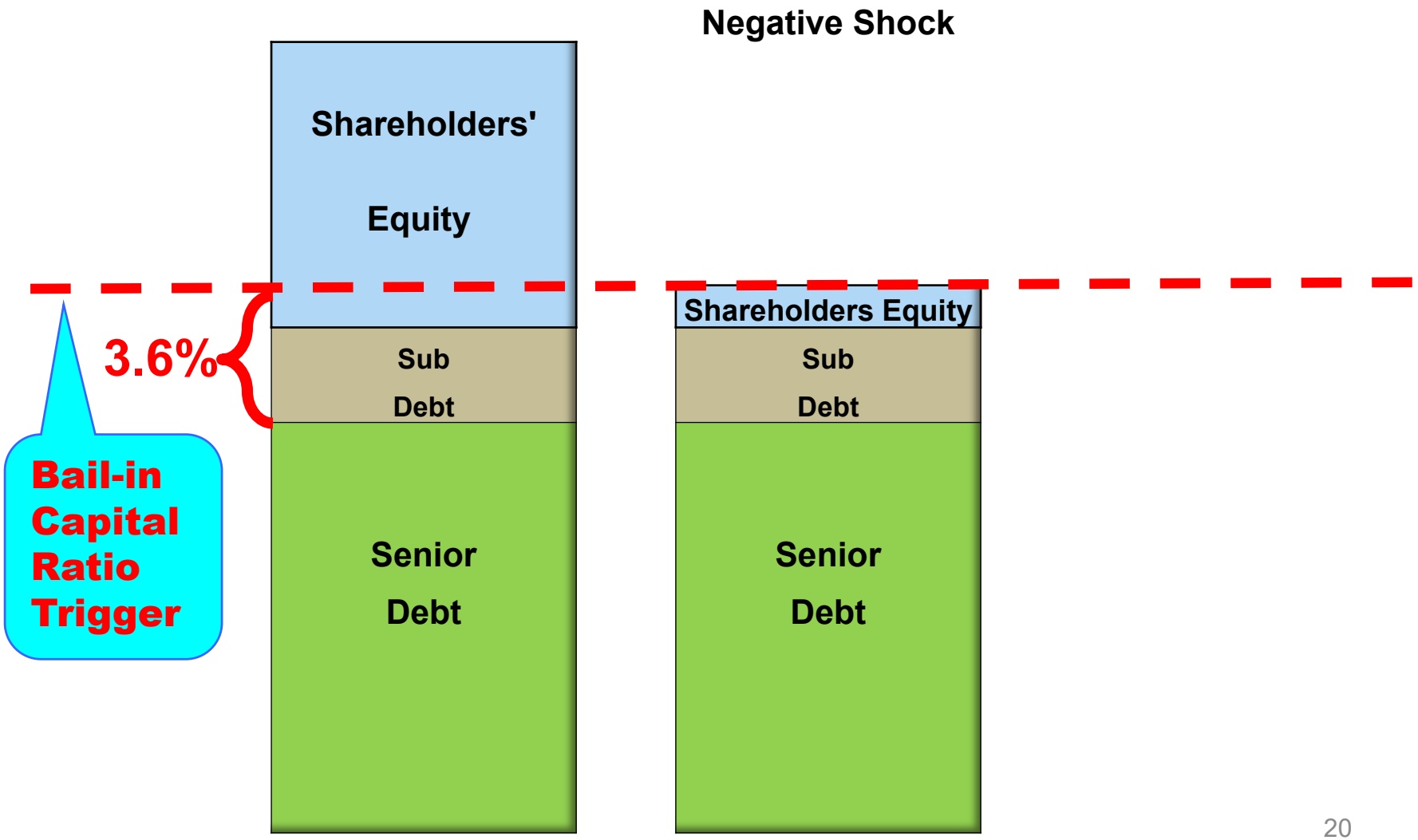
Optimal Capital Structure of BHC for Socially Optimal Bailout (base case calibrated to U.S. BHC data)



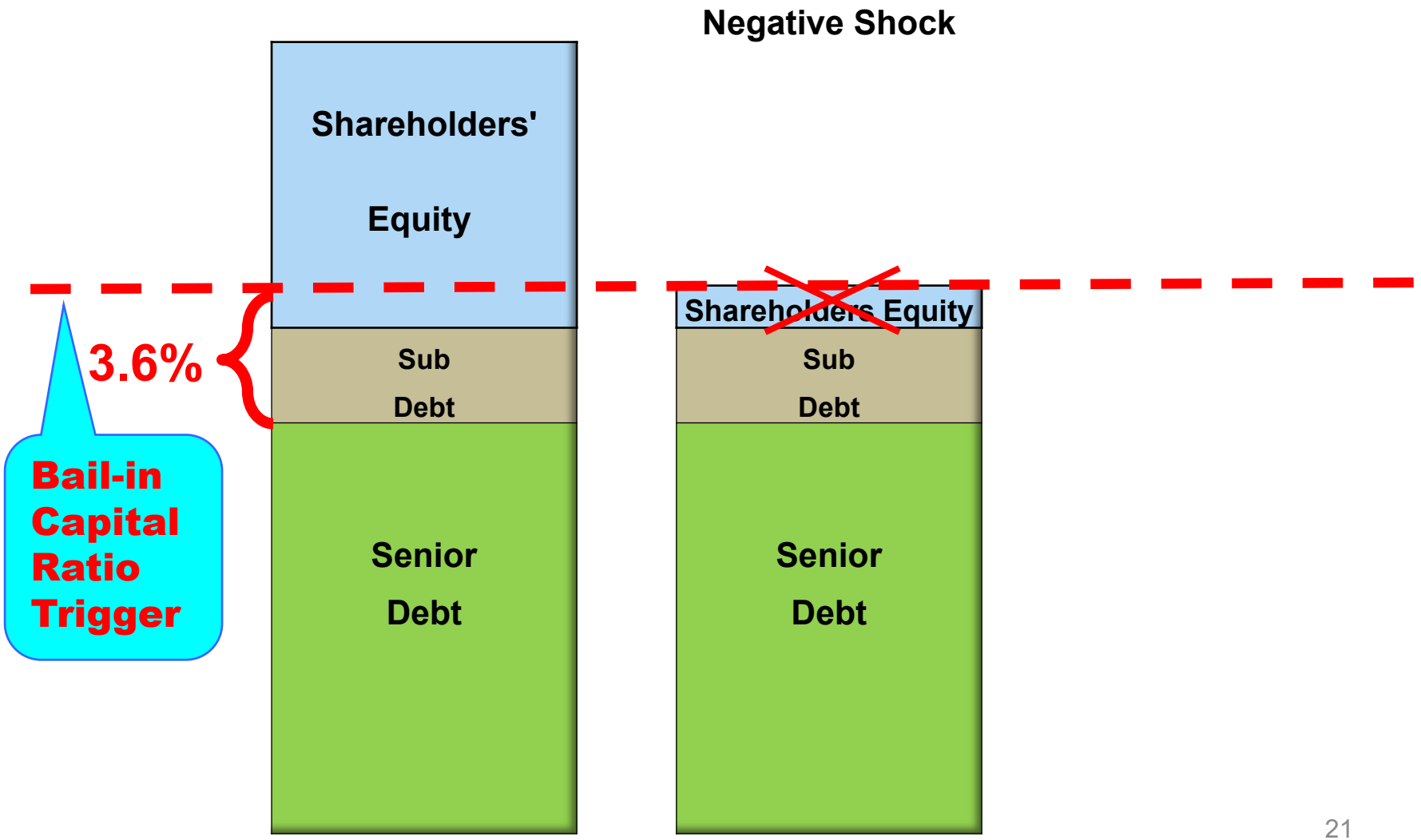
Bail-in Regime with Stress Test



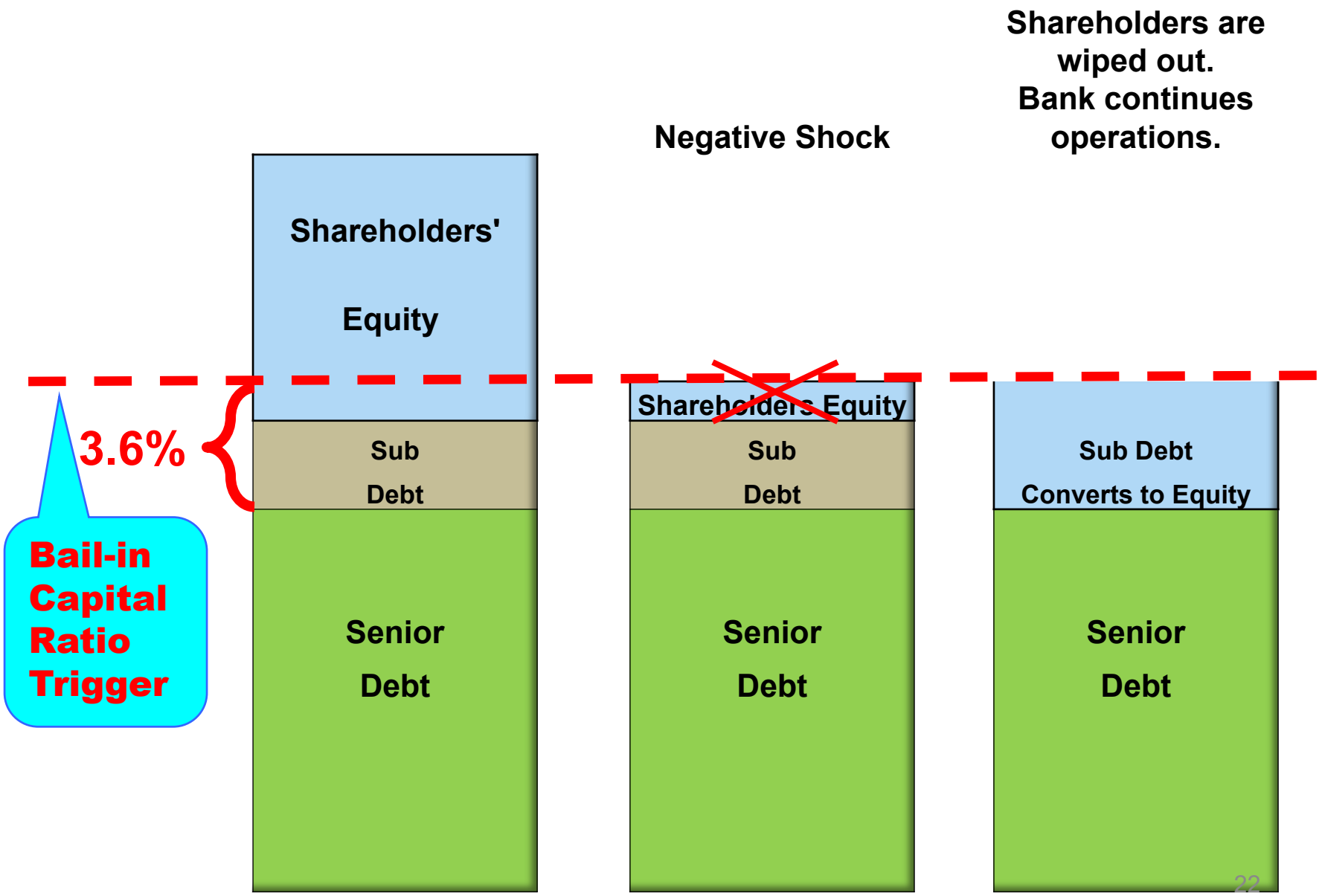
Bail-in Regime with Stress Test (cont.)



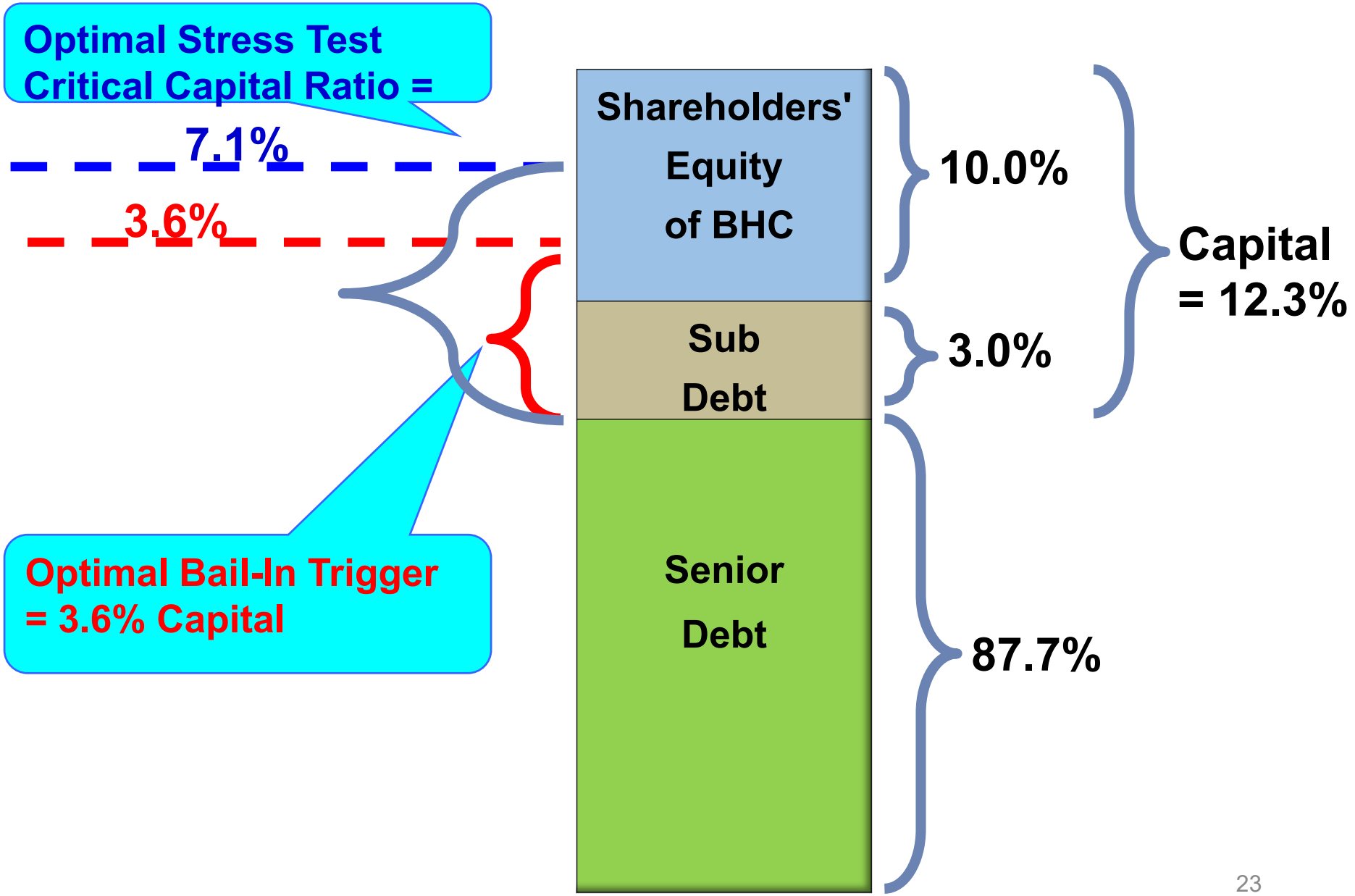
Bail-in Regime



Bail-in Regime



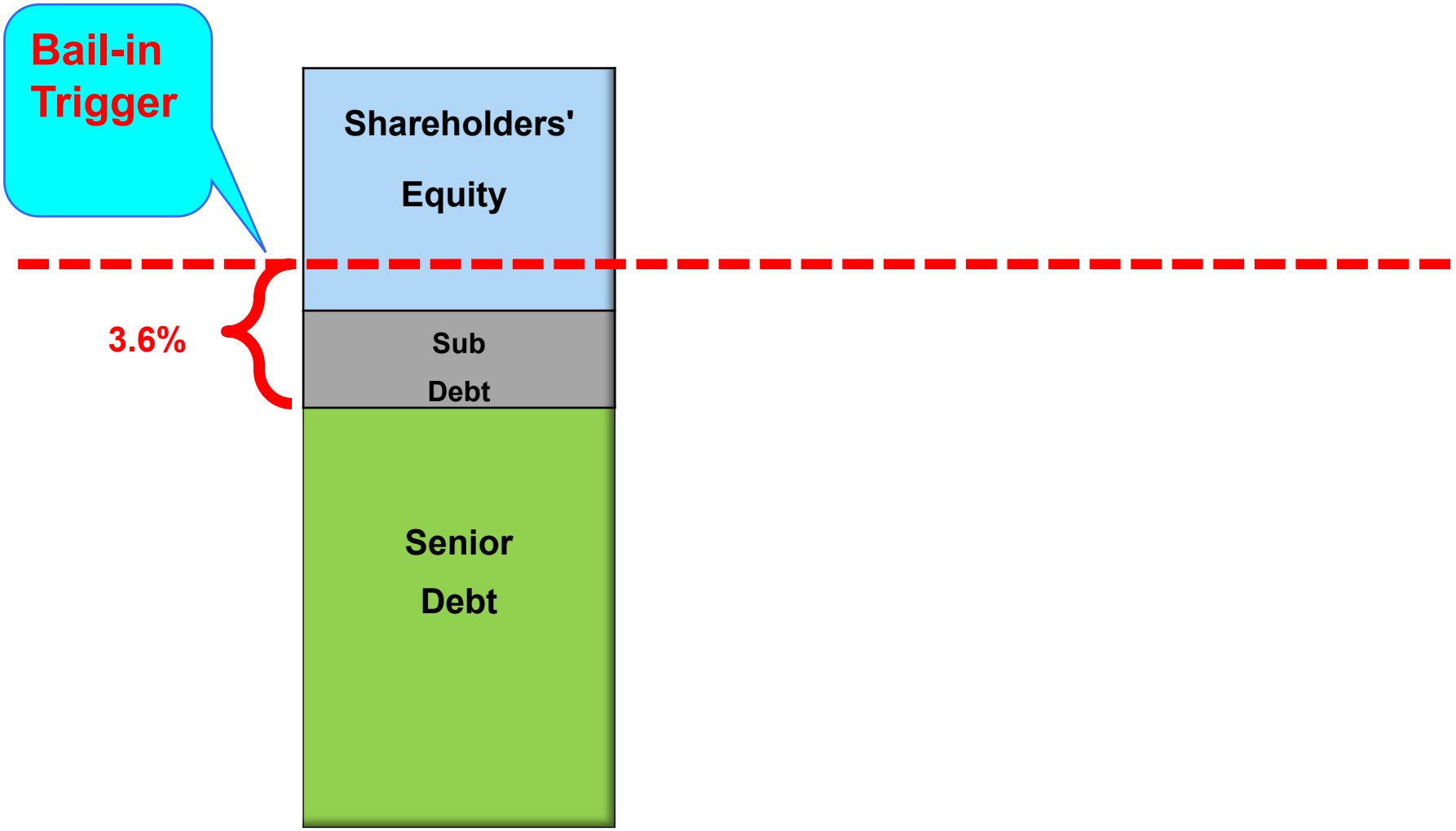
Optimal Capital Structure of BHC for Socially Optimal Bail-in (base case)



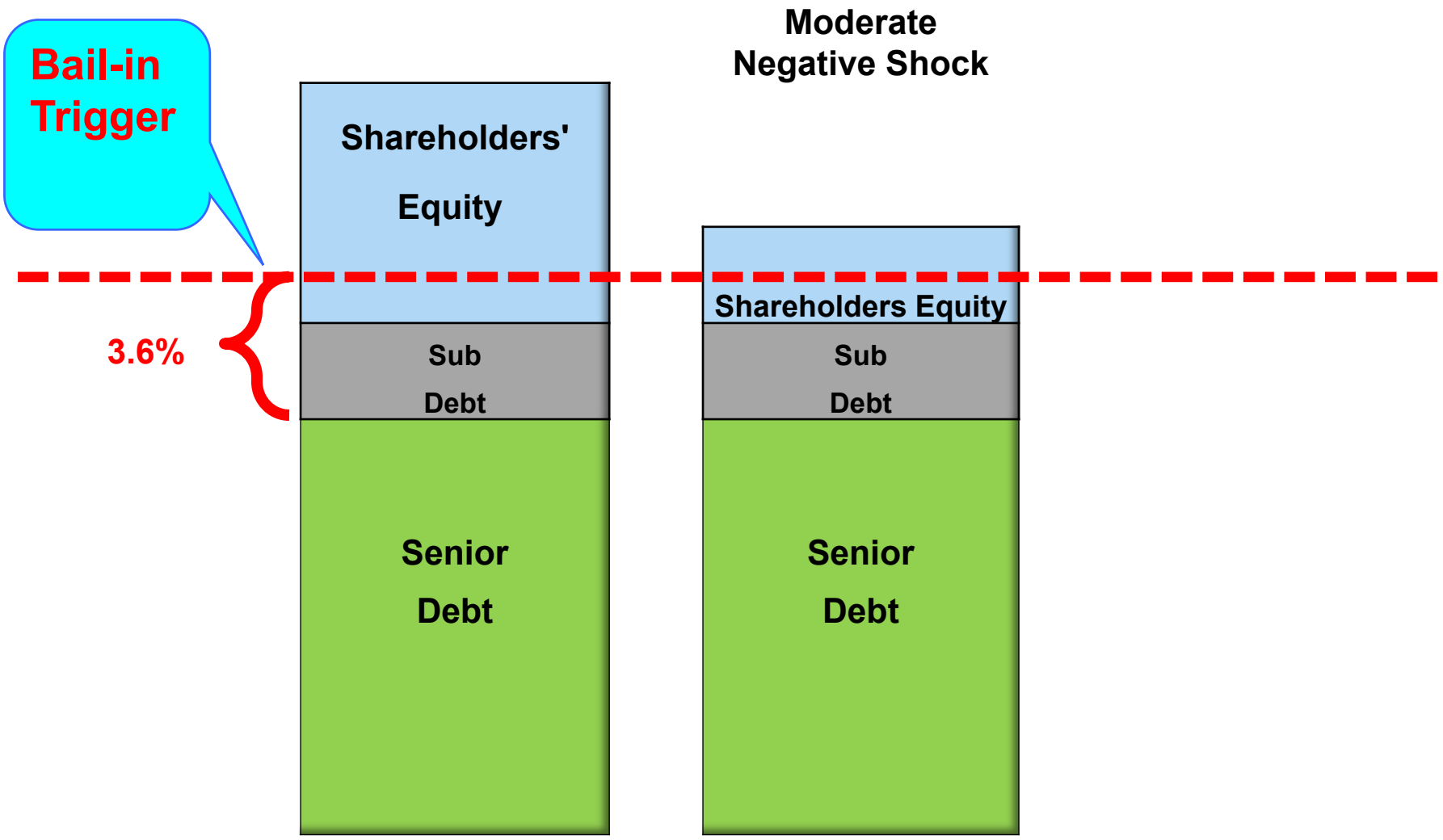
Main Findings of Model (1)

- Bail-ins provide superior capital incentives for financial institutions.
  - Of the three regimes, only the optimally-designed bail-in regime generates incentives for BHCs to recapitalize preemptively during financial distress to avoid having their equity shares wiped out in a bail-in.

Bail-in (OLA) of the BHC



Bail-in (OLA) of the BHC



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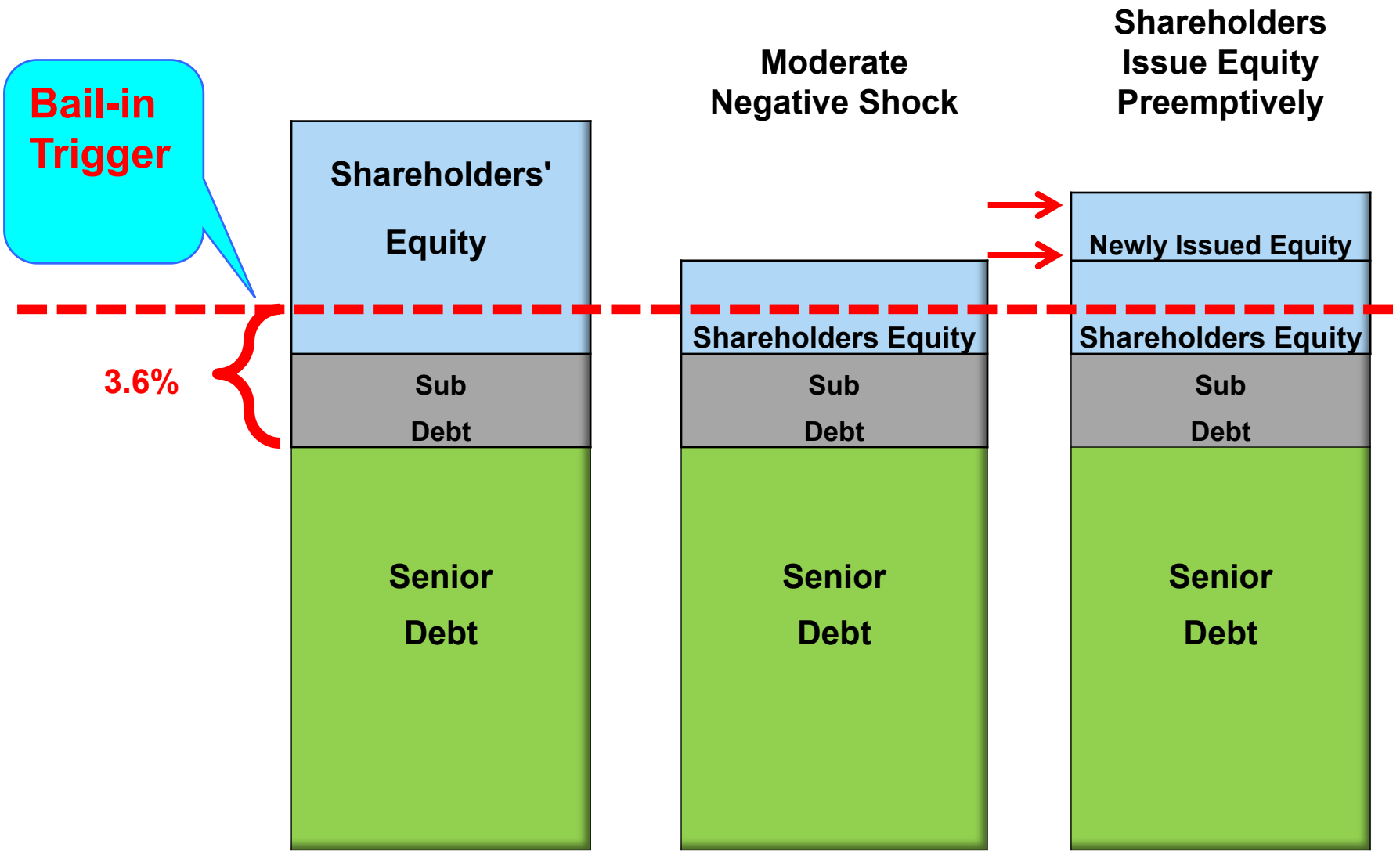
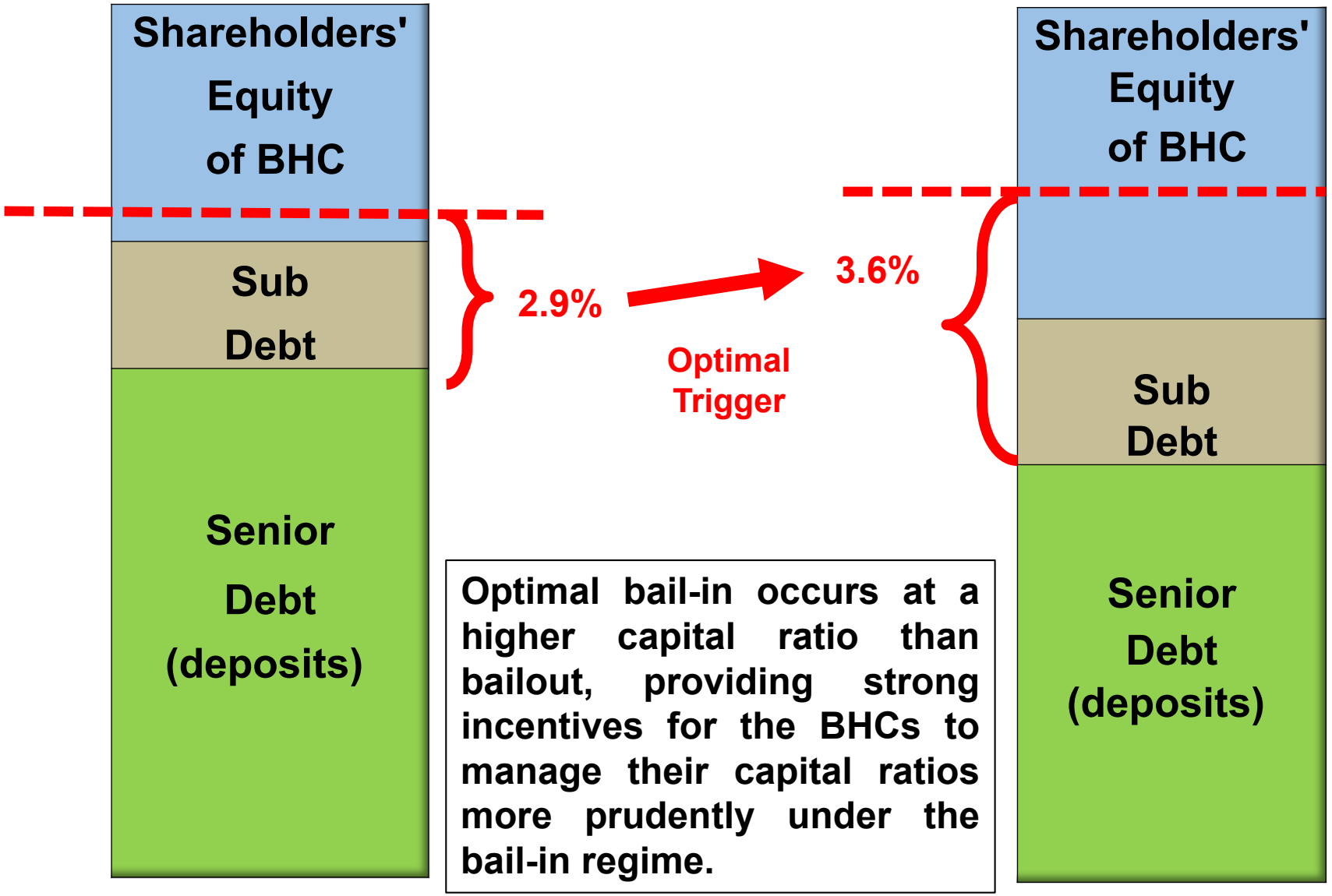
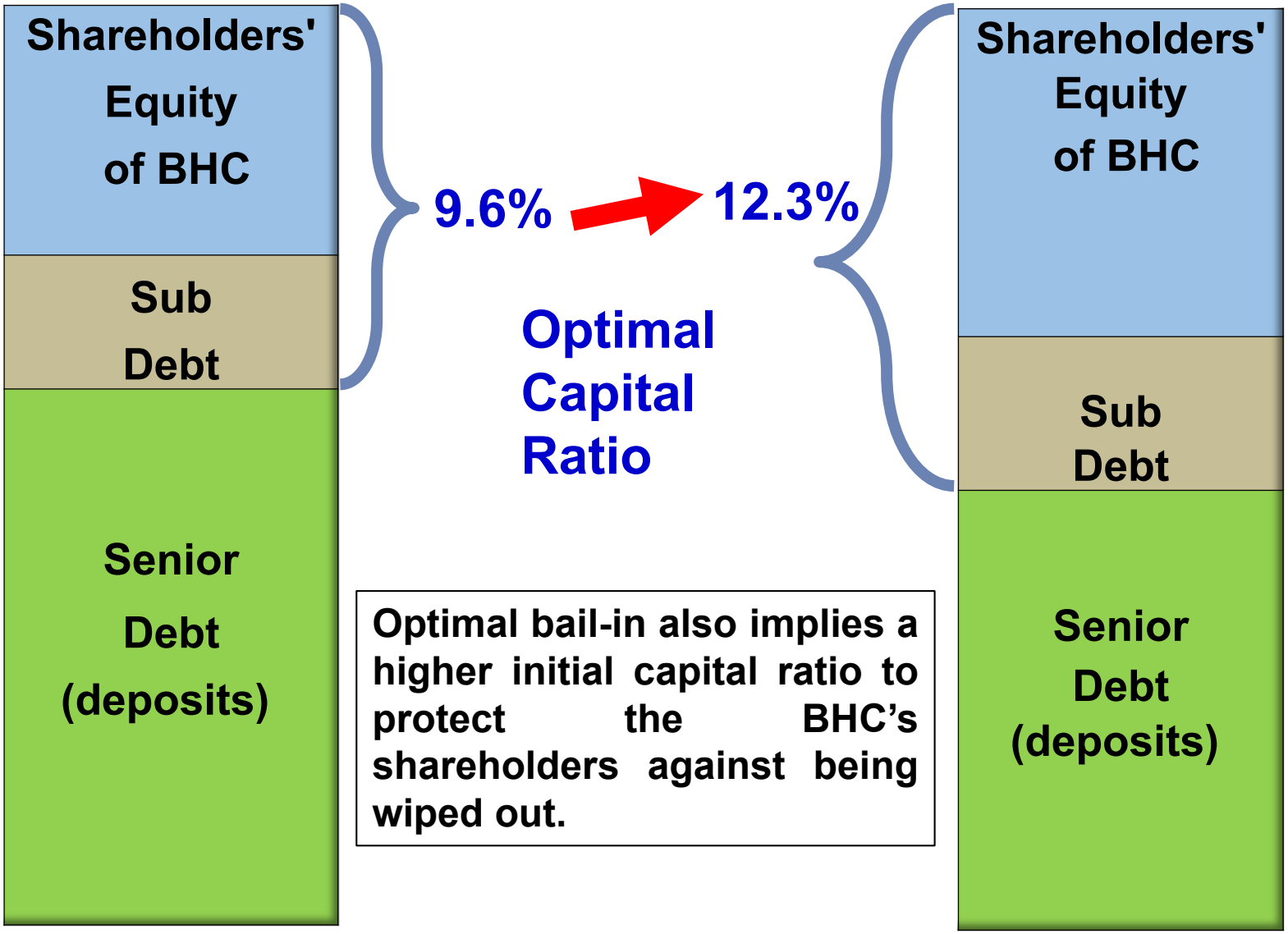


Bailout vs Bail-In



Optimal bail-in occurs at a higher capital ratio than bailout, providing strong incentives for the BHCs to manage their capital ratios more prudently under the bail-in regime.

Bailout vs Bail-In



Optimal bail-in also implies a higher initial capital ratio to protect the BHC's shareholders against being wiped out.

Main Findings of Model (2)

- Based on our social welfare function, optimally-designed bailouts and bail-ins clearly dominate the no-regulatory-intervention regime, which only includes a stress test that restricts capital payouts.
  - This suggests that the more intrusive regulatory tools like bailouts and bail-ins are more effective in reducing the likelihood of bank default than stress tests alone.
- We also find that bailouts and bail-ins result in roughly similar social welfare values.
- Optimal bail-ins produce higher social welfare values than optimal bailouts when the social welfare function takes into account other reasonable costs associated with bailouts such as
  - Costs of risking public taxpayers' funds
  - Transaction costs of raising and distributing public funds

Optimal Regulatory Design

- “One size fits all" resolution approach is suboptimal.
  - Regulators should adjust intervention trigger points to reflect each bank's individual characteristics.

Empirical Tests: The effects of switching from *expectations* of bailouts pre-crisis to *expectations* of bail-ins post crisis.

- The dynamic model predicts higher initial capital and subsequent capital adjustments in the bail-in regime relative to the bailout regime.
- We test for higher capital ratios and faster speeds of adjustment resulting from the change in regime.

Data for Empirical Tests

- Quarterly data for the top 50 publicly traded U.S. BHCs for the bailout (2000:Q3-2007:Q2) and bail-in (2010:Q3-2017:Q2) regimes.

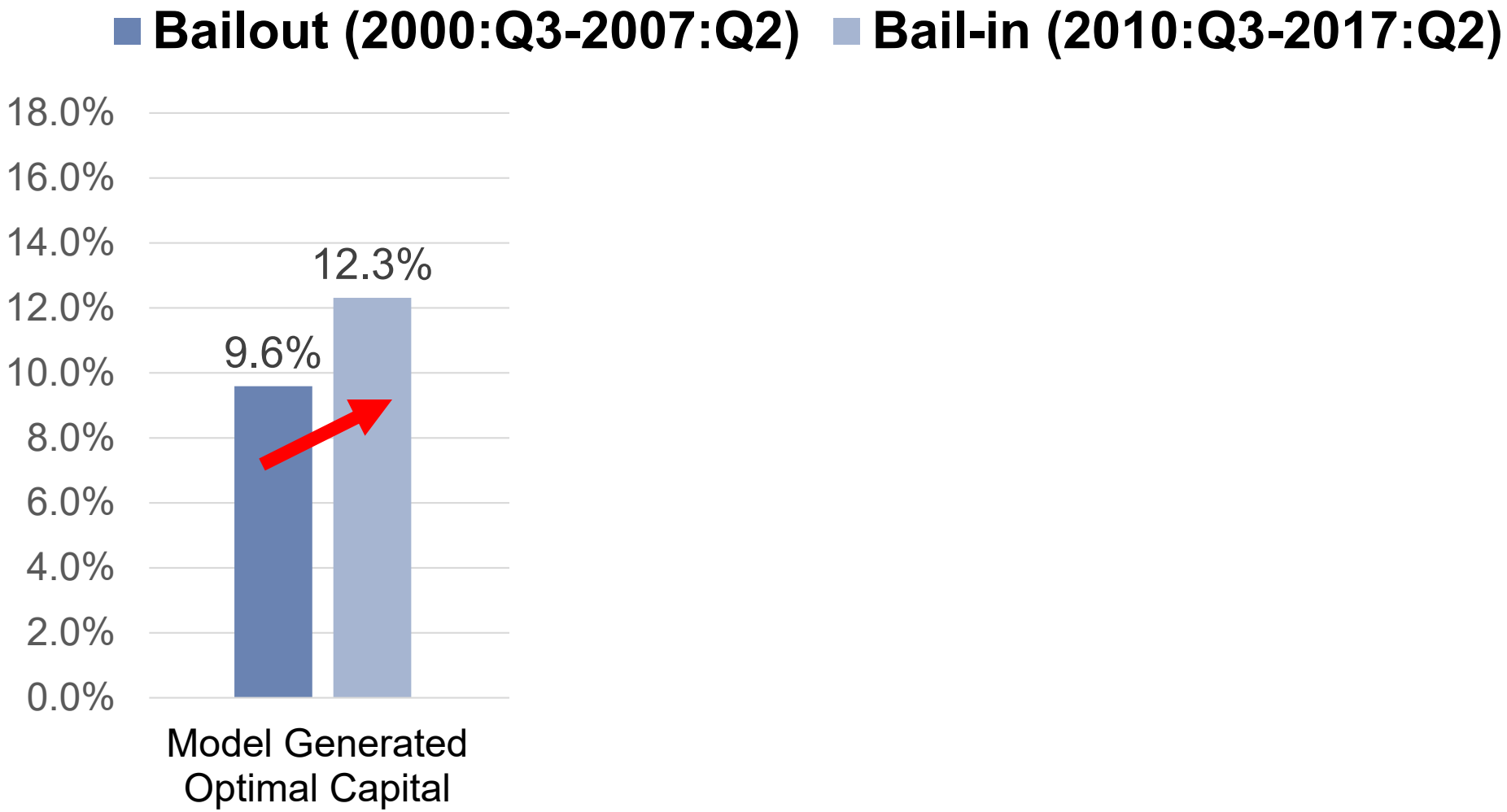
- The 8 very large, complex U.S. banking organizations designated as Globally Systemically Important Banks (G-SIBs) is the treatment group.
  - G-SIBs are the most likely to be subject to bailouts and bail-ins.
  - All 8 G-SIBs received TARP bailouts

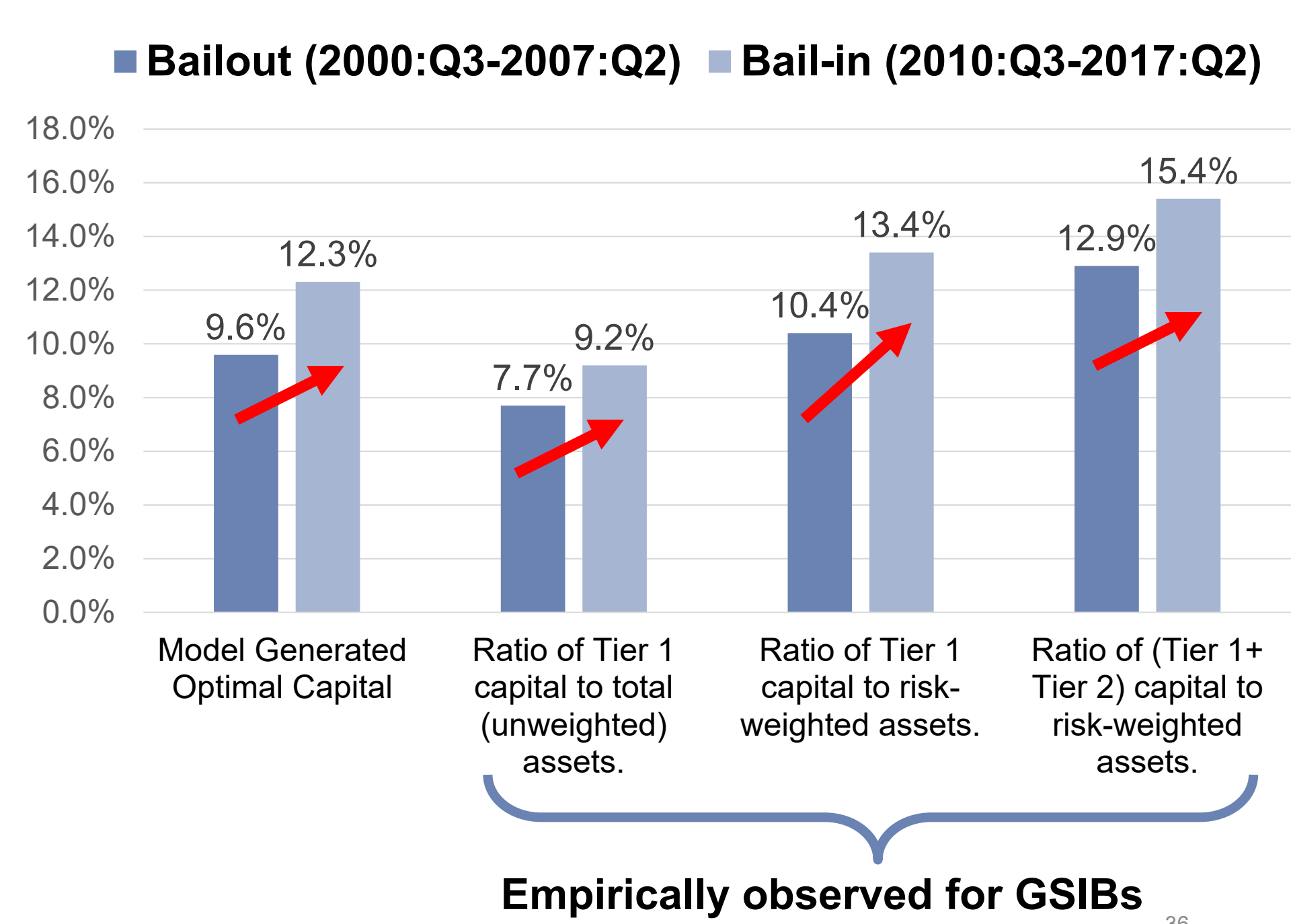
- Remaining 42 large BHCs are the control group

Capital Ratios

❑ Three capital ratio variables, all of which regulators scrutinize for compliance with capital standards:

- CAPLEV is Tier 1 capital divided by total unweighted assets.
- CAPTIER1 is Tier 1 capital divided by risk-weighted assets.
- CAPTOTAL is Tier 1 plus Tier 2 capital divided by risk-weighted assets.


Bailout (2000:Q3-2007:Q2)
Bail-in (2010:Q3-2017:Q2)
18.0%
16.0%
14.0%
12.0%
10.0%
8.0%
6.0%
4.0%
2.0%
0.0%
12.3%
9.6%
Model Generated
Optimal Capital


Bailout (2000:Q3-2007:Q2)
Bail-in (2010:Q3-2017:Q2)
18.0%
16.0%
14.0%
12.0%
10.0%
8.0%
6.0%
4.0%
2.0%
0.0%
9.6%
12.3%
7.7%
9.2%
10.4%
13.4%
12.9%
15.4%
Model Generated Optimal Capital
Ratio of Tier 1 capital to total (unweighted) assets.
Ratio of Tier 1 capital to risk-weighted assets.
Ratio of (Tier 1+ Tier 2) capital to risk-weighted assets.
Empirically observed for GSIBs

Regression Models

- Difference-in-difference (DID) models to test model predictions that in response to the change from bailout regime to bail-in regime, G-SIBs would increase capital ratios more than other BHCs.

$$\text{BANK CAPITAL}_{b,t} = \beta_1 \text{BAIL-IN PERIOD}_t \times \text{G-SIB}_b + \beta_2 X_{b,t-1} + \beta_3 \text{TIME}_t + \beta_4 \times \text{non-GSIB}_b + \varepsilon_{b,t}$$

- **BAIL-IN PERIOD** = 1 during 2010:Q3-2017:Q2.
- **BAIL-IN PERIOD × G-SIB,** interaction term, captures the effect of the treatment (bail-in regime) on the treated BHCs (GSIBs).
- **X** is a vector of BHC characteristics, while TIME and BHC represent time and BHC fixed effects.

Regression Results

Difference-in-Difference (DID) Analysis			
	(1)	(2)	(3)
VARIABLES	CAPLEV	CAPTIER1	CAPTOTAL
BAIL-IN PERIOD × G-SIB	0.010***	0.023***	0.027***
	(6.79)	(11.37)	(13.10)
ROA	0.052**	0.087**	0.093**
	(2.070)	(2.472)	(2.569)
STDEVROA	0.176***	0.351***	0.420***
	(6.081)	(8.754)	(10.178)
MKTBOOK	0.025***	0.029***	0.003
	(6.210)	(5.019)	(0.437)
LNASSETS	-0.010***	-0.012***	-0.013***
	(-9.447)	(-8.474)	(-9.094)
RETAILDEPOSITS	-0.007***	-0.006*	-0.007*
	(-2.636)	(-1.646)	(-1.725)
BUSINESSLOAN	0.016***	-0.028***	-0.015***
	(4.067)	(-5.077)	(-2.589)
LIQUIDITY	0.041***	0.069***	0.044***
	(5.371)	(6.495)	(4.011)
CDLOANS	-0.031***	0.011	0.033***
	(-3.700)	(0.928)	(2.789)
Other Controls	YES	YES	YES
TIME FE & BHC FE	YES	YES	YES
No. Observations	2,796	2,796	2,796
R-squared	0.928	0.917	0.899

Partial Adjustment Analysis

- The dynamic model predicts that bail-ins provide stronger incentives for G-SIBs to rebuild capital prior to financial distress, whereas bailouts do not.
- This implies that G-SIBs are likely to adjust to their target capital ratio faster then Non-G-SIBs after moving into the bail-in period.
- We test this empirically using a partial adjustment methodology.

$$\text{Capital}_{i,t} - \text{Capital}_{i,t-1} = \lambda(\text{Target}^*_{i,t} - \text{Capital}_{i,t-1}) + \zeta_{it},$$

λ is the speed of active adjustments toward target capital.

Partial Adjustment Analysis

	BAILOUT PERIOD (2000:Q3-2007:Q2)	BAIL-IN PERIOD (2010:Q3-2017:Q2)	Differences in Regression Coefficients
VARIABLES	CAPLEV-Target*	CAPLEV-Target*	
λ_1 × G-SIBs	0.388*** →	0.926***	0.538***
	(2.882)	(29.754)	(3.884)
λ_2×NON-G-SIBs	0.904*** →	0.811***	-0.093
	(14.5)	(23.98)	(-1.315)
Other BHC Controls	YES	YES	
G-SIB × Other BHC Controls	YES	YES	
No. Obs	1,400	1,400	

Conclusions & Policy Implications

- We present a dynamic model of socially optimal designs of three regulatory regimes for handling potential failure of large U.S. BHCs.
  - The regulator sets the trigger points knowing that the BHC will self-optimize in choosing its capital structure.
- Three main conclusions:
  - Bail-ins provide the best capital incentives for BHCs.
  - Using a simple social welfare function, no regulatory intervention is dominated in terms of social welfare by optimal bailouts and bail-ins that have roughly similar social values.
  - Including taxpayer and transactions costs of bailouts in the social welfare function, bail-ins produce higher social values than bailouts.
- Our results have policy implications.
  - The optimal resolution design requires a delicate balance in terms of the “aggressiveness” of the regulator.
  - “One size fits all” resolution design is suboptimal.

Going Beyond the Model

- Other factors outside the model may also matter for the comparison of bailouts, bail-ins, and no regulatory intervention.
- Actual bailouts may perform significantly worse than the optimal bailouts in the dynamic model.
  - Optimal bailouts involve no subsidies or “free money” for BHCs, as regulators intervene in a timely fashion and dilute the claims of shareholders.
  - In reality, regulators likely step in later than is optimal and provide government subsidies to BHCs in bailouts, rewarding BHCs that are too big to fail.

Directions for Future Research

- Future research might focus on the role of regulatory ambiguity in place of our “pure play” regimes to enlighten policy for incentivizing financial institutions.
- Researchers can also investigate other types of regulatory mechanisms or hybrids of regimes that might be more efficient than pure play regimes.