



Background on Using Economic Scenarios in SIF Equity Ratio Stress Analysis

September 2017

Overview

- Goal is to incorporate economic stress testing into overall SIF governance.
- Requires two general elements:
 - Developing our own or accessing others' economic stress scenarios. Decided to use Federal Reserve CCAR/DFAST scenarios, widely used by depositories.
 - Developing ways to translate economic stress indicators into credit union indicators relevant to SIF performance.
 - Example: Need a way or ways to translate changes in the unemployment rate to credit union losses or share growth.
- Three primary drivers of the SIF equity ratio:
 - Insurance losses
 - Insured share growth
 - Yield on the SIF investment portfolio
- To do stress tests, need to develop quantitative links from variables in the Federal Reserve scenarios to insurance losses, share growth, and the SIF yield.

Macroeconomic Scenarios

- Starting point is Federal Reserve CCAR/DFAST economic scenarios. Generally provide a Baseline, Adverse, and Severely Adverse scenarios.
- Scenarios are usually published early in the calendar year with Q4 data of the previous year as the last actual data quarter. No updates during the year.
- Fed provides a small number of economic variables (23), including international conditions variables.
- CCAR/DFAST scenarios extend for 13 quarters. Shorter horizon is appropriate for depository institution capital positions, but is too short for comprehensive SIF analysis.
- NCUA has adopted a 5 year forecast horizon to allow for the time it takes for changes at credit unions to affect the SIF and to cover nearly a full economic cycle.
- For stress testing purposes, OCE only used the Adverse and Severely Adverse scenarios and did not produce a forecast using the Fed's baseline scenario. NCUA projected the equity ratio under a 'base case' using the assumptions outlined in the July 20, 2017 Board presentation.

Macroeconomic Scenarios

- For 2017 analysis, scenarios were extended to 2021 and shifted forward by one quarter using data supplied by Macroeconomic Advisers, LLC (MA) in April 2017.
 - MA takes the Fed scenarios that have 2017Q1 as their first quarter and moves them forward to start in 2017Q2. Then it fills in projections for 2021.
- Necessary because 2017Q1 data was already known when OCE started the analysis. MA scenarios essentially match the Fed scenarios for variables provided by the Fed (though they are advanced one quarter into the future compared to the CCAR/DFAST scenarios).
- MA also uses its proprietary model to develop estimates consistent with the Fed scenarios for other useful variables (about 400 or so). Useful because the extra variables could have closer relationships with credit union variables than just the variables the Federal Reserve projects.
 - Example: the MA estimates include a full yield constant maturity Treasury yield curve.
- OCE used only a few variables from the projections to drive the economic scenarios as ways to quantify the risks associated with a moderate and a severe recession, so that the inputs to the share insurance fund model would be economically consistent.

Macroeconomic Scenarios

- OCE provides annual average assumptions to the SIF model by averaging growth rates and other rate variables directly.
- For 2017 analysis, needed to extend the scenarios to 2022. OCE held the 2021 growth rates and unemployment rates constant.
- No clear bias in using 2021 rates for 2022. Examples of offsetting effects:
 - Recovering economy in 2022 might otherwise result in a falling (not constant) unemployment rate. So keeping 2021 rate would tend to overstate losses for that year (and lower the equity ratio).
 - But 2021 also has very robust income and house price growth, which, when replicated for 2022 (instead of lowered) tends to offset losses that would be projected by using the 2021 unemployment rate.
 - Inflation remains low with 2022 fixed at 2021 rate, but would actually likely increase as the economy recovers further. Using the (lower) 2021 rate would understate projected share growth for 2022 and raise the equity ratio (because the insured share denominator is smaller).

Translating Economic Scenario Stress to Credit Union Indicators

- Three primary drivers of the equity ratio are (1) Insured share growth, (2) Insurance losses, and (3) Yield on investment portfolio
- Used only a few general economy indicators to drive credit union results (see equations below). Limited usable time series data is a challenge.
- For insured share growth and key indicators of insurance losses, OCE developed regression equations
 - Use historical data to capture a usable relationship between needed equity ratio drivers and general economy indicators
 - Use the estimated historical relationships to translate projections of economic conditions in the Adverse and Severely Adverse scenarios into projections of equity ratio drivers
- For yield on investment portfolio, interest rates are taken directly from the Adverse and Severely Adverse scenarios (as augmented by MA algorithm)
 - Interest rate inputs are applied to the SIF's investment portfolio

Share Growth Equation

- Simple equation relating growth in total shares and deposits to key macroeconomic variables.
 - Use growth in total shares. Data on growth in insured shares skewed by the increase in the insurance cap.
- Use annual growth in inflation-adjusted dollars from 1991 to 2016 (inflation rate subtracted before estimation)
- Equation uses five variables (including inflation):
 - Unemployment rate: Negative effect imposed before estimating so that consistent high unemployment eventually reduces share growth
 - Change in the unemployment rate: Positive effect captures historic “flight to quality” behavior; effect disappears after a year.
 - Change in the 3-month Treasury bill: Negative effect, rising rates reduce deposit growth, potentially an opportunity-cost effect.
 - Real disposable income growth: Positive effect, higher incomes increase deposits

Regression Equations – Share Growth

Annual Share Growth, %, 1991-2016

Variable	Coefficient	Standard Error	t statistic
Inflation rate, %	1.00	n/a	n/a
Unemployment rate, %	-0.50	n/a	n/a
Change in unemployment rate, ppts	1.69	0.64	2.64
Change in 3 month T Bill rate, ppts	-1.37	0.47	-2.95
Annual growth in real disposable income, %	0.50	0.32	1.56
Constant	6.18	0.96	6.41
Adjusted R ² (fit)			0.60
Number of observations			26
Standard error			2.27
Average of share growth, 1991-2016			7.20

CAMEL 4/5 Deposit Share Equation

- Use equation to project share of FICU deposits in CAMEL 4/5 CUs.
- Use data from 1996 to 2016 to calculate the code 4/5 asset share. Equation has two variables:
 - Unemployment rate: Captures general credit risk; a higher unemployment rate (or an increase) raises the share of deposits in CAMEL 4/5 credit unions.
 - House price growth: Captures homeowner credit risk; faster house price growth lowers the share of deposits in CAMEL 4/5 credit unions.
- Develop projections of dollar losses by multiplying an assumed loss rate by the level of insured deposits in CAMEL 4/5 CUs. Assumed loss rate is taken from the SIF baseline.

Regression Equation – Code 4/5 Deposit Share

Share of Aggregate Deposits in Code 4/5 FICUs, %, 1996-2016

Variable	Coefficient	Standard Error	t statistic
Unemployment rate, %	0.56	0.07	7.87
Change in the Unemployment rate, %	0.31	0.13	2.35
CoreLogic House price growth, %	-0.04	0.02	-2.41
Constant	-1.70	0.47	-2.41
Adjusted R ² (fit)			0.87
Number of observations			21
Standard error (or F statistic)			0.50
Average of 4/5 Deposit Share, 1996-2016			1.45

Economic Projections

Listing of Data Used in the Projections of the Credit Union Drivers for the Adverse (Moderate Recession) and Severely Adverse (Severe Recession)
Actual Data for 2014-2016

Base provided for information only

	Unemployment Rate, %			Real Disposable Income Growth, %			Consumer Price Inflation, %		
	Base	Moderate Recession	Severe Recession	Base	Moderate Recession	Severe Recession	Base	Moderate Recession	Severe Recession
2014	6.17			3.50			1.61		
2015	5.26			3.46			0.12		
2016	4.85			2.77			1.28		
2017	4.55	5.50	6.28	2.26	1.28	0.32	2.53	2.44	2.28
2018	4.36	7.16	9.60	2.83	-0.08	-2.88	2.30	1.84	1.45
2019	4.24	7.14	9.66	2.46	1.35	0.48	2.38	2.03	1.75
2020	4.24	6.75	8.78	2.01	2.15	2.54	2.40	1.90	1.52
2021	4.39	6.31	7.95	1.87	2.67	4.15	2.41	1.97	1.32
2022	4.39	6.31	7.95	1.87	2.67	4.15	2.41	1.97	1.32

Economic Projections

Listing of Data Used in the Projections of the Credit Union Drivers for the Adverse (Moderate Recession) and Severely Adverse (Severe Recession)
Actual Data for 2014-2016

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	3-Month Treasury Bill Rate, %			7-Year Treasury Note Rate, %			10-year Treasury Note Rate, %		
	Base	Moderate Recession	Severe Recession	Base	Moderate Recession	Severe Recession	Base	Moderate Recession	Severe Recession
2014	0.03						2.54		
2015	0.05						2.18		
2016	0.32			2.24			2.65		
2017	0.96	0.23	0.23	2.47	2.08	0.90	2.66	2.33	1.11
2018	1.76	0.10	0.10	3.00	2.15	0.72	3.15	2.49	0.90
2019	2.52	0.10	0.10	3.42	2.23	1.14	3.54	2.59	1.36
2020	2.86	0.10	0.10	3.54	2.29	1.52	3.69	2.64	1.73
2021	2.87	0.10	0.11	3.59	2.35	1.65	3.76	2.71	1.89
2022	2.87	0.10	0.11	3.59	2.35	1.65	3.76	2.71	1.89

Economic Projections

Listing of Data Used in the Projections of the Credit Union Drivers for the Adverse (Moderate Recession) and Severely Adverse (Severe Recession)
Actual Data for 2014-2016

Base provided for information only

	CoreLogic House Price Growth, %			CoreLogic House Price Level, Jan 2000 = 100		
	Base	Moderate Recession	Severe Recession	Base	Moderate Recession	Severe Recession
2014	5.00			162.20		
2015	5.00			171.07		
2016	5.48			180.45		
2017	5.47	2.59	0.40	190.32	185.11	181.18
2018	2.51	-6.57	-13.73	195.11	172.95	156.31
2019	2.87	-4.19	-8.97	200.71	165.70	142.29
2020	3.15	2.85	5.67	207.03	170.42	150.36
2021	3.30	6.51	9.30	213.86	181.52	164.34
2022	3.30	6.51	9.30	220.91	193.34	179.62

Projections of Primary Equity Ratio Drivers

Projected Inputs	Year	Scenario		
		Base	Adverse	Severely Adverse
Insured Share Growth	2017	5.10%	6.60%	6.92%
	2018	5.30%	6.30%	6.20%
	2019	5.50%	4.20%	2.34%
	2020	5.60%	3.70%	1.66%
	2021	6.00%	3.90%	2.48%
	2022	5.70%	4.67%	3.90%
Insurance Losses (in Millions)	2017	\$52.8	\$142.0	\$216.0
	2018	\$58.1	\$311.2	\$532.0
	2019	\$52.4	\$257.8	\$425.4
	2020	\$60.2	\$202.8	\$292.4
	2021	\$78.1	\$164.2	\$230.4
	2022	\$76.7	\$188.6	\$269.6
Yield on Investment Portfolio	2017	1.64%	1.56%	1.48%
	2018	1.92%	1.73%	1.49%
	2019	2.16%	1.84%	1.47%
	2020	2.40%	1.93%	1.47%
	2021	2.57%	2.00%	1.46%
	2022	2.74%	2.05%	1.51%