Financial Risk Management

Spring 2016

Dr. Ehud Peleg

Stress Testing

UCLA Anderson
THINK IN THE NEXT

Stress Testing Agenda

- Stress Testing vs. Modeling
- Scenario Analysis and Multiple Variable Stress
- Top-down macro stress testing
  - Macro models
  - Satellite Models
- CCAR / DFAST
- Reverse Stress Testing

Disadvantages of VaR

- Backward looking
- Does not give insight into bad scenarios and to possible mitigation plans
- Makes restrictive assumptions about underlying variables
- Difficult to communicate to management

Individual vs. Several Variables

- Stress individual variables (Scenario Analysis)
  - Better assessment of specific risk
  - Easy to use and control as a risk management limit
  - Allows more freedom in stress
- Scenarios where several variables change
  - More realistic as variables are correlated
  - Tells a story and lends itself to a mitigation plan
  - But, limits the extremity each variable takes

Stress Testing

- Key Questions
  - How do we generate the scenarios?
  - How do we evaluate the scenarios' effect on our portfolio?
  - What do we do with the results?

Typical Stress Testing Framework

Stress Event – High level story (e.g. Subprime Crisis, Euro Crisis)

Macroeconomic Model - Links event to macroeconomic variables (e.g. GDP, interest rates, FX rates)

"Satellite" models - Link macroeconomic variables to their effects on banks' assets (e.g. credit losses, MTM losses)

Impact on Firm/Portfolio – (e.g. earnings, capital, liquidity)

Adapted from Foglia(2009) – Stress Testing Credit Risk: A Survey of Authorities Approaches

Generating Scenarios

- Choose particular days when there were big market movements and stress all variables by the amount they moved on those days
- Form a stress testing committee of senior management and ask it to generate the scenarios
- Regulatory requirements
- Extreme shocks in Macro models

Regulatory Stress Tests

- Comprehensive Capital Analysis and Review (CCAR).
- Dodd Frank Act Stress Tests (DFAST)
- Annual tests performed by the Fed and by the Banks (BHCs) themselves
  - About 30 banks with assets greater than $50B
- Financial institutions submit capital plans that include projection of revenues, losses and balance sheet levels, as well as payout plans.
- The Fed can approve the plan, or object from quantitative or qualitative reasons.

CCAR Scenarios for 2015

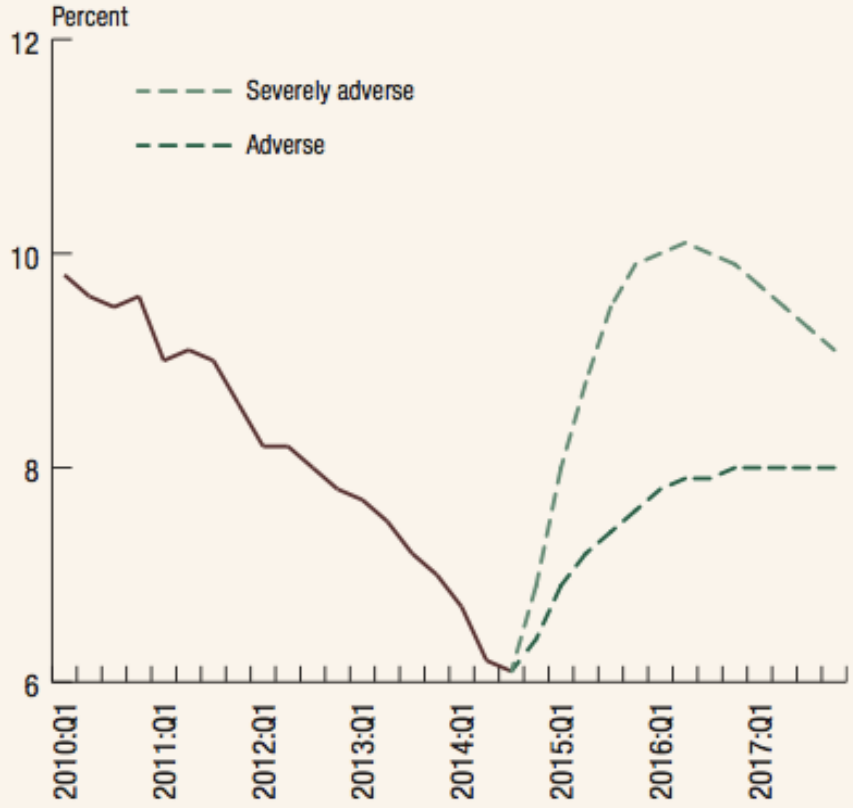
- Three scenarios: baseline, adverse, severely-adverse
- Quarterly scenarios: 2014:Q4-2017:Q4
- 28 macro variables: domestic and international
  - Economic activity: GDP, unemployment, disposable personal income, CPI
  - Asset Prices: house prices, stock market, VIX, commercial real estate prices
  - Interest Rates: 3mo, 5yr, 10yr treasury, 10-yr BBB, prime, 30yr mortgage
  - International: UK, Euro area, Asia, Japan

Severely Adverse Scenario

- Substantial weakening in economic activity across all countries
- Significant reversal of recent improvements in US housing market
- Flight-to-safety capital flows towards US cause depreciation of other currencies
- Recessions in Euro, UK and Japan, which are slow to recover
- Below-trend growth in developing Asia

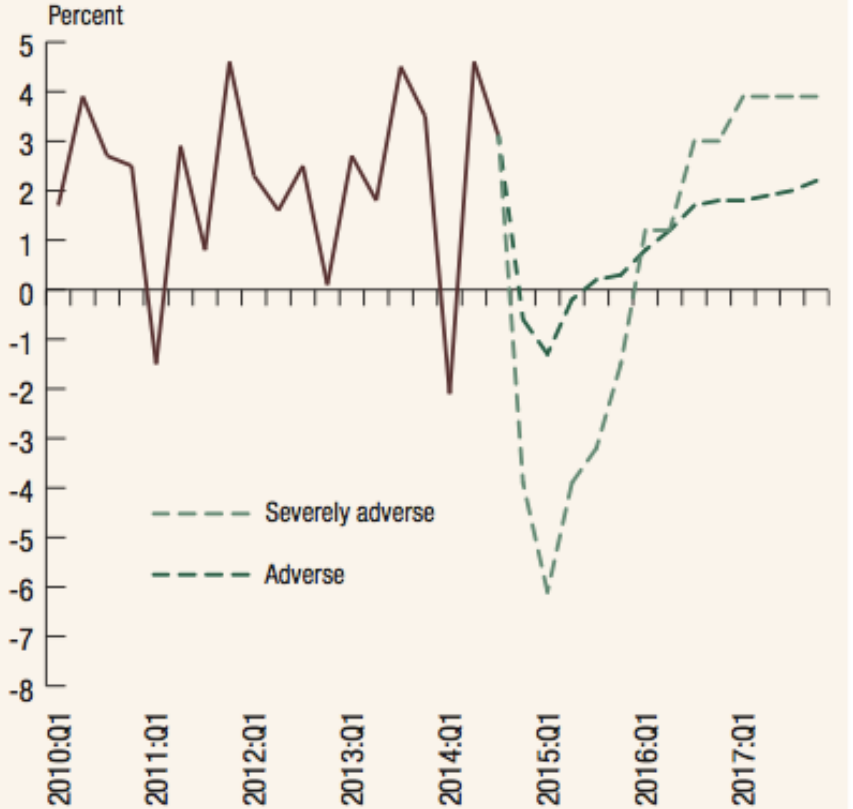
CCAR 2015 – Macro Variables in Scenarios

Figure 2. Unemployment rate in the severely adverse and adverse scenarios, 2010:Q1–2016:Q4



Source: Bureau of Labor Statistics and Federal Reserve assumptions in the supervisory scenarios.

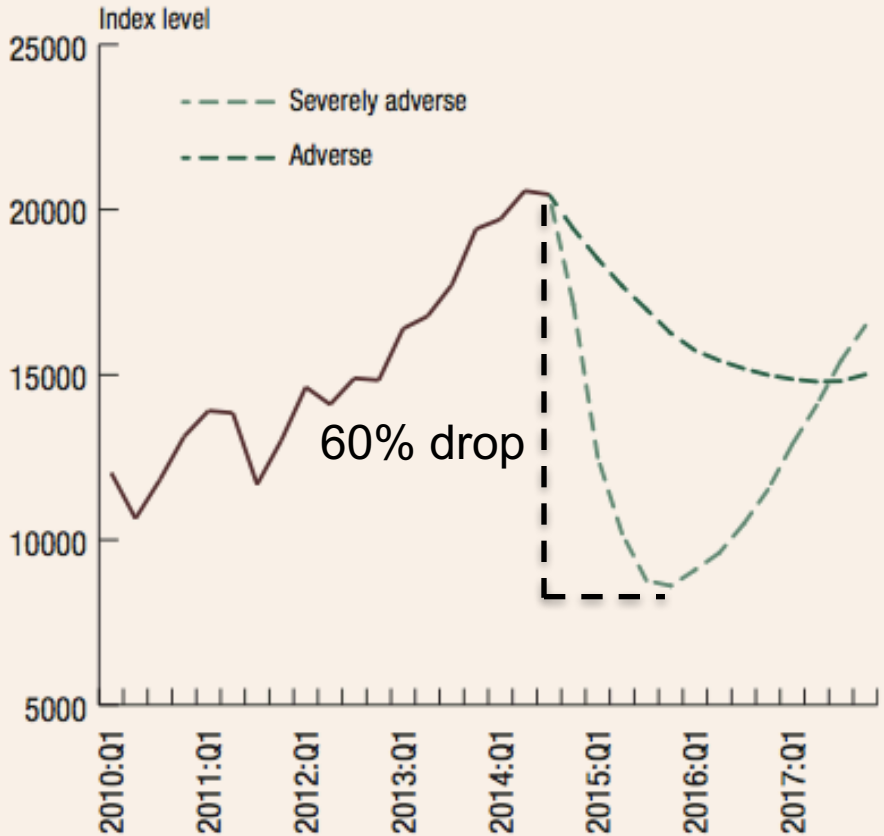
Figure 3. Real GDP growth rate in the severely adverse and adverse scenarios, 2010:Q1–2016:Q4



Source: Bureau of Economic Analysis and Federal Reserve assumptions in the supervisory scenarios.

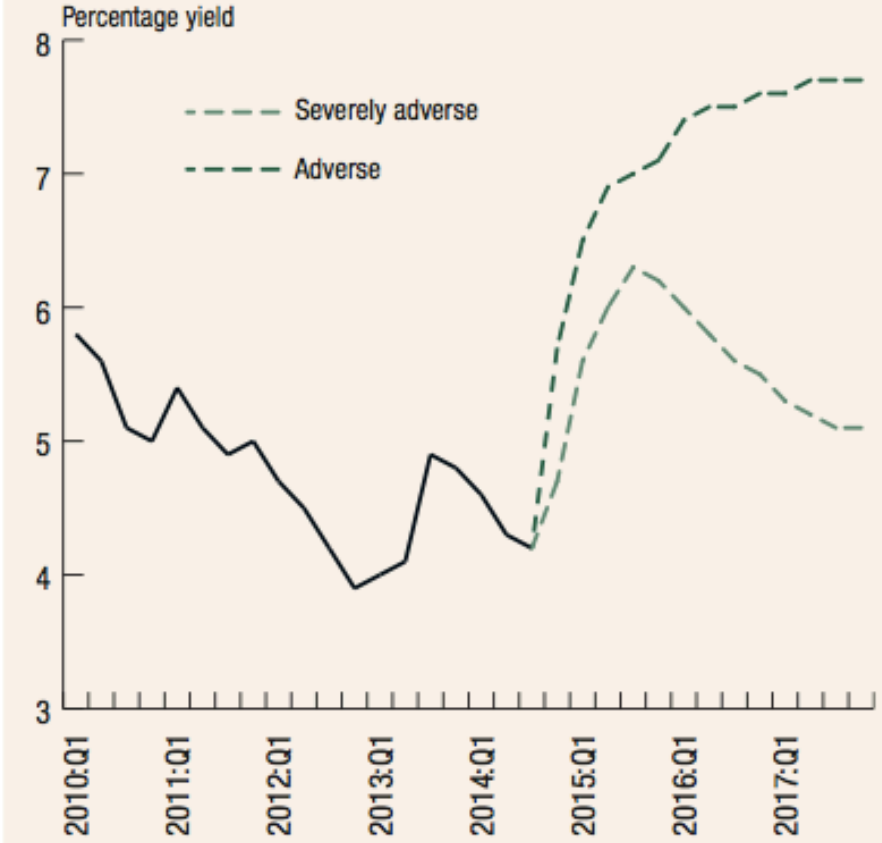
CCAR 2015 – Market Variables in Scenarios

Figure 4. Dow Jones Total Stock Market Index, end of quarter in the severely adverse and adverse scenarios, 2010:Q1–2016:Q4



Source: Dow Jones and Federal Reserve assumptions in the supervisory scenarios.

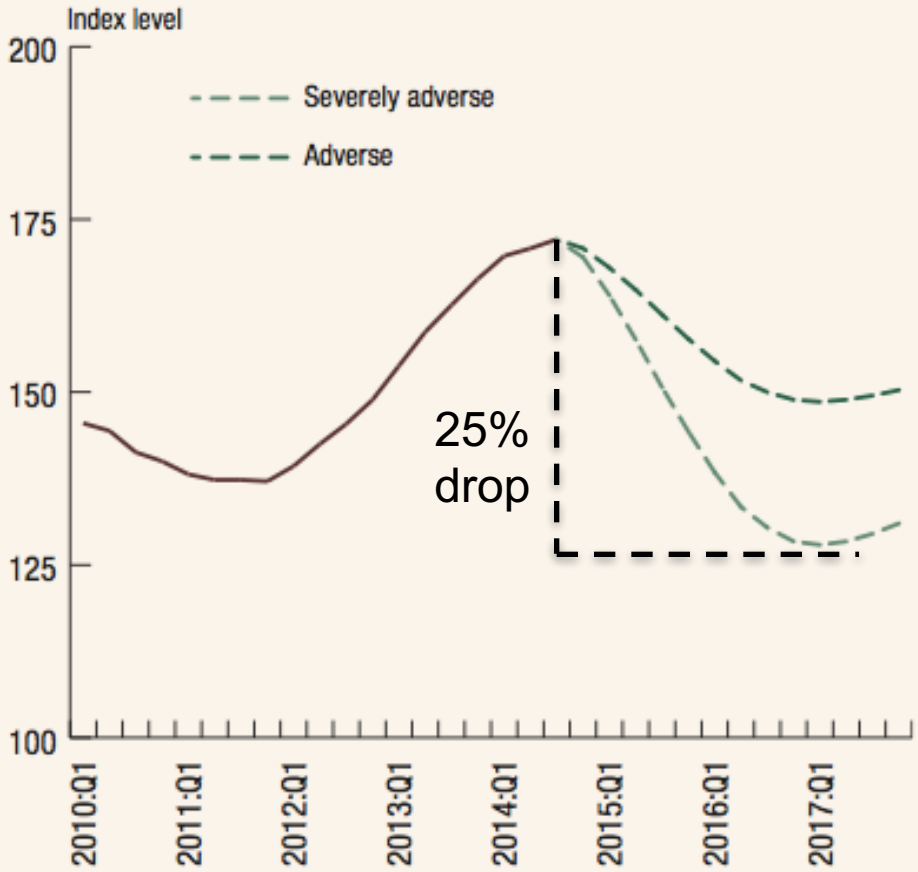
Figure 6. U.S. BBB corporate yield, quarterly average in the severely adverse and adverse scenarios, 2010:Q1–2016:Q4



Source: Merrill Lynch (adjusted by Federal Reserve using a Nelson-Siegel smoothed yield curve model) and Federal Reserve assumptions in the supervisory scenarios.

CCAR 2015 – Market Variables in Scenarios

Figure 5. National House Price Index in the severely adverse and adverse scenarios, 2010:Q1–2016:Q4



Source: CoreLogic (seasonally adjusted by Federal Reserve) and Federal Reserve assumptions in the supervisory scenarios.

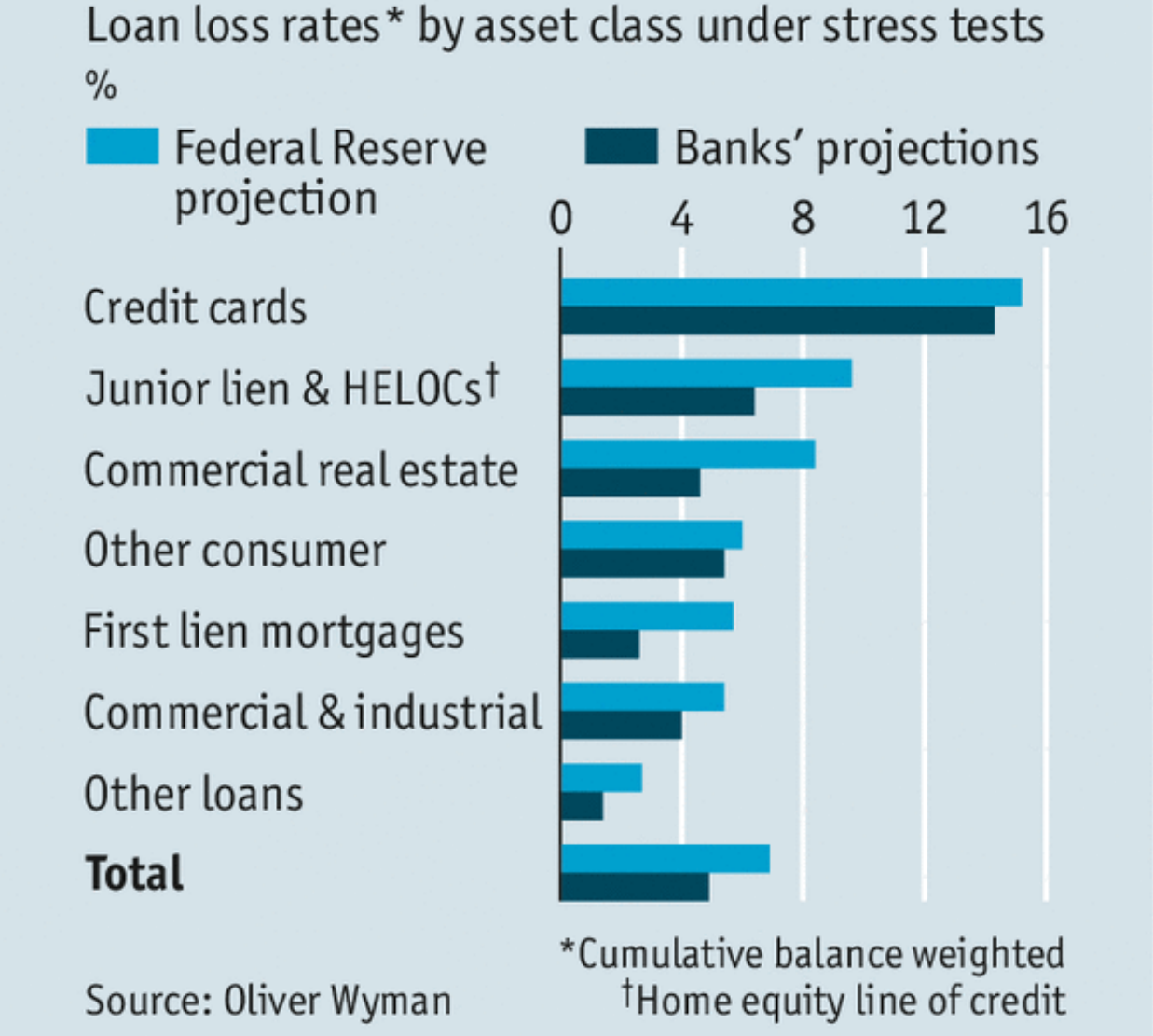
- VIX reaches 79 within one quarter of stress
- Commercial real estate prices decline by 35%
- Yield on 10-year Treasuries declines to 1%

CCAR-Additional Shocks

- 6 BHCs are subject to another severe global market shock to their trading portfolio:
  - Shift in sovereign yield curves
  - Shocks to corporate and emerging market spreads
  - A severe Euro crisis
  - Increased risk aversion across markets
  - Instantaneous as opposed to the “main” evolving scenarios
- 8 BHCs are subject to an additional Counterparty Default Scenario

Satellite Models

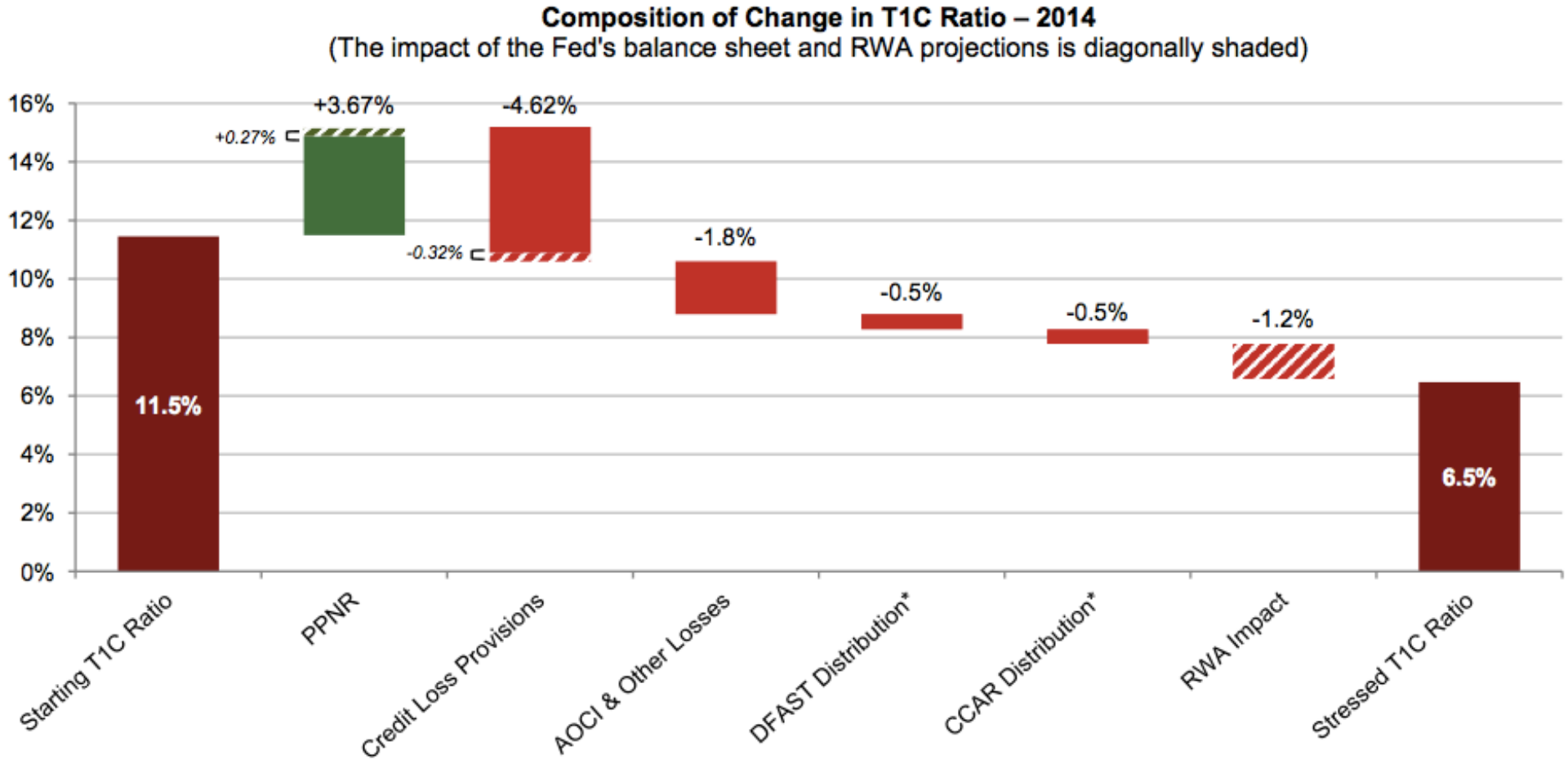
- How does the scenario affect the bank's results?
- Top-down approach – Macro-based regression models
  - Used by regulators. Foglia (2009) documents many variations.
  - LHS: default rate or losses; RHS: Macroeconomic factors
- Bottom-up approach – Considers effects of macro variables on specific loans/securities or well-defined portfolios
  - Commonly used by banks


Loan loss rates* by asset class under stress tests
%
Federal Reserve projection
Banks' projections
0
4
8
12
16
Credit cards
Junior lien & HELOCs†
Commercial real estate
Other consumer
First lien mortgages
Commercial & industrial
Other loans
Total
*Cumulative balance weighted
†Home equity line of credit
Source: Oliver Wyman

Applications for Stress Test Results

- Solvency Tests
  - Verify that institution has enough capital to cover losses
  - Under CCAR BHCs have to show that they are well-capitalized (Tier 1 common ratio above 5%) even in stress-scenarios
- Liquidity Tests
  - Verify that bank has enough liquid assets and stable funds to withstand intensive withdrawal of funds
- Decision-making – Inform return vs. risk analysis
- Risk appetite – Define limits to cap losses on a portfolio

Effect on Capital Ratios



"Stress testing: A look into the Fed's black box" (pwc, 2014)

Reverse Stress Testing

- First we assume that there is a large loss then we look for what is the story
- Typically done as a qualitative exercise
- We can also look for the worst scenarios in our VaR simulation and figure out to what macroeconomic scenario they relate
- Can be a useful input to the stress testing committee.

Thanks