FEDERAL RESERVE BANK of NEW YORK

U.S. Supervisory Stress Testing

James Vickery Federal Reserve Bank of New York Presentation at Fed21 forum, March 28, 2017



necessarily represent the views of the Federal Reserve Bank of New

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What are bank stress tests?





- <u>Basic idea</u>: Try and project what would happen to the bank in one or more "bad" scenarios.
- Could imagine many possible scenarios:
 - Severe recession? Stock market crash? Loss of confidence in the bank, leading to runs? Bad "idiosyncratic" shocks?
 - All of the above?
- Many possible ways to evaluate whether bank "passes" test:
 - Stays solvent? Maintains liquidity buffers? Maintains reasonable market cap? Able to continue to grow lending?
- Stress test could focus on individual banks, or the financial system as a whole.



- Today I'll focus on stress tests of bank capital adequacy conducted by the Federal Reserve.
- In banking, "capital" means common and preferred equity and (sometimes) long-term subordinated debt
 - Why is equity capital important? Answer: aligns incentives; provides a buffer against insolvency; reduces run risk etc.
- U.S. banking firms are subject to regulatory capital minimums expressed as accounting ratios of capital relative to:
 - Total assets ("leverage ratios")
 - Risk-weighted assets, which give higher/lower weights to more/less risky assets ("risk-based ratios")





Regulators set minimum ratios of:

- Regulatory capital as a % of total assets
- Regulatory capital as a % of *risk-weighted assets*



Regulatory ratio	Minimum			
Common equity tier 1 capital ratio	4.5 percent			
Tier 1 capital ratio	6 percent			
Total capital ratio	8 percent			
Tier 1 leverage ratio	4 percent			

<u>Note</u>: these are minimum standardized approaches regulatory capital ratios applying to U.S. bank holding companies. Not included: countercyclical capital buffer, capital conservation buffer, supplementary leverage ratio.

Source: https://www.federalreserve.gov/newsevents/press/bcreg/20160629a.htm



Lessons from 2007-09 period:

- In a crisis, lots of "left tail" opacity about losses and solvency.
- Regulatory capital lags reality (e.g., Lehman 11.6% in Sep 08!)
- Banks may not act proactively to conserve capital (see below)





- Projects what *might* happen to a bank's capital if the economy declines, under a particular scenario.
- Some key features:
 - Model-driven, forward-looking perspective to assessing whether a bank has sufficient capital *today* to withstand shocks.
 - Explicitly considers revenue risk: models revenues and expenses under stress, in addition to losses on loans, securities etc.
 - Horizontal information about the banking system as a whole.
 - Focus on downside risk. Not a panacea, but a kind of upper bound if the scenario and assumptions are severe enough.



U.S. supervisory stress tests

- First U.S. bank stress tests conducted in 2009, during the heat of the financial crisis.
 - Helped restore confidence
 - Banks raised \$100bn in equity
 - Inspired at least one book title! →



- Today, two closely related set of tests are conducted annually:
 - Comprehensive Capital Analysis and Review (CCAR)
 - Dodd-Frank Act Stress Tests (DFAST)



- Annual forward-looking assessment of large, complex bank holding company (BHC) capital adequacy processes
 - U.S. BHCs with assets > \$50 billion (33 firms in CCAR 2016)
- Key questions considered in the CCAR:
 - How does a BHC determine how much capital it needs?
 - Are the processes used by the BHC to make this determination thorough and robust?
 - Is the capital held by the firm adequate?
- Stress tests: an important part of CCAR, but not the only part
 - CCAR includes both company-run tests, and independent stress tests conducted by the Federal Reserve.



- Firms submit a detailed capital plan, describing capital policy and processes, planned capital actions, and capital projections.
- The Fed either "objects" or "does not object" to each plan
 - Fed could object because stressed capital ratios fall below regulatory minimums, and/or for other reasons
 - If the Fed objects, BHCs may make only capital distributions (dividends, repurchases) explicitly not objected to
 - Object / non object decision is publicly disclosed
- BHCs must re-submit capital plan if the Fed objects, or if BHC experiences a material change in risk exposure



CCAR versus DFAST stress tests

- Also conducted on same cycle: stress tests mandated under Dodd-Frank Wall Street Reform and Consumer Protection Act.
 - Fed-run stress tests under three Fed scenarios ("baseline", "adverse", "severely adverse"). Adv. & sev. adv. results disclosed.
 - Company-run stress tests under same three Fed scenarios
 - Broader set of firms (>\$10bn assets). Firm disclose sev. adv. results.
 - Company-run tests under three scenarios defined by the firm
- DFAST & CCAR stress tests closely related but distinct
 - Same macroeconomic scenarios and net income projections
 - Different capital actions (e.g., dividends, share repurchases etc.)
 - DFAST: stylized assumptions mandated in the regulation
 - CCAR: actions in BHCs' capital plans under baseline scenario



Stress testing around the world

- What's different about U.S. supervisory stress tests compared to those conducted in Europe and elsewhere?
- <u>One key distinction</u>: U.S. tests involve both "company run" tests, and "Fed run" independent projections
 - In Europe, tests conducted only by the banks. Regulator uses "top-down" models to test reasonableness of bank projections.
- U.S. tests during the financial crisis historically seen as more credible than similar tests conducted in Europe (e.g. Spain).
 - One issue in Europe no public funds as backstop for banks that failed the tests and needed recapitalization.



How Does the Federal Reserve Conduct Supervisory Stress Tests? Stress test has nine quarter horizon: for CCAR 2016, test ran from 2016:Q1 to 2018:Q1.

Key inputs:

- Hypothetical macroeconomic scenarios
- Detailed data collected from the BHCs
- Models that project net income and capital

Basic idea (crude approximation):

- 1. Plug macroeconomic scenarios and BHC data into the models, and generate projections of revenue and losses.
- 2. Add up results to obtain projections of net income and capital.



Generating stress test projections



Why might stress test projections change over time? Could be:

- Changes in macroeconomic scenario
- Changes in firms' exposures (e.g., makeup of loan portfolio)
- Model changes and reestimations



- Each cycle, Fed develops three economic & financial scenarios
 - Baseline, Adverse, Severely Adverse
- Includes countercyclical elements: unemployment in sev. adv. scenario peaks at least at 10%, regardless of initial unemployment rate.
- Severely Adverse scenario from CCAR 2016:
 - Deep recession and falling asset prices
 - Low short-term interest rates
 - Sharp rise in credit spreads + financial market volatility
 - Trading positions at six large BHCs subject to global market shock (big moves in spreads, rates, prices)
 - Default of largest counterparty at 8 large BHCs



Stress scenarios: unemployment and stock prices

Figure 2. Unemployment rate in the severely adverse and adverse scenarios, 2011:Q1-2019:Q1



Figure 4. Dow Jones Total Stock Market Index, end of quarter in the severely adverse and adverse scenarios, 2011:Q1-2019:Q1



For more details of scenario design: http://www.federalreserve.gov/newsevents/press/bcreg/bcreg20160623a1.pdf



Data collection from BHCs

- BHCs provide extensive data on loans, securities, and trading portfolios; business activities; revenue / expenses; balance sheet etc.
 - FR 14-M, FR 14-Q and FR 14-A regulatory collections (developed for Fed stress testing program)
- E.g., for major loan categories, data is at loan level, and includes:
 - Loan characteristics (e.g., credit score, loan-to-value ratio, location of property securing the loan)
 - Monthly or quarterly performance data (is borrower delinquent? did they prepay the loan? etc.)
- In all -- millions of data elements per BHC





- The Federal Reserve uses a suite of models to project revenues, losses, the balance sheet, risk-weighted assets, and capital
 - With few exceptions, independent estimates, not adjustments to bank projections.
- Fed models intended to capture "typical" BHC behavior
 - Calibrated using industry-wide data
 - No firm-specific adjustments, just firm-specific input data
 - Limited use of "fixed effects"
 - Consistent assumptions across BHCs
- Key objective is consistency across BHCs
 - Differences in projections due to input data (e.g., types of loans).



loss = EAD x PD x LGD

EAD: Exposure at default PD: Probability of default LGD: Loss given default

PD model: (separate models for fixed, adjustable, option ARM loans)

- Quarterly transitions in loan status between different states -- current, delinquent, paid off, default etc.
- Right-hand side variables:
 - Macro scenario: home prices, unemployment, interest rates
 - Loan characteristics (from Y-14 data)

LGD model: Recovery rate depends on inputs like property value at time of default, and time elapsed between default and recovery.



Overview: How are capital projections arrived at?



Disclosure

- Unusual feature of stress tests: lots of public disclosure.
- Federal Reserve publicly releases:
 - Macro scenarios,
 - Income, Ioan losses (by category) and capital projections firm-by-firm,
 - Overview of Fed stress testing methodology,
 - CCAR decisions (object or non-object).
- <u>Contrast</u>: most bank supervision happens behind closed doors.
- Disclosure not complete though:
 - E.g., Fed does not release all details of models, to reduce gaming, and discourage firms from simply copying the Fed.



CCAR 2016 net income projections: severely adverse/

Projected losses, revenue, and net income before taxes through 2018:Q1

ltem	Billions of dollars	Percent of average assets ¹	
Pre-provision net revenue ²	383.6	2.5	
Other revenue ³	1.6		
less			
Provisions	438.6		
Realized losses/gains on securities (AFS/HTM)	11.3		
Trading and counterparty losses ⁴	113.0		
Other losses/gains ⁵	17.3		
equals			
Net income before taxes	-195.0	-1.3	
Memo items			
Other comprehensive income ⁶	13.6		
Other effects on capital	Actual 2015:Q4	2018:Q1	
AOCI included in capital (billions of dollars) ⁷	-37.0	-32.2	



Sources of losses: CCAR 2016 severely adverse scenario/





Loan loss rate by firm – severely adverse





Note: Estimates are for nine quarter period from 2016:01-2018:01 as a percent of average balances.

Pre-provision net revenue by firm – severely adverse/





CCAR 2016: Starting and post-stress CET1 ratios (%)



Historical and stress industry capital ratio



Source: FR Y-9C, FR Y-14A, and supervisory estimates under the severely adverse scenario.





- Fed conducted 5 year review of CCAR in 2016.
- 2016 speech by Fed Governor Tarullo suggested some possible changes in the program. For example:
 - Combine stress test results with capital conservation buffer
 - "Stress capital buffer" = max(2.5%, stress test drop in capital)
 - Incorporate more liquidity, funding, fire sale elements.
 - Assume flat balance sheet (assets, RWA)

See: https://www.federalreserve.gov/newsevents/speech/tarullo20160926a.htm



Closing thoughts

- Federal Reserve's stress testing program represents significant break from "traditional" approach to bank supervision, e.g.,:
 - Quantitative, model-based methodology
 - Much more detailed data collection from firms
 - Based on explicit "worst case" scenarios
 - Horizontal test across many firms
 - Much greater disclosure of results
- Part of an overall trend towards use of supervisory stress testing around the globe



Appendix



Regulatory capital transition schedule

	Jan. 1, 2014	Jan. 1, 2015	Jan. 1, 2016	Jan. 1, 2017	Jan. 1, 2018	Jan. 1, 2019
	(percent)	(percent)	(percent)	(percent)	(percent)	(percent)
Capital conservation buffer Minimum common equity tier 1 capital ratio + capital			0.625	1.25	1.875	2.5
conservation buffer	4.0	4.5	5.125	5.75	6.375	7.0
	5.5	6.0	6.625	7.25	7.875	8.5
Minimum total capital ratio + capital conservation buffer Maximum potential countercyclical capital buffer	8.0	8.0	8.625 0.625	9.25 1.25	9.875 1.875	10.5 2.5

TABLE 5-REGULATORY CAPITAL LEVELS FOR ADVANCED APPROACHES BANKING ORGANIZATIONS

Table 6 shows the regulatory capital levels banking organizations that are not satisfy to avoid limitations on capital advanced approaches banking organizations and banking organizations payments during the applicable

that are covered SLHCs generally must distributions and discretionary bonus

transition period, from January 1, 2016 until January 1, 2019.

TABLE 6-REGULATORY CAPITAL LEVELS FOR NON-ADVANCED APPROACHES BANKING ORGANIZATIONS

	Jan. 1, 2015	Jan. 1, 2016	Jan. 1, 2017	Jan. 1, 2018	Jan. 1, 2019
	(percent)	(percent)	(percent)	(percent)	(percent)
Capital conservation buffer Minimum common equity tier 1 capital ratio + capital conservation buff-		0.625	1.25	1.875	2.5
er	4.5	5.125	5.75	6.375	7.0
Minimum tier 1 capital ratio + capital conservation buffer	6.0	6.625	7.25	7.875	8.5
Minimum total capital ratio + capital conservation buffer	8.0	8.625	9.25	9.875	10.5

